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# TRANSMITTING INFORMATION THROUGH TECHNOLOGY: ADOPTION OF SMART PHONES AMONG INDIAN FARMERS

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## ABSTRACT

Cell phones assure wider opportunities with access to agricultural information to farmers. In spite of constraints in adapting to new technologies, agro-advisory service providers help the farmers by providing text and voice messaging services. The current scenario in Indian farming visualizes a mixed age group of famers – both senior farmers and younger generation. It is evident that a greater transformation will occur in a decade or two as the younger generation becomes completely involved in decision making. Hence, the need for information technology adoption is becoming crucial among farmers in agri-based businesses and agri-based marketing to have a blooming season. It is really amazing to see the technological development creating greater significance in agriculture with its increased usage. Greater directions are provided worldwide for developing support tools for farmers and other agricultural stakeholders. The present study is to bring to the limelight about transmitting information through technology via smartphone adoption by farmers in India. It also gives a view on various support services offered for farmers in lieu with the economic development of the nation.

***Keywords: Technology, Smart phone Adoption, Mobile applications***

## 1. INTRODUCTION

Cell phones assure wider opportunities with access to agricultural information to farmers. In spite of constraints in adapting to new technologies, agro-advisory service providers help the farmers by providing text and voice messaging services. Several mobile phone based applications are available through Smart phones by offering several information like weather, market prices, policies, government regulations, government schemes and new technologies. In India, most of the farmers are elderly people. The current scenario in Indian farming visualizes a mixed age group of famers – both senior farmers and younger generation. It is evident that a greater transformation will occur in a decade or two as the younger generation becomes completely involved in decision making. Hence, the need for information technology adoption is becoming crucial among farmers in agri-based businesses and agri-based marketing to have a blooming season.

## 2. RURAL MOBILE SUBSCRIBER BASE IN INDIA

According to the statistical report of trak.in (Feb 2015), it is understood that with an increase of 9.31 million in March 2015, total mobile subscriber base has reached to 969.89 million. India had 960.58 million subscribers by end of Feb 2015. Urban India witnessed a monthly decrease of 0.28 percent or –1.56 million subscribers, while rural mobile subscriber base increased significantly by 2.70 percent or 10.88 million. Urban India has a total of 555.71 million, while rural India has a total of 414.18 million mobile subscribers.

## 3. SMART PHONE USAGE IN AGRICULTURE

According to Indian Council for Research on International Economic Relations (2010), “Field investigations conducted from August 2008 to November 2008 in the states of India where mobile-enabled agricultural information service providers are operating, show that mobile telephones are being used in ways that contribute to agricultural productivity improvements, implying that along with improvements in supporting infrastructure and capacity building, mobile telephony can help in disseminating information to realize much

needed productivity gains in agriculture. The internet has also helped Indian farmers, who can use their cell phones to find real-time information on commodity prices and then dispatch their produce to the appropriate market, which gives them higher returns.

Some service providers, such IFFCO Kisan Sanchar Limited (**IKSL**), have reached more than 1.3 million farmers across 18 states of India. According to a survey by Kisan Sanchar (2011), 9% of the farmers have smart phones, 17% in Haryana; every farmer has at least one phone; the farmers who are strictly into farming practices never change their mobile number, but those who are either students or also do some additional business keep changing their number as well as operators; only 8% of the registered farmers are female and in general their access to knowledge-based services is negligible; about 70% farmers have minimum qualification of 10th grade; 52% of the farmers have their own irrigation source while 7% are organic farmers; 73% farmers have their own land, 12% are landless and 15% are agricultural labourers; and only 27% of the members of KS are linked with the banking system. Farmers are using features such as SMS, Voice Messaging, Helpline, Whatsapp, Facebook and group meetings to get information about weather and rain forecast, wind speed alert, weather, agronomy, insect pest management, market rates, career counseling for young members of farming families, agribusiness opportunities and networking among the farmers. It is mostly the 40-plus age group of farmers who are on the knowledge network of KS and using the helpline to avail of the information services, while young farmers are pretty much absent and barely show an interest in farming.

## 4. FARMING INFORMATION SERVICES IN INDIA

### 4.1. Free Voice Message

Through the Green SIM Card, every day, up to four free voice messages are delivered to the Subscribers. Each such voice message is of one-minute duration and cover contextual alerts and advisories on diverse subjects like soil management, weather forecasts, weather based agro-advisory, crop management, plant protection, market rates, dairy and animal husbandry. Information of general use on health, employment, education, women empowerment, financial inclusion, awareness of climate change and Government schemes are also provided. These voice messages are prepared by experts on subjects of immediate interest to the rural Subscribers. Market rates and weather information at district-level is also given as text

message. The endeavor is to empower rural subscribers, particularly farmers, with latest information for informed decision making.

- **Helpline**

The subscribers of Green SIM Card of IFFCO Kisan have the privilege of access to a dedicated Helpline service, which has the potential to become a rural lifeline through a 6 digit number 534351. Farmers can get a solution to their problems, queries by using this short code. Experienced professionals are accessible on this helpline, who provide solutions to farmers. Where required, Subject Matter Experts (SMEs) are taken on conference call to provide a satisfactory resolution to queries.

- **Other Programmes through Mobile Phone**

Apart from the free voice messages and helpline, IFFCO Kisan organizes live phone-in-program on specific subjects of interest to farmers. In these 'Phone In' programmes, subject matter specialists join IFFCO Kisan's officials at one place for redressal of specific issues of the caller, provide clarifications, etc. The Helpline number used by farmers is also used for these programmes. Mobile based quizzes are organized to sharpen the knowledge levels of subscribers and attractive gifts are provided to winners. Mobile based quizzes also help to encourage subscriber participation in IFFCO Kisan activities.

## 5. ACCESS TO ICTs IN AGRICULTURE

In a developing nation like India, smartphones have penetrated deep into the rural areas. With an increasing usage of smartphones by farmers and younger generation in rural areas, there has been enormous application development in every areas including agriculture. Data logging and management Apps help farmers in assisting them with necessary farming information like “Manure Monitor” assists a farmer in managing and logging data regarding manure. “Wireless Monitor” is designed completely for farm management. It provides information such as area coverage, chemical usage, property records etc. are recorded for cost management. Crop monitoring tasks by regular data logging are provided. Information regarding pesticide spray, planting, ground preparation etc. can be stored in the app and then reviewed categorically.

## 6. CONCLUSION

Recent trends in communication technology have witnessed several support services, call centre assistance, tele shows, webinars, mobile applications which pave way for the farmers to get widespread information about better farming. It is really amazing to see the technological development creating greater significance in agriculture with its increased usage. Greater directions are provided worldwide for developing support tools for farmers and other agricultural stakeholders. Thus we expect booming technological development and economic improvement through transmitting information to farmers segment all around the world, especially in India.

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# In Vitro Studies on Endangered Medicinal Orchids of Habenaria Intermedia D. Don.

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## ABSTRACT

*In vitro* culture is a one of the methods for *ex situ* conservation of rare and endangered plant species. The aim of the present study was to examine the main aspects of *in vitro* culture initiation and propagation of ***Habenaria intermedia*** **D. Don**, an endangered wild plant species in Latvia. The effect of the cytokinins kinetin, 6-(γ,γ-dimethylallylamino) purine and 6-benzilaminopurine on the micropropagation of *S. esthonica* was analyzed. Successful initiation of tissue culture of ***Habenaria intermedia*** **D. Don** was achieved from seeds. The best results on shoot proliferation were obtained using 6-benzilaminopurine at concentrations 0.5 to 1 mg L–1. Addition of 6-(γ,γ-dimethylallylamino) purine promoted shoot elongation and root formation, but it was not effective on multiplication. The multiplication rate using kinetin at concentrations 0.5 to 2 mg L–1 was invariable without production of tissue swelling. About 30% of explants were rooted. The present study confirms that micropropagation of ***Habenaria intermedia*** **D. Don** can be efficiently performed by using cytokinins at low concentrations.

***Key words: -Endangered plants, micro propagation, Habenaria intermedia D. Don***

## 1. Introduction

Orchidaceae, which comprises an estimated 20000 to 35000 species, constitutes one of the most diverse families (Dressler, 1993) and most species of this family have medicinal and ornamental properties (Singh, 2001). Orchidaceae are among the most evolutionarily and ecologically significant plants known for a wide variety of epiphytic and terrestrial growth forms and hardiness; they successfully colonize almost every habitat on earth, including soil (terrestrial), rock surfaces (lithophytic) and other plants (epiphytic). Habenaria longicorniculata, long-tailed is a 1-3 ft high terrestrial herb, oblong-elliptic leaves are 3-10, clustered on the base and lie flat on the ground. Flowers occur on a long erect stalk which is 30-80 cm tall. White fragrant flowers are 1-4 in number.Greenish white petals are 10-14 mm long. Flowers have a spur which is 10-15 cm long. Overall, the flowers have the shape of an inverted funnel. It was first collected by John Graham from Khandala (Graham, 1839).

Genus Habenaria Wild belongs to large genus family Orchidaceae with 83 species from India (Mishra, 2001). Orchid phytochemicals are generally categorized as alkaloids, flavonoids, carotenoids, anthocyanins and sterols. Among orchids, Dendrobium is the leading genus for phytochemical content and Zhang et al. (2003)reviewed 100 compounds from 42 Dendrobium species, including 32 alkaloids, 6 coumarins, 15 bibenzyls, 4 fluorenones, 22 phenanthrenes and 7 sesquiterpenoids.

Williams (1979) conducted a major survey of leaf flavonoids and surveyed 142 species in 75 genera and found that the most common constituents were flavones C-glycoside and flavonols. To date, more than 2000 orchid species have been screened for their alkaloids and/or flavonoids contents. Altogether, a single familial pattern of flavonoid distribution is not evident in orchids.The root decoction of Habenaria commelinifolia administered orally on an empty stomach to cure spermatorrhoea and urinary trouble has been reported (Kirtikar and Basu, 1981; Singh, 2001; Jalal, 2008).The tuber paste of Habenaria furcifera (Lindl.) is used as an ointment for cuts, wounds and poisonous bites (Roy, 2007). The whole fresh plant paste of Habenaria hollandiana Sant. is applied externally for scorpion sting and also for maggot infested sores (Roy, 2007). The tuber paste of Habenaria longicorniculata (Graham) with turmeric is used as an external application for leucoderma (Roy, 2007). A tuber decoction of Habenaria marginata (Coleb) is taken orally to treat malignant ulcer (Leander, 1967; Hossain, 2009). The leaves and tubers of Habenaria pectinata (D. Don) are crushed and applied as an antidote to snake bites. Tubers mixed with condiments are used in arthritis

(Chauhan, 1990; Singh and Duggal, 2009). Habeneria roxburghii (Nicolson) tuber decoction is applied externally for snake bite (Roy,2007).

In the market, there is no clear cut distinction between Riddhi and Vriddhi. The larger tubers of various species of Habenaria are used as Vriddhi and the smaller ones as Riddhi. Ayurvedic system of medicine, a rejuvenating herbal formulation 'Astavarga' is derived from a group of 8 herbs, some of these herbs i.e. jivak (Microstylis wallichii), kakoli (Habenaria acuminata), riddhi (H. intermedia) and vriddhi (H. edgeworthii) are orchids (Handa, 1986; Singh and Duggal, 2009). Flickingeria macraei is used in 'Ayurveda' in the name of 'jeevanti' which is used as astringent to the bowels, aphrodisiac and in asthma and bronchitis (Kirtiker and Basu, 1975).Other commonly used orchid drugs in the Ayurvedic system are Salem (Orchis latifolia and Eulophia latifolia), jewanti (Dendrobium alpestre), shwethuli and rasna (Acampe papillosa and Vanda tessellata). In 'Sushrutasamhita' it is mentioned that the underground tuber of Orchis latifolia is used in the drug 'munjatak' which pacifies cough (Khasim and Rao, 1999). The leaves of Vanda roxburghii have been prescribed in the ancient Sanskrit literature for external application in rheumatism, ear infections, fractures and diseases of nervous system. Incredible diversity, high alkaloids and glycosides content, research on orchids is full of potential. The residents of India are acquainted with a far larger number of orchid species than the native of any other country in the face of the earth (Kirtikar and Basu, 1981).

Several novel compounds and drugs, both in phytochemical and pharmacological point of view have been reported from orchids. Linking of the indigenous knowledge to the modern research methodology will provide impetus to discover new drugs much more effective than contemporary synthetic medicines. The present study reviews the traditional therapeutic uses of orchids and recent advances in pharmacological investigations. In the present study, we report a high-throughput micro-scaled method which enables digestion of small quantities of plant samples for subsequent elemental profiling by ICP-spectrometry,DPPH anti-scavenging activity, antimicrobial activity. The investigations led to the identification of phytochemical contents of orchids of indigenous origin.

## 2. Plant Description

Intermediate Habenaria is a very beautiful orchid found in the Himalayas, from Pakistan to Nepal, at altitudes between 1500-2500 m. Plant is 30-50 cm tall, with oblong, stalkless tuberoids. Stem is

evenly leafy. Leaves are 3-5, ovate-oblong, acuminate, up to 8x4 cm, sheathing. Large flowers are borne in clusters of 1-4. Bracts are leaflike. Flowers are large, green and white. Sepals are green, the dorsal ovate-lanceolate, recurved, 20-24 x 9-10 mm, lateral-sepals falcately lanceshaped, spreading, 23-28 x 6-7 mm. Petals are white, crescent-shaped, recurved and adherent to dorsal sepal, minutely ciliolate on margins. Labellum pale or yellowish-green, 3-lobed from an undivided, white, up to 10 mm long base, mid-lobe linear-acumi¬nate, straight or slightly turned upwards, 20-30 x 2.5 mm; side lobes 25-30 mm long, somewhat diverging with c. 10, partly divided, fine, up to 20 mm long fringes on the outer margin. Spur green, 6 cm long, ± flexuous, somewhat widened towards apex and base. Not so rare, but one of the biggest flower in Habenarias. Flowering: July-August. **Medicinal uses:** Intermediate Habenaria is used in Ayurvedic medicine.


## 3. Plant material and explant source

Capitula of ***Habenaria intermedia*** were collected from a wild population in Aydın-Turkey (Samsun mountain, localities: N 37 º 47.01 “ ; E 027º 19.16 “) during summer period (July and August -2008) before seed dormancy period (**Fig. 1**). *Habenaria intermedia* has been propagated from seed in the past (**Khasimand Rao1999**). However, researchers have explained that the seed is not suitable explant for *in vitro* propagation of *Habenaria intermedia* due tostrong seed dormancy and low

germination frequency even after dormancy period. Therefore, embryos isolated from achenes which have not yet crossed dormancy periods were used as initial explant.The achenes isolated from capitula were sterilised, and mature zygotic embryos that were dissected out from achene were used as initial explant. Mature zygotic embryos were dissected out from achenes and cultured on Murashige and Skoog (MS) (**Kingston, H.M. and Lois, B. 1988)** basal medium for germination. The shoots that were obtained from *in vitro* germinated mature embryos were used for axillary shoot proliferation.

## 4. Seed sterilization, media preparation and culture conditions

In order to determine proper sterilization procedure, achenes isolated from capitula were washed thoroughly under running tap water for 30 mins. Subsequently at various times,achenes were put in 70% (w/v) ethanol and 4.5% (w/v) sodium hypochlorite containing 2 drops of wetting agent (Tween-80); afterwards, the achenes were rinsed three times (5 mins each) with sterile distilled water in a laminar flow hood. After sterilisation, zygotic embryos were isolated from achenes and cultured on PDA (Potato Dextrose Agar) to determine early contamination. PDA cultures were maintained at 24 ± 2 ºC for 3 days. At the end of this period, observations were made in order to determine the appropriate sterilisation time. All the experiments were maintained on semi-solid basal medium supplemented with or without various concentration of plant growth regulators. Basal medium contained Murashige and Skoog (MS) (**Kingston, H.M. and Lois, B. 1988)** mineral salts, 100 mgl-1 myo-inositol, 2 mgl-1 glycine, 0.5 mgl-1 nicotinic acid, 0.5 mgl-1 pyridoxine-HCl, 0.1 mgl-1 thiamine-HCL, 3% (w/v) sucrose, 8 gl-1 agar (Agaragar), various concentration of plant growth regulators 1N6- Benzyladenine (BA) and Kinetin (KIN), indole-3-butyric acid (IBA), indole-3-acetic acid (IAA) or naphthalene acetic acid (NAA) were used in experiments depending on experimental objectives. The pH of media was adjusted to 5.8 with 1M NaOH or HCl prior to autoclaving at 105 kPa and 121° C for 15 min. Culture vessels were 190 ml glass jars containing 30 ml of medium.

## 5. Axillary shoot proliferation

Mature embryos that were isolated from achenes were cultured on MS basal medium to obtain sterile seedlings (unpublished data). After eight weeks, seedlings (~2-3 cm), were separated from primary roots and transferred to MS medium containing different concentrations of BA or KIN (0.1, 0.5, 1.0 and 2.0 mgl-1) for axillary shoot propagation. A control treatment without cytokinins was also included. At the end of the 3 subculture, the number of shoots per explant and average shoot length was evaluated for each cytokinin type and concentration. Axillary shoot proliferation experiments

were conducted with 15 replications consisting of one explant per jar and were repeated three times. Cultures were incubated at 24 ± 2 °C under a light regime of 16 h photoperiod by cool-white fluorescent lamps. The cultures were subcultured to fresh medium of the same composition at an interval of 4 weeks.

## 6. Shoot rooting and acclimatization of plantlets

After three subcultures, elongated shoots (~4 cm) were excised stock cultures and transferred to MS and half strength MS medium (½ MS) with or without different concentrations (0.5, 1.0,2.0 and 5.0 mgl-1) of auxins (IBA, IAA or NAA) for rooting. The results of rooting experiments were expressed in percentage after 6 weeks of culture initiation.

Rooting experiments were conducted with 15 replications consisting of one explant per jar and were repeated three times. Cultures were incubated at 24 ± 2 °C under a light regime of 16 h photoperiod by cool-white fluorescent lamps. The cultures were subcultured to fresh medium of the same composition at an interval of 4 weeks. After 8 weeks of rooting *in vitro*, the plantlets were removed from the culture jars then the agar was carefully washed off the rooted plantlets to minimize pathogen attack. The plantlets were planted into 10 cm diameter plastic pots containing garden soil and kept in the growth chamber under 24 ± 2°C and 16-h light photoperiod. After 4 weeks the plantlets kept at normal laboratory conditions.

## 7. Results and Discussion

The smaller size of explants were chosen due to fact that smaller size of explants provide less chance of contamination, as well as longer leaves showed total loss of morphogenic potential. **(Mujib, A., 2003**). Initiation of calluses from leaf explants did not pose a major problem. During initiation the explants did not show any leaching or browning of tissues. MS basal medium was the most effective for callusing of leaf explants. The explant cultured on MS basal medium supplemented with different combinations of BAP and IAA show varied response for callusing (**Fig. 1**). Leaf explants culture on MS basal medium without any PGR supplementation show only swelling of explants that were not significant for callusing. This was possibly due to significant role of PGR over callusing. In the media supplemented with BAP and IAA, the leaf segments remain green for long period with very slow process of callus induction. Further transfer into media containing BAP and IAA rapidly shows callus induction because the excretion of phenolic compounds from explants to the medium was strictly avoided by regular sub-culturing of callus.

Callus is an unorganized mass of plant cells and its formation is controlled by growth regulating substances present in the medium (auxins and cytokinins) **(Shah et. al., 2003**). The specific concentration of plant regulators needed to induce callus, varies from species to species and even depends on the source of explant (**Charriere et. al., 1999).** It has been demonstrated in many cases that 2,4-D is usually the choice of auxin for callus induction and subculture of grasses (**Bhaskaran and Smith, 1990; Chaudhury and Qu, 2000**). Lately more and more experimental results indicate that the addition of a low concentration of cytokinin in callus culture medium often enhances callus regeneration (**Alpeter and Posselty, 2000; Chaudhury and Qu, 2000; Cho et. al., 2000; Bai and Qu, 2001; Bradely et. al., 2001).** Minimal cytokinins and auxins in culture media would avoid somaclonal variation and efficiently produce true to type plantlets **(Edson et. al., 1996**). The success of micropropagation largely relies on the selection of suitable plant part, which is to be used as the starting material for the experiment. In the present experiment leaf explants was best fit for purposes. The best callusing was observed in media having BAP: IAA in concentration ratio of (1.0**:** 0.5ppm). In the media supplemented with only BAP and IAA the callus induction was very significant (**Fig. 2)**. This remains in accordance with previous reported work of **(Mathur et.al., 1987).** Different types of calli with variation in colour and texture were noticed **(Fig. 1)** and among them, the light green, fragile calli responded well for the induction of shoots. This study further demonstrates that shoot regeneration from callus was very earlier in media supplemented with BAP and IAA in concentration ratio of (2.5**:** 0.4 ppm), in comparison to 2.5**:**0.3, 1.0**:**0.5 or 2.0**:**0.5 (**Fig. 2**). Thus, the PGR concentrations have significant impact on shoot regeneration. This is basically due to endogenous level of growth regulators. For elongation of shoot 1ppm GA3 was also used, this provides a better result No root could be induced in either basal medium of full or half strength MS media. However, when 2.5-4.0 cm. elongated shoots were placed on half strength MS basal medium supplemented with BAP ,IAA and NAA in concentration ratio of (2.5**:** 0.5**:** 0.5 ppm)roots were induced in nearly 100% of shoots within 2 weeks. Other concentration BAP, IAA and NAA (2.5**:**0.4**:**0.4 and 2.5**:**0.3**:**0.3) induce rooting in slightly lower percentage **(Fig. 3**). Basal media supplemented with NAA was found to be better for root regeneration this was in accordance with previous reported work of **Kumar, *et al*., 1993**. Taking care of root regeneration data it can be concluded that the standard protocol developed for regeneration of *Rauvolfia* was nearly 100% efficient but in accordance with hardening data **(Table 4)** there is a need for further standardization and work to increase the efficiency, during hardening so that this medicinally important plant could be propagate

at larger scale and its medicinal importance properties could be utilized for well being of human population. This further become important due to advancement in commercialization of plant tissue cultured plantlets by commercial sectors have led to continued exponential growth within the industry in terms of numbers of new units as well as numbers of plants produced by the units **(Govil, S. and Gupta, S.C., 1997**). The development of a reliable *in vitro* protocol are of great importance for producing plant material and for conservation of rare plant species, and offset the pressure on the natural populations as well as plant medicinal purposes. The present study describes a well documented and reliable protocol of ***Habenaria intermedia*** from leaf explants with much higher rate of multiplication. This protocol can be used as a basic tool for commercial cultivation of orchids plant.

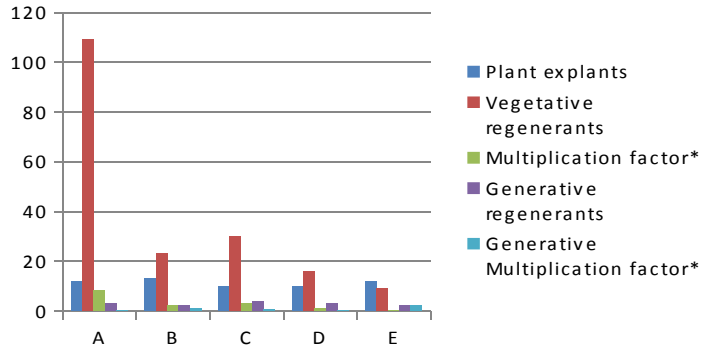


**Fig 1: Formation of vegetative and generative regenerates from dormant buds of *Habenaria intermedia* Orchids on six culture media 160 days after inoculation.**

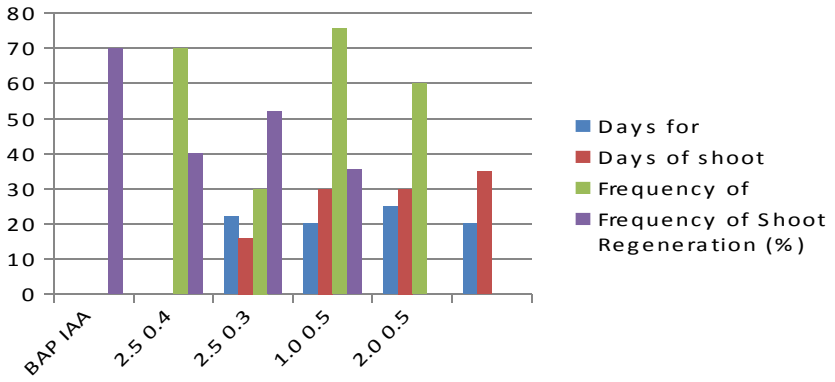


Fig **2: Effect of different concentration of PGRs added to MS medium on induction of callus and regeneration of shoots from leaf of *Habenaria intermedia***

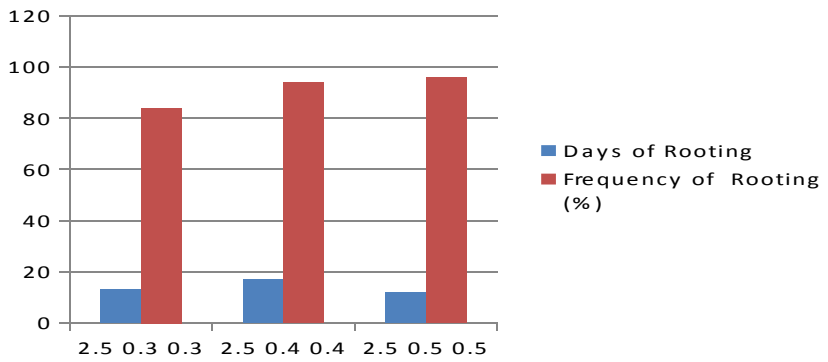


**Fig. 3 . Effect of different concentration of PGR added to MS medium for root regeneration from shooted callus of *Habenaria intermedia*.**

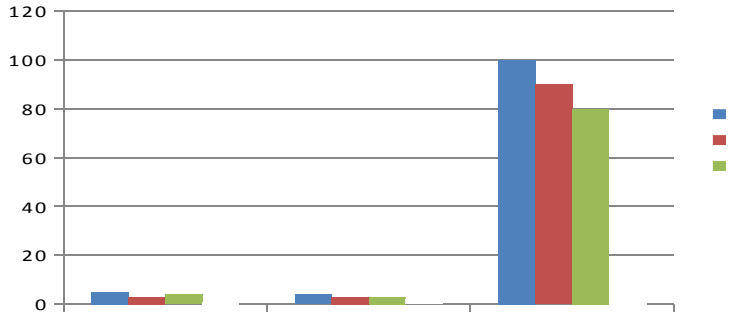


**Fig 4** . Estimated survival of plants after hardening.

## 8. Conclusion

*Habenaria* species have an ancient history of the multiple indigenous uses and is one of the most highly commercialized indigenous traditional medicines from India. The species which has reached the threatened category because of the human activities can survive only with human support. Plant tissue culture could be one of the most suitable alternative tools to minimize the pressure on natural population of medicinal orchids and their sustainable utilization.

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**Research Article**

# Studies on Dendrobium Plant Lets and Root Development using Plant Growth Regulator

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## Abstract

The experiment was conducted to investigate the combined effect of different plant growth regulators with and without charcoal supplementation for root formation and plantlet development from protocorm like bodies (PLBS) of orchid. The combination of BAP + NAA, BAP + IAA, BAP + IBA, and IAA + IBA at different concentrations was studied. It revealed that the highest number of roots was obtained from 1.0 mg/L each of IAA + IBA combination (6.667) and the highest root length was recorded from 2.0 mg/L BAP + 1.0 mg/L IBA with charcoal supplementation. The treatment combinations, 1.0 mg/L each of BAP + NAA, BAP + IAA, BAP + IBA, and IAA + IBA were found best for producing more rooted plantlets with charcoal supplementation. It revealed that charcoal enhanced the root formation.

***Keywords: Orchid, Dendrobium, hybrid, in vitro rooting.***

## 1.INTRODUCTION

*Dendrobium* hybrid is the most popular orchid for cut flower trade in Asia. Thailand alone exports Dendrobium more than $ 12 million per year to Europe and Germany (Rao, 1977). About 70% of Singapore total orchid exports were *Dendrobiums* (Singapore Orchid Industry, 2004). Commercially orchids are high demanding costly flower. The environmental conditions required for the growth, development and culture of orchids are adequately available throughout the year in Bangladesh. In

developed countries, micropropagation of orchids is the most frequently used convenient technique for their exploitation as a major trade (Goh and Tan, 1982; Sagawa and Kunisaki, 1982). When mass propagation of a new hybrid or a variety is needed within a short period of time, tissue culture is the only method to fulfill that objective (Goh et al., 1992). This is because commercially mass propagation of orchid is possible by producing millions of plantlets using tissue culture techniques (Lim et al., 985). Many studies on micro propagation of orchids have been carried out (Fu, 1978; Lin, 1986; Tanaka, 1987; Kobayashi et al., 1991; Ichihashi, 1992). Tokuhara and Mu (1993) reported that the appropriate combination and concentrations of hormones, organic additives and the composition of macro and micro elements in the culture medium were of key importance for micropropagation of *Dendrobium* on commercial scale. Sometimes for better root formation, it needs to add some organic additives, such as activated charcoal in the medium. But information on this regard is scarce. Considering the above idea in mind, the present experiment was conducted to observe the combined effect of different growth regulators with charcoal supplementation for root formation and plantlet development.

## 2. Materials and Method

The experiment was carried out at the laboratory of Biotechnology Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. The protocorm like bodies (PLBs) which were collected from a crossed pod of *Dendrobium* orchid were used as plant material. Murashige and Skoog (1962) medium was used for culturing the planting materials. BAP, NAA, IAA, and IBA were used as growth regulators. Twenty grams of sucrose, 8.0 g of agar were used per liter of the medium. The pH of the medium was adjusted to 5.8 before adding agar. The media were autoclaved at 1.1 kg/cm2 pressure and 121°C for 20 mm. The inoculated cultures were incubated at 26 ± 1°C under approximately about 2000 lux by cool-white fluorescent tubes for 16/8 light/dark cycle. Explants were subcultured at four weeks intervals or when necessary. Experiments were carried out in a completely randomized design (CRD) with three replications. Data recorded from each treatment on number of rooted plantlets per sample, number of roots per plantlet and root length was subjected to analysis of variance and means were separated by Duncan's Multiple Range Test (DMRT).

## 3. Results and Discussion

*In vitro* grown PLBs were cultured in MS medium supplemented with different combinations of growth regulators and the concentration is 0.5, 1.0, and 2.0 mg/L each of BAP, NAA, IAA and 1.0 mg/L IBA. Data were recorded at 120 days after inoculation (DAI) and results have been present. Ia , Ib, Ic & Id. Root formation and plantlet establishment are shown in . Number of roots per plantlet: Among all the treatments, the highest number (6.667) of roots was developed on the hormonal combination of 1 mg/L of IAA + IBA in the presence of charcoal supplement. Without charcoal supplement, the same treatment also showed second highest number of roots (6.557) induction. It revealed that the hormonal combination of IAA and IBA was the best growth regulator for root induction. BAP + NAA: A significant effect was noticed on number of roots per plantlet at different concentrations and combinations of BAP + NAA and with or without charcoal supplementation. In without charcoal supplementation, the highest number of root (3.33) was obtained in 1.0 mg/L each of BAP + NAA followed by 0.5 mg/L each of BAP + NAA. On the other hand, the highest number of roots (5.183) was observed at 2.0 mg/L each of BAP + NAA followed by 1.0 mg/L each of BAP + NAA (4.167). Results indicated that root development was the best when activated charcoal was added into the medium. Similar findings were also reported by Vij et al. (1994)

Means followed by a common letter are not significantly different at the 5% level by DMRT BAP + IAA: In case of BAP + IAA combination, the maximum number of roots per plantlet was obtained from 2.0 mg/L each of BAP + IAA without charcoal supplementation and the lowest number (1.282) was recorded from control treatment. On the other hand, 1.0 mg/L each of BAP + IAA combination gave the highest number of roots (5.283) with charcoal supplementation. BAP + IBA: In BAP + IBA combination, the highest number of roots (3.333/plantlet) was obtained in 1.0 mg/L each of BAP + IBA with 1.0 g/L charcoal supplementation followed by 2.0 mg/L BAP + 1.0 mg/L + IBA (2.333). On the other hand, in without charcoal, the highest number of roots (2.583) was observed is 2.0 mg/L BAP + 1.0 mg/L + IBA.

**IAA + IBA**: The highest root length (2.823 cm) was obtained from without charcoal supplementation at 1.0 mg/L each of IAA + IBA. At the same concentration (1.0 mg/L each of IAA + IBA) in charcoal supplementation, the highest root length (2.667 cm) was observed which was lower than

that of without charcoal supplementation (Table 1). Result indicated that in charcoal supplemented media, root length was not always the highest but root number was always higher.

**Number of rooted plantlets**: Significant variation was observed in number of rooted plantlets at different concentrations and combinations of growth regulators and also with and without charcoal supplementation. Results indicated that in all the treatment combinations, 1.0 mg/L each of BAP + NAA, BAP + IAA, BAP + IBA, and IAA + IBA were found best for producing more rooted plantlets in charcoal supplementation. Among all the treatment combinations, the highest number of rooted plantlets was observed in the hormonal combination of BAP + IAA. BAP + NAA: In BAP + NAA combination, the highest number of rooted plantlets was obtained from 1.0 mg/L each of BAP + NAA without charcoal treatment, while at the same concentration, the highest number was observed in charcoal supplemented media.

**BAP + IAA**: In BAP and IAA combination, 0.5 mg/L each of BAP and IAA gave the maximum rooted plantlets (7.17) followed by 1.0 mg/L each of BAP + IAA (6.53) in without charcoal treatment. On the other hand, the highest number of rooted plantlets (9.49) was observed from 1.0 mg/L each of BAP + IAA in charcoal supplemented media and control treatment produced rootless plantlets. Result indicated that charcoal enhanced root formation.

**BAP + IBA**: In BAP + IBA combination, both charcoal and without charcoal supplemented media, the highest number of rooted plantlets was obtained from 1.0 mg/L each BAP + IBA where charcoal treated media produced more rooted plantlets (4.5) than without charcoal .

**IAA + IBA**: In case of IAA +IBA combination, both charcoal and without charcoal supplemented media, the highest number of rooted plantlets was obtained from 1.0 mg/L each IAA + IBA where charcoal treated media produced more rooted plantlets than without charcoal .

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**Research Article**

# A STUDY ON LABOUR WELFARE MEASURES IN BHEL

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## ABSTRACT

The success of every business or an industry is dependent on its human factor. "Man power or Human Resource" may be thought of as the total knowledge, skills, creative abilities, talents and aptitude of an organization work force as well as the values, attitude and benefits of an Individual involved. Labor welfare activities are combinations of various steps like workers education scheme, death relief fund, staff benefit fund, leave travel concession, uniform stitching charges, protective clothing, allowances like dearness allowance, house rent allowance, city compensation allowance, night duty snack allowance, conveyance allowance, washing allowance.

***Keywords :- labour , allowances, welfare, awards, industry.***

## 1. INTRODUCTION

The success of every business or an industry is dependent on its human factor. "Man power or Human Resource" may be thought of as the total knowledge, skills, creative abilities, talents and aptitude of an organization work force as well as the values, attitude and benefits of an Individual involved. Of all the 5 M'S in management i.e material, machine, Men, money and minutes. The most important one is the human factor. Human resource is what he can do and the motivation determines what he will do ?

## 2. AWARDS AND INCENTIVES

Cash award for higher qualification, Housekeeping awards, Suggestion award

### 2.1 Issue Items

All employees in BHEL are provided with the following items like diaries, New Year compliments, fountain pen, soaps and wrist watch. Housing facilities are provided for the employees with subsidiced rates around 3000 houses are there with current, electricity etc. Hospital, school, bank facilities are there. Kailasapuram club community centre, theatre and swimming are available.

### 2.2 Objectives of the Study

To most valuable asset of every organization. The level of performance of an employee is a function of his abilities and motivation. The ability determines study the existing pattern of labour welfare measures available in BHEL.

- To examine the various labour welfare measures provided by BHEL, from employees point of view.
- To recommend suitable remedies to overcome the welfare measure deficiency so as to increase the job satisfaction and there by productivity.

### 2.3 Scope of the Study

Labor welfare activities are combinations of various steps, the cumulative effect of which is to grease the wheels of Industry and society. Sound industrial relations can only be based on human relations and good human relation dictate that labour well being. Human being should be treated humanely which include respect for labour dignity. Fair dealing and concern for the employee's physical and social needs.

## 3. REVIEW OF LITERATURE

**Anjula Gurtoo (2008)** Labour relations in developing countries is characterised by recent shift to market driven external environment, economically vulnerable surplus labour, low skills, inflexible employment laws, politicised unions with low labour representation, and low corporate

involvement in governance. There is a need for policy changes that incorporate economic stability for labour, employment regulation for organisational flexibility, union management for true representation and corporate contribution in labour security and governance.

**Jon-Chao Hong, Sung-De Yang, Li-Jung Wang, En-Fu Chiou, Fan-Yin Su, sui-Lan Huang (2006)** says everyone works in expectation of some rewards, and welfare is one of them. In order to understand the impact of employee benefits on employees' work-motivation and productivity, different genders have different benefit demands; unmarried employees, more than married employees, perceive that employee benefits have a greater impact on job performance. Employees with different education levels and positions perceive different employee benefit impacts; and employee benefit programmes have greater influence on younger employees' job performance.

**Corinne M.Karuppan (2004)** identifies individual, organizational, and job factors of the range-number element of labor flexibility. Tenure and emotional stability are found to increase a worker's flexibility. Emphases on quality, speed, and flexibility (time) also have positive influences on labor flexibility. Finally, task complexity, joint responsibility for decision making, and automation require workers to expand their skill repertoire and therefore enhance their flexibility. This study focuses on a sound measurement of labor flexibility and proposes strategies to cultivate this capability.

## 4. METHODOLOGY

A questionnaire was prepared by the researcher. The data were collected from two sources namely primary sources and secondary source. The researcher had collected data directly from the work Man and also from the secondary source like booklets. Journals, etc published by BHEL**.**

**Both mandatory** Statutory welfare Measures and Non – statutory Welfare Measures like workers education scheme, death relief fund, staff benefit fund, leave travel concession, uniform stitching charges, protective clothing, allowances like dearness allowance, house rent allowance, city compensation allowance, night duty snack allowance, conveyance allowance, washing allowance, hazardous allowance, educational and travelling allowance. Advances like festival advance, car motorcycle advance, house building advances with interest subsidy is provided

**Table 1: LABOUR WELFARE FACILITIES OF THE RESPONDENTS**

| YEARS OF EXPERIENCE | NO.OF RESPONDENTS | PERCENTAGE |
|---|---|---|
| 1-5 | 60 | 30 |
| 6-10 | 46 | 23 |
| 11-15 | 62 | 31 |
| 16-20 | 26 | 13 |
| 21-25 | 2 | 1 |
| 26-30 | 4 | 2 |
| Total | 200 | 100 |

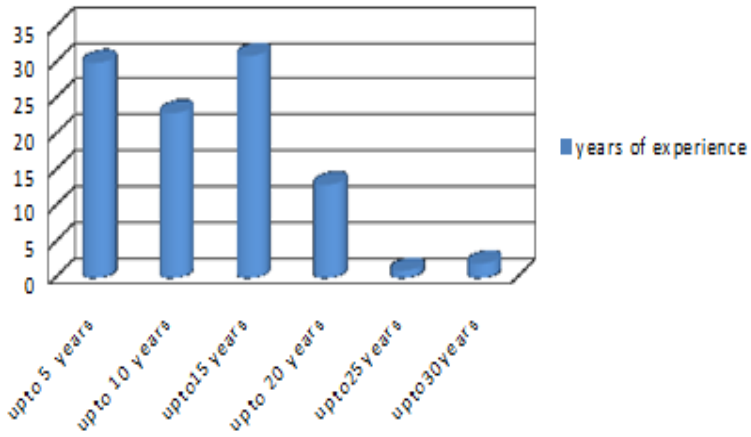


**Chart – 1 Labour Welfare Facilities**

## 5. LIMITATIONS OF THE STUDY

- This study covers the BHEL Tiruchirappalli unit only.
- It took the workers in main units and office staff only owing to cost and time considerations.
- The workers were at random on sampling basis in order to absorb the opinions about labour welfare measures provided by the organization.

## 6. RESULTS AND DISCUSSION

- 59% of the respondents have stated that the canteen facilities in the organization were good.
- 50% of the respondents have stated that latrines, urinals and bathroom facilities were good.

- Majority of 72% of the respondents felt that the rest shed facilities in the organization were good.
- Out of the total respondents, majority 61% have opined that hospital facilities were good.
- Majority 63% of the respondents responded that insurance benefit as good.
- 63% of the respondents responded that bonus benefit were good.
- Out of total respondents, 51% of the respondents have stated that security facilities provided in the housing unit is good.
- 70% of the respondents have stated that the holiday facilities provided by the company as good.
- 30% of the respondents responded that the sports facilities provided to employees as good.

## 7. SUGGESTION

- Crowding at the lunchtime can be avoided either by extending the room if possible or by alternate arrangement.
- By providing more quarters, the housing problem can be solved.
- Few more emergency beds may be provided and frequent inspection to be made to check the first – aid box.

## 8. CONCLUSION

BHEL, Tiruchirappalli is one of the navaratnas of India. Till now it had shown tremendous growth, increased profits, and there by contributing greatly to the economic development of the country. These achievements are possible only because of the successful workforce it has. An employee becomes successful only when he remains satisfied at his work place. This amply demonstrates the welfare measures existing in BHEL and continuous improvement of the same.

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*[5]. International* Journal of *Scientific & Engineering Research, Volume 5, Issue 12 PSU'S (* BHEL *) differences regarding* labour welfare *practices.*

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**Research Article**

# INVESTOR BEHAVIOR TOWARDS GENERAL AND LIFE INSURANCE OF RELIANCE INSURANCE COMPANY IN TRICHY DISTRICT- A STUDY

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## ABSTRACT

Insurance basically is a tool against protection of life or against any unforeseen event or death of individuals. It provides financial protection against such risks. The purpose of investments in life insurance for every individual might differ. This large number of insurance companies and having wide range of products confuse the investors as to which product and of which company to purchase. So marketers are interested to know the investment pattern of insurance investors in order to form their marketing strategies. The present paper is an attempt to know the behaviour of individual with related to life and general insurance and also to know the problems faced by them. The study revealed that Insurance advisor is the main influencer in investment decision of life and general insurance investors and they depend largely on the insurance advisor.

***Keywords :***

## 1. INTRODUCTION

An individual who commits money to investment products with the expectation of financial return. Generally, the primary concern of an investor is to minimize risk while maximizing return, as opposed to a speculator, who is willing to accept a higher level of risk in the hopes of collecting

higher-than-average profits. An **investor** is someone who allocates capital with the expectation of a financial return. The types of investments include, gambling and speculation, equity, debt securities, real estate, currency, commodity, derivatives such as put and call options, etc. This definition makes no distinction between those in the primary and secondary markets. That is, someone who provides a business with capital and someone who buys a stock are both investors. Since those in the secondary market are considered investors, speculators are also investors.

The term "**investor protection**" defines the entity of efforts and activities to observe safeguard and enforce the rights and claims of a person in his rule as an investor. This includes advice and legal action. Countries with strong investor protections tend to grow fast than those with poor investor protections.

## 2. GENERAL INSURANCE

**General insurance** or non-life insurance policies, including automobile and homeowners policies, provide payments depending on the loss from a particular financial event. General insurance typically comprises any insurance that is not determined to be life insurance.

## 3. HEALTH INSURANCE

Every human being is exposed to various healthcare hazards that require medical treatment. Such medical treatment can be due to illness (Chronic / Critical / Terminal / Major and Minor) or due to injuries that require hospitalization.

Such hospitalizations tend to,

a. Burn a hole in your pocket

b. Alter your quality of life by imposing financial restrictions

c. Create loss of career options / Income

d. Cause mental trauma or incapacitation

Private hospitals and medicines have become rather expensive. Diagnostic charges are beyond the common man's reach and specialists come only at a steep price.

Health Insurance can be the answer to the financial difficulties arising out of these unexpected medical emergencies. Health insurance policies guarantee peace of mind for the insured and the family against financial perils and inadequacies. It covers an individual against hospitalization

expenses with the option of including spouse, dependent children and dependent parents with a family discount. It is definitely a price worth paying, for complete peace of mind.

## 4. TRAVELLING INSURANCE

Travelling for business or pleasure? Whether it's education, employment, meeting your loved ones or just taking a break; online **Travel insurance policy** makes your journey hassle-free. With extensive benefits that cover any eventuality you might face, our Travel Insurance is always right by your side.

### 4.1 BUSINESS/LEISURE TRAVEL INSURANCE

1. Door-to-door Cover
2. Adventure Sports Cover
3. Senior Citizens Cover

### 4.2 STUDENT TRAVEL INSURANCE

- Door-to-door Cover
- Sponsor protection cover
- Study interruption cover

### 4.3 CORPORATE TRAVEL INSURANCE

- No medical checkup required
- Completely custom-made
- Web-enabled online policy issuance at your premises
- Express claim processing

## 5. HOME INSURANCE

Your hard work and hard-earned money have gone into making your very own dream home and when dreams turn real with your own home, it's just the time to go the extra mile. **Total Home Protect** with triple benefits - a one-of-a-kind revolutionary **home insurance plan**. Not just your home and the attached valuables within, you can even protect your family now. That would mean not just one or even two; now get three-fold protection.

- Comprehensive coverage - Cover for the house structure, contents and family against unforeseen unfortunate events
- Hassle-free purchase process - No additional documents or valuation certificate required while purchasing the policy
- Convenient claims processing
- Wide range of Sum Insured options to suit your requirements

## 6. VEHICLE INSURANCE

Liability only policy: covering the liabilities towards third parties only, as per motor vehicles act. This insurance is mandatory for a vehicle plying in public place, as per motor vehicles act. Package policy: in addition to the above, the loss or damage to the value declared and other terms and conditions in the policy.

Premium depends upon various factors viz. type, make, model, cc, usage, place of registration, past claims history etc. of the vehicle. Therefore approach our underwriting office with vehicle details for exact premium. Existing insurance will be renewed by the same office.

## 7. TYPES OF INSURANCE PRODUCTS

### 7.1 TERM INSURANCE PLAN

In insurance language this is a "pure risk cover" and can be defined as an insurance or risk management product in its purest and simplest form. In case of your untimely death, your dependents will receive the risk- cover amount or the 'sum assured'. On the other hand, there is no survival benefits if you survive the policy term, and you also do not get back the premiums paid. Endowment assurance plans. It is a traditional investment-cum-insurance plan. In other words, it provided both life cover (in the event of death of life insured) or maturity benefits if he/she survives the policy term. Endowment plans are typically front loaded. Therefore it makes sense for you to remain in the policy for at least 12-15 years.

### 7.2 MONEY BACK POLICY

It is a variant of the difference is that you get the survival benefits intermittently over the life of the policy. Thus taking care of his lump-sum monetar4y requirements to enable him to meet his financial

goals and major commitments. The maturity benefit is the sum assured value less the survival benefits already paid under the policy, plus bonuses accrued, if any. In case of untimely death the nominee will receive the entire sum assured without considering the payouts already made to you before the unfortunate death.

### 7.3 WHOLE LIFE PLAN

This policy provides the life assurance cover for almost the entire life. Most of the insurance companies provide protection up to the age of 100 years. The sum assured is paid to you once you reach this age, and the policy is terminated. In this payment of premium is for whole life, and the sum assured is paid to your nominee in the event of your death. In other words, this is equivalent to a term plan over your lifetime.

### 7.4 PENSION PLAN

A pension plan can be looked as more of an investment product offered by insurers to cater to the "golden" retirement years of an individual. Also referred to as retirement plans, these are designed to ensure that you are financially independent during your retirement years. Most of the pension plans also provide an optional life assurance cover in them.

### 7.5 CHILD PLAN

It basically aims at ensuring the achievement of life goals of your child. The goal can be higher education, financial plan, the life assured can be the parent or the child. The beneficiary for the policy, however, is the child. As a child is a minor, the life insurance contract is between the parent and the insurance company. In case of early death, the premium payment is waived off by the insurance company and the policy continues as originally planned.

### 7.6 UNIT LINKED INSURANCE PLAN

ULIPs have been the darling of insurance companies, intermediaries and the insured population alike over the last five years. The main reason for this popularity is the twin advantage of a pure life cover (insurance component) and a range of investment funds or options (savings component) to match your risk profile. While the pure life cover provides the much needed financial security to your dependents in the event of your untimely death, the savings component allows you to participate in the capital markets and build wealth over the long term tenure of the policy.

## 8. OBJECTIVES

- To know the factors influenced to investors about insurance company.
- To know the investor knowledge about insurance company products.
- To know the reason behind choosing a particular insurance company.
- To know the kind of insurance policy that investors prefer.
- To know the satisfaction level of investors

# 9. METHODOLOGY

## 9.1 RESEARCH DESIGN

A research design is the detailed blue print used to guide a research study towards its objectives. It helps to collect, measure and analysis of data. The present study seeks to find out the investors behavior towards Reliance Life Insurance Company. The study also aims at finding the satisfaction level of insurance policies. So this makes the study a Descriptive Research.

## 9.2 SAMPLING DESIGN

### 9.2.1 SAMPLE SIZE

For the purpose of proper survey, the researcher took the population of Trichy Region from which the sample size of 200 respondents was taken by convenience sampling.

# 10. DATA COLLECTION

There are two types of data collection.

- Primary data questionnaire collected from the respondents
- Secondary data as company details

## 10.1 PRIMARY DATA COLLECTION

### 10.1.1 RESEARCH INSTRUMENT

In this study the research instrument is "Questionnaire". It is consists a set of question which is presented to the respondents. The questionnaire is structured & combination of various closed and open ended questions. Close ended question already have the possible answers and the open ended question allow the respondents to answers in their own word. The method helps to obtain right information from respondents.

## 10.2 SECONDARY DATA COLLECTION

In this study the secondary data is collected from the following sources.

- Websites and journals
- Reports of company
- Books on Marketing and Research methodology

## 11. STATISTICAL TOOLS USED

- ✓ Chi-Square Test
- ✓ T-Test
- ✓ Correlation

**Table 1 : ANALYSIS AND INTERPRETATION**

| | | | |
|---|---|---|---|
| **Gender** | Male | 148 | 74.0 |
| | Female | 52 | 26.0 |
| **Age** | 20-25 | 58 | 29.0 |
| | 26-30 | 71 | 35.5 |
| | 31-35 | 27 | 13.5 |
| | 36-40 | 27 | 13.5 |
| | Above 40 | 17 | 8.5 |
| **occupation** | Business | 49 | 24.5 |
| | Government | 78 | 39.0 |
| | Private | 43 | 21.5 |
| | Others | 30 | 15.0 |
| **Income** | upto10000 | **32** | 16.0 |
| | Rs 10001-20000 | 34 | 17.0 |
| | Rs 20001-30000 | 52 | 26.0 |
| | Rs 30001-40000 | 44 | 22.0 |
| | Above Rs 40000 | 38 | 19.0 |

From the above analysis it is inferred that there are 74% are male and 26% are female, nearly 35.5% of respondents are between 26-30 years of age and 29% of respondents are between 20-25 years of age. Only 8.5% of respondents are above 40 years of age, nearly 39% of respondents are government employees and 24.5% of respondents are doing own business, 21.5% of respondents are private

employees and 15% and 26% of respondents' income are between Rs 20001-30000 and 22% of respondents' income are between 30001-40000. Only 16% of respondents are earning below 10000.

**Table 2 :RESPONDENT'S INTEREST TOWARDS INSURANCE POLICY**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1. | Yes | 154 | 77 |
| 2 | No | 46 | 23 |
| **Total** | | 200 | 100 |

The above analysis inferred that 77% of the respondents are having interest towards the insurance policy.

**Table 3 : NUMBER OF LIFE INSURANCE POLICY OF THE RESPONDENTS**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | One | 58 | 29.0 |
| 2 | Two | 60 | 30.0 |
| 3 | Three | 55 | 27.5 |
| 4 | Four | 27 | 13.5 |
| | **Total** | 200 | 100.0 |

The above table inferred that 30% of the respondents are having two insurance policy and 29% of respondents' having one insurance policy. Nearly 13.5% respondents are having four insurance policies.

**Table 4 : RESPONDENT'S PERCENTAGE OF SAVINGS GOES INTO INVESTMENT**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | <25% | 59 | 29.5 |
| 2 | 25-50% | 90 | 45.0 |
| 3 | 51-75% | 35 | 17.5 |
| 4 | >75% | 16 | 8.0 |
| | **Total** | 200 | 100.0 |

The above table it is inferred that 45% of respondents' are investing 25% to 50% from their savings and 29.5% of respondents' are investing less than 25% from their savings. Only 8% of respondents are investing above 75% from their savings.

**Table 4 : RESPONDENT'S KNOWLEDGE ABOUT THE INSURANCE PRODUCTS**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Print Media | 116 | 58.0 |
| 2 | Electronic Media | 51 | 25.5 |
| 3 | Both | 13 | 6.5 |
| 4 | Others | 20 | 10.0 |
| | **Total** | 200 | 100.0 |

The above table inferred that 58% of respondents getting knowledge about the insurance product from print media and 25% of respondents' from electronic media. Only 6% of respondent's form both these sources.

**Table 6 : RESPONDENTS' CONVENIENT MODE OF PAYMENT**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Monthly | 70 | 35.0 |
| 2 | Quarterly | 90 | 45.0 |
| 3 | Half yearly | 28 | 14.0 |
| 4 | Yearly | 12 | 6.0 |
| | **Total** | 200 | 100.0 |

The above table it is inferred that 45% of respondents' are convenient to pay quarterly premium and 35% of respondents' are convenient to pay monthly premium. Only 6% of respondents are convenient in yearly premium.

**Table 7 : RESPONDENT'S REASON BEHIND CHOOSING THE PARTICULAR INSURANCE COMPANY**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Safety | 54 | 27.0 |
| 2 | Brand Name | 98 | 49.0 |
| 3 | Good Track Record | 26 | 13.0 |
| 4 | Good Return | 22 | 11.0 |
| | **Total** | 200 | 100.0 |

From the above table it is inferred that 49%of respondents choosing the particular insurance policy for the company's brand name and 27% of respondents' are choosing for safety. Only 11% of respondents are choosing for good track

**Table 8 : RESPONDENT'S PREFERENCE TOWARDS PENSION PLAN**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Respondents opted pension plan | 146 | 73.0 |
| 2 | Respondents not opted pension plan | 54 | 27.0 |
| | **Total** | 200 | 100.0 |

Source: primary data

From the above table it is inferred that 73% of the respondents opted pension plan.

**Table 9 : RESPONDENT'S PREFERENCE TOWARDS INVESTMENT PLAN / CHILD PLAN**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Respondents opted investment and child plan | 92 | 46.0 |
| 2 | Respondents not opted investment and child plan | 108 | 54.0 |
| | **Total.** | 200 | 100.0 |

Source: primary data

From the above table it is inferred that only 46% of the respondents opted investment and child plan.

**Table 10 : RESPONDENTS' PREFERENCE TOWARDS TAX SAVINGS PLAN**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Respondents opted tax savings plan | 78 | 39.0 |
| 2 | Respondents not opted tax savings plan | 122 | 61.0 |
| | **Total** | 200 | 100.0 |

Source: primary data

From the above table it is inferred that only 61% of the respondents opted tax savings plan.

**Table 11 : FACTORS INFLUENCED THE RESPONDENTS TO SELECT PARTICULAR COMPANY**

| S.No | Particulars | Frequency | Percentage |
|---|---|---|---|
| 1 | Personal Interest | 65 | 32.5 |
| 2 | Friends | 50 | 25.0 |
| 3 | Family | 55 | 27.5 |
| 4 | Others | 30 | 15.0 |
| | **Total** | 200 | 100.0 |

From the above table it is inferred that 32% of respondents' prefer particular insurance company out of their personal interest and 27.5% for their family.

**CHI-SQUARE TESTS**

**Hypothesis : There is an Association between gender and the service offered by the company**

| | Value | Df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| **Pearson Chi-Square** | 1.831[a] | 4 | .767 |
| **Likelihood Ratio** | 1.863 | 4 | .761 |
| **Linear-by-Linear Association** | 1.120 | 1 | .290 |
| **No of Valid Cases** | 200 | | |

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is .78.

**Significance Level: 0.05Inference:**

The above table shows that Pearson Chi-square value is not significant at 0.05 levels. Hence null hypothesis is accepted and alternate hypothesis is rejected. Therefore, there is no association between gender and the service offered by the company

**Hypothesis There is an association between satisfaction of age and the service offered by the company**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| **Pearson Chi-Square** | 25.126[a] | 16 | .068 |
| **Likelihood Ratio** | 24.192 | 16 | .085 |
| **Linear-by-Linear Association** | 4.443 | 1 | .035 |
| **No of Valid Cases** | 200 | | |
| a. 11 cells (44.0%) have expected count less than 5. The minimum expected count is .26. | | | |

**Inference:**

The above table shows that Pearson Chi-square value is not significant at 0.05 levels. Hence null hypothesis is accepted and alternate hypothesis is rejected. Therefore, there is no association between age and the service offered by the company

## 12. FINDINGS

- 77% of investors are showing more interest towards the insurance policy/investment plan.
- 30% of investors are having two life insurance policies.
- 45% of investors are spending their 25-50% of savings through investment.
- 58% of respondents are getting more knowledge about insurance policy through print media when compare to others sources.
- 45%of respondents are prefer for quarterly payment.
- 49% of respondents are choosing particular insurance company based on their brand name.
- 73% of respondents are preferred to choose pension plan.
- 54% of respondents are preferred to choose investment plan and child plan.
- 61% of the respondents are not opted for tax savings schemes.
- 32% of respondents are influenced by their personal interest to select the insurance company.

## 13. SUGGESTIONS

1. From the study female investors are low when compared to male investors so the company has to take measure to improve the female customer by providing offers.
2. Presently investors who's age group between 26-30 are more when compare to other age group. So the company has to take some measure to cover other age groups also.

3. Investors gather knowledge about the insurance product mostly through print media. So the company has to improve the advertisement strategy through other sources also.
4. Government employees are investing more in insurance policy. So the company has to take some measure to cover business persons and others to expand their business.
5. The most of the investors are prefer quarterly convenient mode of payment. So the company has to take step regarding this thing.
6. The investors are more prefer to purchase life insurance and pension plan when compare to investment plan, child plan and tax saving plan. So the company has to motivate investors to increase the policy in those three plans.

## 14. CONCLUSION

The study titled "A study on investor's behavior towards Reliance Insurance Company in Trichy district" has been conducted to study the behavior of the investors. From the study it found that some of the investors are satisfied with the company but some of them are dissatisfied. So the company has to concentrate more on customer service and offers. Due to heavy competition in this sector for their survival they have to do something extra to retain and attract the customers.

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**Research Article**

# A STUDY ON STRESS MANAGEMENT AMONG SCHOOL TEACHERS WITH SPECIAL REFERENCE TO SRIRANGAM TALUK

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## ABSTRACT

Stress is strain, force, tension, emphasis, difficulty, break down, anxiety, depression. Stress is an inevitable part of today's fast life in this age of globalization and liberalization of the economy, competition among organizations has increased modern organizations are facing the problems of executive stress. Individuals and organizations have to pay economic and human cost due to these problems stress is the order of the day and it is impossible to be entirely without stress. Pressure of time often results in people reporting to their workplace with migraine attack, body aches, mental strains, etc., stress therefore, is a costly business affair, that affects two aspects-first, the employee's health-which directly affects the second – the organization's profits. This is so because, if the health does not allow the body to function normally, it will lead to increased absenteeism, late comings and short leaves in the organization, which directly affect the organization's growth and profit since employees are the main source of profit generation fort an organization. Teachers are facing lot of problems in their family and work place Therefore an attempt is made to study the stress level of school teachers in Srirangam Taluk.

***Key Words: Stress, absenteeism, physical, individual, group, organization.***

## 1. INTRODUCTION

Stress is strain, force, tension, emphasis, difficulty, break down, anxiety, depression. Stress is an inevitable part of today's fast life in this age of globalization and liberalization of the economy, competition among organizations has increased modern organizations are facing the problems of executive stress. Individuals and organizations have to pay economic and human cost due to these problems stress is the order of the day and it is impossible to be entirely without stress. Day-to-day life is full of stress-both on the personal and the professional fronts. Pressure of time often results in people reporting to their workplace with migraine attack, body aches, mental strains, etc., stress therefore, is a costly business affair, that affects two aspects-first, the employee's health-which directly affects the second – the organization's profits. This is so because, if the health does not allow the body to function normally, it will lead to increased absenteeism, late comings and short leaves in the organization, which directly affect the organization's growth and profit since employees are the main source of profit generation fort an organization.

## 2.STATEMENT OF THE PROBLEM

Day-to-day life is full of stress-both on the personal and the professional fronts. Pressure of time often results in people reporting to their workplace with migraine attack, body aches, mental strains, etc., stress therefore, is a costly business affair, that affects two aspects-first, the employee's health-which directly affects the second – the organizations' profits. This is so because, if the health does not allow the body to function normally, it will lead to increased absenteeism, late comings and short leaves in the organization, which directly affect the organization's growth and profit since employees are the main source of profit generation fort an organization. Bank employees are facing lot of problems in their family and office. Therefore an attempt is made to study the stress level of school teachers in Srirangam Taluk.

## 3. OBJECTIVES OF THE STUDY

- To know the socio-economic conditions of the respondents
- To study the causes for stress among the school teachers.
- To find out the signs and symptoms of stress.
- To suggest the remedial measures for overcoming stress.

## 4. METHODOLOGY

The Questionnaire was distributed to the respondents during the leisure time and filled in questionnaire were collected.

**4.1Data collection-**The final version of the questionnaire was applied on a sample size of 50 respondents. The researcher selected on the basis convenience sampling whoever is available willing and whose co-operation is fully available were taken as respondents for the study research. Primary and secondary data were collected for this study.

**Definition-** According to the Dr. Hans selye "stress is the sum of all the non-specific efforts of factors that can act upon the body"

## 5. CONCEPT OF STRESS

The word stress is derived from the Latin term 'stringers which means "to draw tight" Some define stress as the non-specific response of the body to any demands made on it. When the demands on an individual exceed his capability and adjustment resources stress occurs. Stress is difficult from anxiety which is a state of uncertainty. It is also difficult from agitation which is the physical part of anxiety. Stress also differs from frustration which is blocked goal attainment. Stress is a pressure condition causing hardship. It is an internal phenomenon and a mental attitude if stress is the condiment, strain is the salt and if there is an imbalance in condiment-salt relationship the result is impalatable stress is generally believed to have a deleterious effect on health and performance. But a minimum level of stress is necessary for effective functioning and peak performance. Research studies across a wide variety of professions indicate that people at work spend most of their time working and coordinating with others. Work interdependence accelerates global and geographical dispersal of work with shorter product life cycles greater knowledge intensity of organizations work and networked forms of organizing are bound to further enhance work interdependence. All these create fertile ground for generation of stress.

### 5.1Golden principles of stress

- Stress is a messenger listen to it
- Don't feel superior, give up your ego
- There are always benefits hidden behind every event in life.
- Consider your pressures as challenges and your coping ability will increase.

### 5.2Causes of Stress at Workplace

According to Dyer the causes of stress at workplace are as follows. **Physical-** Lighting, noise, temperature, vibration and air pollution. **Individual-**Role conflict, work load, family problem. **Group-**Lack of unity, inadequate support or conflict among team members. **Organization-**Culture, structure and/or leadership influence.

### 5.3 Stages of Stress

- Alarm stage
- Exhaustion stage
- Identify hazards
- Identify who might be harmed and how
- Evaluate the risk
- Record the findings
- Monitor and review

## 6. REVIEW OF LITERATURE

### 6.1Workplace Stress

Stress has been defined by many in different ways as it takes different forms depending on the situations. According to Douglas (1980), stress is defined as any action or situation that places special physical or psychological demands upon a person. According to van Fleet (1983), stress is caused when a person is subjected to unusual situations, demands, extreme expectations. Or pressures that are difficult to handle. Workplace stress can be defined as the most harmful physical and emotional responses that occur within a human being when the requirements of the job so not match his capabilities, resources, or even needs. Some experts argue moderate amount of both physical and mental stress is required for a normal and healthy growth. A little degree of stress at workplace energizes the employees psychologically and physically, as it motivates them to learn new skills and master their jobs resulting in increasing productivity. The problem arises only when stress is not managed properly. Excessive workplace stress will affect the employee's motivation and health leading to lack of interest in job, reduced productivity, and more incidences of sickness, frequent absence, and poor morale of employees. Stress also affects the growth and profit of any organization. The direct cost of stress in the organization is frequent absence of employees,

replacement of skills, loss of service, or production time. The indirect cost of stress in the organization is reduced productivity, low morale less innovation, lower customer service, increased errors, high staff turnover, increased recruitment cost, poor time keeping, and more health insurance costs. Today workplace stress is becoming a major issue and a matter of concern for the employees and the organizations. It has become a part of life for the employees, as life today has become so complex at home as well as outside that it is impossible to avoid stress. Experts say that stress is the main cause for all the problems of the modern world that affects both the individuals and organizational health. In the present day competitive environment, all service oriented organization believes their employees to be the most important assets of the company.

According to statistical reports from WHO stress related depression is the number one occupational disease of 21st century. According to the American Medical Association, stress is a factor in more than 75% of sickness today. World health organization says stress is America's #1 Health Problem. In 2001 alone heart disease killed an estimated 700,142 people (Centers for Disease Control and Prevention). The experts say most cardio vascular cases are related to stress. NIOSH explains 40% of workers reported their job was very or extremely stressful, 25% view their jobs as the number one stressor in their lives; three fourths of employees believe that workers have more on – the – job stress than a generation ago, 29% of workers felt quite a bit or extremely stressed at work, 26 percent of workers said they were "often or very often burned out or stressed by their work"3. An estimate of The World Health Organization (WHO) Global Burden of Disease Survey shows that mental health disease, including stress-related disorders, will be the second leading cause of disabilities by the year 2020. Survey in 2007 by Associated Chamber of Commerce and Industry of India also reported that work related stress and mental fatigue is affecting the India employees. Associated Chamber of Commerce and Industry of India (ASSOCHAM), in a study conducted in 2007, has also reported that those attract a large pool of customers for various schemes besides ensuring timely recovery of one or other problems related to stress. According to a recent study conducted by Associated Chambers of Commerce and Industry of India (ASSOCHAM), it has been found that schools are top 10 high stress workplace in recent times.

The national Institute of Mental Health sited that stress related suicide was the 3rd leading cause of death among young people aged 15-24years of age. During the past decade, the school sector had under gone rapid and striking changes like policy changes due to globalization and liberalization increased competition due to the entrance of more private (corporate) sector schools, downsizing, introduction of new technologies, etc., Due to these changes, the employees in the school sector, downsizing sector are experiencing a high level of stress. A study was conducted to investigate and to compare the level of stress experienced by the employees of the nationalized school in Chennai. The population selected for this particular study is employees from public sector units in Chennai. Public sector comprise of Union School of India, Vijaya School and the state bank of India. The study is explorative as well as descriptive in nature. The size of sample was 100. Findings reveal that about 97% of the respondents believed that they face high level of stress, which may be due to both professional and personal reasons. The respondent were overburdened with work load in their work life imbalance is one of the major attribute which contribute to stress for an employee. Stress exist in every organization, either big or small the work place and organizations have become so much complex due to which it exists, works place stress have significant effect over employees job performance. Stress not only affects physical psychological and financial balances of an employee, but also the employers as well. Desired result cannot be expected from employers who are burn out, exhausted or stressed. The national institute of occupational safety and health states that job stress now more that ever poses threat to the health of workers and health of organization. About one third of workers report high level of stress, one quarter of employees view their job as number one of stressor.

A study examines occupational stress of employees in the school sector. A sample of 60 bank employees at different organizational levels and educational backgrounds was used. Data collection utilized the occupational stress Indicator (OSI). Results of data analysis provided evidence that employees' educational level affect the degree of data experience in various ways.

School employees cannot afford the time to relax and "wind down" when they are faced with work variety, discrimination, favoritisms, delegation and conflicting tasks. The study also shows the degree to which some employees tend to bring work-related problems home

(and take family problems to work) depends on their educational background, the strength of the employees' family support, and the amount of time available for them to relax.

Another study examines the relationship between job stress and job performance on school employees of school sector in Pakistan. The study tests the purpose model in relation f job stress and its impact on job performance by using (n=144) data of graduate, senior employees including manager and customers services officers of well reputed growing school in Pakistan. The data obtained through questioners was analyzed by statistical test correlation and regression and reliabilities were also confirmed. The results are significant with negative correlation between job performances and shows that job stress significantly reduces the performance of an individual. The results suggest that organization should facilitate supportive culture within the working atmosphere of the organization.

**Table – 1 Socio-Economic profile of the respondents**

| **Particulars** | | **No.of Respondents** | **%** |
|---|---|---|---|
| Age | 20-29 yrs | 11 | 22 |
| | 30-39yrs | 22 | 44 |
| | 40-50yrs | 14 | 28 |
| | Above 50 yrs | 3 | 6 |
| Gender | Male | 19 | 38 |
| | Female | 31 | 62 |
| Marital Status | Married | 37 | 74 |
| | Unmarried | 13 | 26 |
| Type of family | Nuclear | 33 | 66 |
| | Joint | 17 | 34 |
| Members in family | Below 3 | 32 | 44 |
| | 4-5 | 15 | 30 |
| | 6 and above | 3 | 26 |
| Area | Urban | 22 | 44 |
| | Semi urban | 15 | 30 |
| | Rural | 13 | 26 |
| Educational Qualification | UG with B.Ed | 14 | 28 |
| | PG with B.Ed | 10 | 20 |
| | D.T.Ed | 26 | 52 |
| Grade Position | UG Assistant | 24 | 48 |
| | PG Assistant | 12 | 24 |
| | Secondary Grade | 14 | 28 |
| Years of Experience | Below 5 years | 15 | 30 |
| | 5-10yrs | 4 | 8 |
| | 11-15 yrs | 16 | 32 |
| | Above 15 yrs | 15 | 30 |

**Table – 2 CAUSES FOR STRESS INTRINSIC TO THE JOB**

| Rank | Intrinsic to the job | | Isolation from others, overcrowding ect | | Lack of health and safety culture | | Deadlines and targets | | Long hours | | Travel | | New technology | | New technology | | Work overload | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | N | % | n | % | N | % | n | % | n | % | n | % |
| *1st* | 5 | 10.0 | 4 | 8.0 | 5 | 10.0 | 9 | 18.0 | 4 | 8.0 | 6 | 12.0 | 9 | 18.0 | ***14*** | ***28.0*** | 5 | 10.0 |
| *2nd* | 8 | 16.0 | 2 | 4.0 | 8 | 16.0 | 3 | 6.0 | 9 | 18.0 | 4 | 8.0 | ***10*** | ***20.0*** | 4 | 8.0 | 6 | 12.0 |
| *3rd* | 7 | 14.0 | ***10*** | ***20.0*** | 4 | 8.0 | 5 | 10.0 | 6 | 12.0 | 3 | 6.0 | 8 | 16.0 | 4 | 8.0 | 8 | 16.0 |
| *4th* | 5 | 10.0 | 7 | 14.0 | 7 | 14.0 | 3 | 6.0 | 7 | 14.0 | ***14*** | ***28.0*** | 2 | 4.0 | 5 | 10.0 | 5 | 10.0 |
| *5th* | 7 | 14.0 | 10 | 20.0 | 9 | 18.0 | ***14*** | ***28.0*** | 4 | 8.0 | 9 | 18.0 | 5 | 10.0 | 10 | 20.0 | 3 | 6.0 |
| *6th* | 4 | 8.0 | 3 | 6.0 | ***9*** | ***18.0*** | 7 | 14.0 | 3 | 6.0 | 4 | 8.0 | 2 | 4.0 | 3 | 6.0 | 5 | 10.0 |
| *7th* | 1 | 2.0 | 8 | 16.0 | 5 | 10.0 | 3 | 6.0 | ***8*** | ***16.0*** | 3 | 6.0 | 7 | 14.0 | 2 | 4.0 | 6 | 12.0 |
| *8th* | **8** | **16.0** | 3 | 6.0 | 1 | 2.0 | 3 | 6.0 | 4 | 8.0 | 5 | 10.0 | 4 | 8.0 | 4 | 8.0 | 3 | 6.0 |
| *9th* | 5 | 10.0 | 3 | 6.0 | 2 | 4.0 | 3 | 6.0 | 5 | 10.0 | 2 | 4.0 | 3 | 6.0 | 4 | 8.0 | ***9*** | ***18.0*** |
| ***Result*** | **8th** | | ***3rd*** | | ***6th*** | | ***5th*** | | ***7th*** | | ***4th*** | | ***2nd*** | | ***1st*** | | ***9th*** | |

**Source: Primary Data**

The above table depicts that 28 percentage of the teacher have given rank1, rank4, rank 5 for the factor new technology and travel and deadlines and targets, 20 percentage of the teacher have given rank 2, rank 3for the factor new technology isolation from others overcrowding act, 18 percentage of the teacher have given rank 6, rank 9, for the factor Lack of health and safety culture and work overload, 16 percentage of the teacher have given rank 7,rank 8 for the factor long hours are intrinsic to the job. 28 percentage of the teacher have given rank 1, rank 4, rank 5 for the new technology are travel are deadlines and targets.

**Table – 3 ROLE IN THE ORGANIZATION**

| Rank | Role ambiguity -no clear work objectives, no clarity, scope, and responsibility | | Role conflict - related to job demands, personal wants, dislikes perception of how jobs should be done | | Lack of recognition and support from managers and co-workers | |
|---|---|---|---|---|---|---|
| | ***N*** | ***%*** | ***n*** | ***%*** | ***N*** | ***%*** |
| *1st* | 12 | 24.0 | 8 | 16.0 | ***26*** | ***52.0*** |
| *2nd* | 18 | 36.0 | ***25*** | ***50.0*** | 12 | 24.0 |
| *3rd* | ***20*** | ***40.0*** | 17 | 34.0 | 12 | 24.0 |
| ***Resul*** | ***3rd*** | | ***2nd*** | | ***1st*** | |

| | | | |
|---|---|---|---|
| ***t*** | | | |

**Source: Primary Data**

The above table shows that 52 percentage of the respondent have rank 1 for the factor lack of recognition and support from managers and co-workers, 50 percentage of the respondent have rank 2 for the factor role conflict related to job demands, personal wants, dislikes perception of how jobs should be done, 40 percentage of the respondents have rank 3 for the role ambiguity no clear work objectives, no clarity, scope, and responsibility.

**Table – 4 RELATIONSHIPS AT WORK**

| Rank | Lack of recognition and support from managers and co-workers | | Bullying by managers or other members of staff | | Racial, sexual or other farms of harassment | | Conflicts between members of staff | |
|---|---|---|---|---|---|---|---|---|
| | ***N*** | ***%*** | ***N*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** |
| *1st* | 14 | 28.0 | ***22*** | ***44.0*** | 9 | 18.0 | 11 | 22.0 |
| *2nd* | ***17*** | ***34.0*** | 4 | 8.0 | 11 | 22.0 | 11 | 22.0 |
| *3rd* | 11 | 22.0 | 15 | 30.0 | 13 | 26.0 | ***16*** | ***32.0*** |
| *4th* | 8 | 16.0 | 6 | 12.0 | ***17*** | ***34.0*** | 12 | 24.0 |
| ***Result*** | ***2nd*** | | ***1st*** | | ***4th*** | | ***3rd*** | |

**Source: Primary Data**

It is clear from the table that, 44 percentages of the respondents have rank1 for the bullying by managers or other members of staff, 34 percentages of the respondents have rank 2, rank 4 for the lack of recognition and support from managers and co-workers are racial, sexual or other farms of harassment, 32 percentages of the respondents have rank 3 for the conflicts between members of staff.

Table – 5 **ORGANIZATIONAL STRUCTURE AND CLIMATE**

| Rank | Organizational structure and climate | | No sense of belonging being part of the team | | Lack of opportunities to participate in briefings, meetings etc | | No involvement indecision-making | | Poor management culture | | Too many demands | | Lack of control by staff over their own jobs | | Poor management of change | | Not included in communications and consultations | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***N*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***N*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** |
| *1st* | 9 | 18.0 | 4 | 8.0 | **16** | **32.0** | 7 | 14.0 | 2 | 4.0 | 5 | 10.0 | 3 | 6.0 | 6 | 12.0 | 8 | 16.0 |
| *2nd* | 3 | 6.0 | 7 | 14.0 | 2 | 4.0 | 6 | 12.0 | 9 | 18.0 | 4 | 8.0 | 8 | 16.0 | 5 | 10.0 | **10** | **20.0** |
| *3rd* | 3 | 6.0 | 7 | 14.0 | 3 | 6.0 | 6 | 12.0 | 2 | 4.0 | 6 | 12.0 | **9** | **18.0** | 6 | 12.0 | 6 | 12.0 |
| *4th* | 3 | 6.0 | **8** | **16.0** | 7 | 14.0 | 4 | 8.0 | 8 | 16.0 | 6 | 12.0 | 4 | 8.0 | 6 | 12.0 | 4 | 8.0 |
| *5th* | 6 | 12.0 | 3 | 6.0 | 5 | 10.0 | 6 | 12.0 | 3 | 6.0 | 4 | 8.0 | 5 | 10.0 | **10** | **20.0** | 4 | 8.0 |
| *6th* | 4 | 8.0 | 5 | 10.0 | 6 | 12.0 | 3 | 6.0 | 3 | 6.0 | **10** | **20.0** | 7 | 14.0 | 2 | 4.0 | 2 | 4.0 |
| *7th* | 3 | 6.0 | 6 | 12.0 | 4 | 8.0 | 6 | 12.0 | **14** | **28.0** | 6 | 12.0 | 6 | 12.0 | 9 | 18.0 | 2 | 4.0 |
| *8th* | 8 | 16.0 | 6 | 12.0 | 2 | 4.0 | **9** | **18.0** | 5 | 10.0 | 5 | 10.0 | 3 | 6.0 | 3 | 6.0 | 8 | 16.0 |
| *9th* | **11** | **22.0** | 4 | 8.0 | 5 | 10.0 | 3 | 6.0 | 4 | 8.0 | 4 | 8.0 | 5 | 10.0 | 3 | 6.0 | 6 | 12.0 |
| ***Result*** | ***9th*** | | ***4th*** | | ***1st*** | | ***8th*** | | ***7th*** | | ***6th*** | | ***3rd*** | | ***5th*** | | ***2nd*** | |

The above Table reveals that 32 percentage of the respondents have rank 1 for the factor lack of opportunities to participate in briefings, meetings etc, 28 percentage of the respondents have rank 7 for the factor of poor management culture, 22 percentage of the respondents

have rank 9 for the factor of organizational structure and climate, 20 percentage of the respondents have rank 2, rank 5, rank 6 for the not included in communications and consultations are poor management of change are too many demands, 18 percentage of the respondents have rank 3, rank 8, for the lack of control by staff over their own jobs are no involvement indecision making, 16 percentage of the respondents have rank 4 for the no sense of belonging being part of the team.

**Table – 6 CAREER DEVELOPMENT**

| Rank | Training - poor quality and or lack o opportunities | | Job security - lack of promotion, opportunities for advancement etc | | Job performance - Inconsistent and /or ineffective evaluation and appraisal procedures targets etc | | Home work interface | |
|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *n* | *%* | *n* | *%* |
| *4st* | 14 | 28.0 | 12 | 24.0 | **16** | **32.0** | 14 | 28.0 |
| *2nd* | **15** | **30.0** | 13 | 26.0 | 15 | 30.0 | 14 | 28.0 |
| *3rd* | 13 | 26.0 | **15** | **30.0** | 14 | 28.0 | 8 | 16.0 |
| *4th* | 8 | 16.0 | 10 | 20.0 | 5 | 10.0 | **14** | **28.0** |
| ***Result*** | ***2nd*** | | ***3rd*** | | ***1st*** | | ***4th*** | |

**Source: Primary Data**

The above Table 32 percentage of the respondents have given rank1 for job performance inconsistent and ineffective evaluation and appraisal procedures targets, 30 percentage of the respondents have given rank 2, rank 3 for the training- poor quality and or lack opportunities are job security- lack of promotion, opportunities for advancement etc, 28 percentage of the respondents have given rank 4 for the home work interface.

**Table – 7 SINGS AND SYMPTOMS OF STRESS INTELLECTUAL SYMPTOMS AFFCTING MIND**

| Rank | Memory retention | | Difficulty in focusing and decision making | | Confusion | | Negative thoughts | | Inability to judge properly | | Loss of objectivity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** |
| *1st* | ***17*** | ***34.0*** | 10 | 20.0 | 9 | 18.0 | 5 | 10.0 | 5 | 10.0 | 6 | 12.0 |
| *2nd* | 8 | 16.0 | 9 | 18.0 | ***11*** | ***22.0*** | 6 | 12.0 | 7 | 14.0 | 11 | 22.0 |
| *3rd* | 4 | 8.0 | 8 | 16.0 | 8 | 16.0 | ***15*** | ***30.0*** | 5 | 10.0 | 6 | 12.0 |
| *4th* | 7 | 14.0 | 5 | 10.0 | 7 | 14.0 | 15 | 30.0 | ***17*** | ***34.0*** | 7 | 14.0 |
| *5th* | 8 | 16.0 | ***12*** | ***24.0*** | 10 | 20.0 | 4 | 8.0 | 5 | 10.0 | 4 | 8.0 |
| *6th* | 6 | 12.0 | 7 | 14.0 | 5 | 10.0 | 5 | 10.0 | 9 | 18.0 | ***16*** | ***32.0*** |
| ***Result*** | ***1st*** | | ***5th*** | | ***2nd*** | | ***3rd*** | | ***4th*** | | ***6th*** | |

**Source: Primary Data**

From the above Table it is inferred that 34 percentage of the teachers have given rank 1, rank 4 for the factor- memory retention are inability to judge properly, 32 percentage of the teacher have given rank 6 for the factor- loss of objectivity, 30 percentage of the teacher have given rank 3 for the factor-negative thoughts, 24 percentage of the respondents teacher have

given rank 5 for the factor- difficulty in focusing and decision making, 22 percentage of the respondents teacher have given rank 2 for the factor-confusion.

**Table – 8 PHYSICAL SYMPTOMS AFFECTING BOBY**

| Rank | Headaches | | Indigestion | | Fatigue | | High blood pressure | | Weight gain or loss | | Bronchitis | | Asthma | | Decrease in sex drive | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| *1st* | **18** | **36.0** | 5 | 10.0 | 4 | 8.0 | 6 | 12.0 | 4 | 8.0 | 3 | 6.0 | 5 | 10.0 | 5 | 10.0 |
| *2nd* | 4 | 8.0 | **11** | **22.0** | 6 | 12.0 | 8 | 16.0 | 8 | 16.0 | 7 | 14.0 | 6 | 12.0 | 3 | 6.0 |
| *3rd* | 9 | 18.0 | 6 | 12.0 | **14** | **28.0** | 3 | 6.0 | 5 | 10.0 | 6 | 12.0 | 6 | 12.0 | 4 | 8.0 |
| *4th* | 2 | 4.0 | 4 | 8.0 | 6 | 12.0 | 6 | 12.0 | 2 | 4.0 | **16** | **32.0** | 3 | 6.0 | 3 | 6.0 |
| *5th* | 6 | 12.0 | 10 | 20.0 | 4 | 8.0 | 5 | 10.0 | **13** | **26.0** | 6 | 12.0 | 8 | 16.0 | 8 | 16.0 |
| *6th* | 2 | 4.0 | 4 | 8.0 | 5 | 10.0 | **15** | **30.0** | 8 | 16.0 | 4 | 8.0 | 5 | 10.0 | 5 | 10.0 |
| *7th* | 3 | 6.0 | 8 | 16.0 | 6 | 12.0 | 4 | 8.0 | 5 | 10.0 | 5 | 10.0 | 4 | 8.0 | **14** | **28.0** |
| *8th* | 6 | 12.0 | 2 | 4.0 | 5 | 10.0 | 3 | 6.0 | 5 | 10.0 | 3 | 6.0 | **13** | **26.0** | 8 | 16.00 |
| ***Result*** | *1st* | | *2nd* | | *3rd* | | *6th* | | *5th* | | *4th* | | *8th* | | *7th* | |

**Source: Primary Data**

From the above Table it is observed that 36 percentage of the teacher have given rank 1 for the factor-headaches, 32 percentage of the teacher have given rank 4 for the factor-bronchitis, 30 percentage of the teacher have given rank 6 for the high blood pressure, 28 percentage of the teacher have given rank3 are rank7 for the factor-fatigue are decrease in sex drive, 26 percentage of the teacher have given rank 5, rank 8 for the factor-weight gain or loss and asthma, 22 percentage of the teacher have given rank 2 for the factor-indigestion.

**Table – 9 EMOTIONAL SYMPTOMS AFFECTING THOUGHTS AND FEELINGS**

| Rank | Moody | | Restlessness and anxiety | | Depression | | Anger and resentment | | Lack of confidence | | Nervous break downs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *%* | *n* | *%* | *N* | *%* | *N* | *%* | *n* | *%* | *n* | *%* |
| *1st* | 10 | 20 | **11** | **22** | 7 | 14 | 6 | 12 | 6 | 12 | 7 | 14 |
| *2nd* | **12** | **24** | 7 | 14 | 11 | 22 | 9 | 18 | 7 | 14 | 6 | 12 |
| *3rd* | 8 | 16 | 9 | 18 | **12** | **24** | 4 | 8 | 5 | 10 | 7 | 14 |
| *4th* | 5 | 10 | 13 | 26 | 7 | 14 | 8 | 16 | 5 | 10 | **13** | **26** |
| *5th* | 5 | 10 | 5 | 10 | 7 | 14 | 7 | 14 | **18** | **36** | 8 | 16 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *6th* | 10 | 20 | 5 | 10 | 6 | 12 | **16** | **32** | 9 | 18 | 9 | 18 |
| ***Result*** | ***2nd*** | | ***1st*** | | ***3rd*** | | ***6th*** | | ***5th*** | | ***4th*** | |

**Source: Primary Data**

The above Table states that 36 percentage of the teacher have given rank 5 for the factor-lack of confidence, 32 percentage of the teacher have given rank 6 for the factor-anger and resentment, 26 percentage of the teacher have given rank 4 for the factor- nervous break downs, 24 percentage of the teacher have given rank 2 are rank 3 for the factor-moody are depression, 22 percentage of the teacher have given rank1 for the factor- restlessness and anxiety.

**Table – 10 BEHAVIOR SYMPTOMS-AFFECTING SYMPTOMS**

| | **Irregular eating habits** | | **Irregular sleeping (insomnia)** | | **Living in isolation** | | **Become alcoholic** | | **Getting angry** | | **Overacting** | | **Nervousness** | | **Running away from responsibility** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rank** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***N*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** | ***n*** | ***%*** |
| *1st* | **13** | **26** | 7 | 14 | 4 | 8 | 2 | 4 | 8 | 16 | 5 | 10 | 7 | 14 | 6 | 12 |
| *2nd* | 4 | 8 | **14** | **28** | 9 | 18 | 4 | 8 | 8 | 16 | 7 | 14 | 5 | 10 | 3 | 6 |
| *3rd* | 6 | 12 | 5 | 10 | 3 | 6 | 10 | 20 | **11** | **22** | 5 | 10 | 3 | 6 | 9 | 18 |
| *4th* | 4 | 8 | 4 | 8 | **13** | **26** | 8 | 16 | 4 | 8 | 5 | 10 | 6 | 12 | 3 | 6 |
| *5th* | 8 | 16 | 4 | 8 | 8 | 16 | **11** | **22** | 8 | 16 | 5 | 10 | 5 | 10 | 4 | 8 |
| *6th* | 5 | 10 | 5 | 10 | 5 | 10 | 2 | 4 | 3 | 6 | 5 | 10 | **12** | **24** | 3 | 6 |
| *7th* | 6 | 12 | 7 | 14 | 3 | 6 | 7 | 14 | 3 | 6 | **9** | **18** | 5 | 10 | 5 | 10 |
| *8th* | 4 | 8 | 4 | 8 | 5 | 10 | 6 | 12 | 5 | 10 | 9 | 18 | 7 | 14 | **17** | 34 |
| ***Result*** | ***1st*** | | ***2nd*** | | ***4th*** | | ***5th*** | | ***3rd*** | | ***7th*** | | ***6th*** | | ***8th*** | |

**Source: Primary Data**

From the above Table explain that 34 percentage of the teacher have given rank 8 for the factor-running away from responsibility, 28 percentage of the teacher have given rank 2 for the factor-irregular sleeping, 26 percentage of the teacher have given rank1,rank 4 for the factor-irregular eating habits are living in isolation, 24 percentage of the teacher have given rank 6 for the factor-nervousness, 22 percentage of the teacher have given rank 3, rank 5 for

the factor-getting are become alcoholic, 18 percentage of the teacher have given rank 7 for the factor-overacting.

**Table – 11 OVERCOMING WITH STRESS**

| Rank | Taking a mental break listening music | | Take a warm bath or shower | | Set realistic targets | | Look for solutions than problems | | Maintain sense feelings instead of bottling them up | | Express your feelings instead of bottling them up | | Manage time | | Prioritize work | | Have some time for self | | Delegate task and break up big projects into smaller parts | | Doing yoga | | Doing mediation | | Discuss situations with spouse close friends | | Pray god | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | N | % | n | % |
| 1st | 7 | 14.0 | 3 | 6.0 | 5 | 10.0 | 3 | 6.0 | 5 | 10.0 | 5 | 10.0 | 2 | 4.0 | 4 | 3.0 | 2 | 4.0 | 3 | 6.0 | 5 | 10.0 | 1 | 2.0 | 6 | 12.0 | 3 | 6.0 |
| 2nd | 6 | 12.0 | 4 | 8.0 | 10 | 20.0 | 4 | 8.0 | 4 | 8.0 | 3 | 6.0 | 8 | 16.0 | 3 | 6.0 | 4 | 8.0 | 3 | 6.0 | 7 | 14.0 | 7 | 14.0 | 6 | 12.0 | 6 | 12.0 |
| 3rd | 1 | 2.0 | 6 | 12.0 | 3 | 6.0 | 5 | 10.0 | 2 | 4.0 | 6 | 12.0 | 5 | 10.0 | 2 | 4.0 | 2 | 4.0 | 2 | 4.0 | 4 | 8.0 | 4 | 8.0 | 3 | 60 | 6 | 12.0 |
| 4th | 4 | 8.0 | 3 | 6.0 | 6 | 12.0 | 8 | 16.0 | 4 | 8.0 | 2 | 4.0 | 2 | 4.0 | 3 | 6.0 | 4 | 8.0 | 3 | 6.0 | 1 | 2.0 | 2 | 4.0 | 3 | 60 | 1 | 2.0 |
| 5th | 3 | 6.0 | 3 | 6.0 | 2 | 4.0 | 4 | 8.0 | 5 | 10.0 | 2 | 4.0 | 5 | 10.0 | 8 | 16.0 | 2 | 4.0 | 5 | 10.0 | 1 | 2.0 | 7 | 14.0 | 2 | 40 | 1 | 2.0 |
| 6th | 5 | 10.0 | 1 | 2.0 | 2 | 4.0 | 2 | 4.0 | 2 | 4.0 | 3 | 6.0 | 3 | 6.0 | 4 | 3.0 | 4 | 8.0 | 3 | 6.0 | 6 | 12.0 | 8 | 16.0 | 3 | 60 | 2 | 4.0 |
| 7th | 2 | 4.0 | 4 | 8.0 | 5 | 10.0 | 2 | 4.0 | 7 | 14.0 | 3 | 6.0 | 3 | 6.0 | 4 | 3.0 | 1 | 2.0 | 3 | 6.0 | 3 | 6.0 | 3 | 6.0 | 3 | 60 | 3 | 6.0 |
| 8th | 2 | 4.0 | 3 | 6.0 | 3 | 6.0 | 5 | 10.0 | 3 | 6.0 | 3 | 6.0 | 3 | 6.0 | 2 | 4.0 | 7 | 14.0 | 5 | 10.0 | 1 | 2.0 | 1 | 2.0 | 1 | 20 | 3 | 6.0 |
| 9th | 4 | 8.0 | 2 | 4.0 | 1 | 2.0 | 2 | 4.0 | 4 | 8.0 | 3 | 6.0 | 4 | 8.0 | 4 | 3.0 | 2 | 4.0 | 2 | 4.0 | 3 | 6.0 | 4 | 8.0 | 13 | 26.0 | 5 | 10.0 |
| 10th | 1 | 2.0 | 6 | 12.0 | 3 | 6.0 | 4 | 8.0 | 4 | 8.0 | 5 | 10.0 | 9 | 18.0 | 6 | 12.0 | 5 | 10.0 | 4 | 8.0 | 2 | 4.0 | 1 | 2.0 | 1 | 20 | 3 | 6.0 |
| 11th | 3 | 6.0 | 1 | 2.0 | 4 | 8.0 | 1 | 2.0 | 1 | 2.0 | 5 | 10.0 | 1 | 2.0 | 2 | 4.0 | 6 | 12.0 | 2 | 4.0 | 1 | 2.0 | 1 | 2.0 | 2 | 40 | 11 | 22.0 |
| 12th | 4 | 8.0 | 4 | 3.0 | 3 | 6.0 | 2 | 4.0 | 5 | 10.0 | 4 | 3.0 | 2 | 4.0 | 5 | 10.0 | 4 | 8.0 | 9 | 18.0 | 6 | 12.0 | 3 | 6.0 | 4 | 80 | 2 | 4.0 |
| 13th | 3 | 6.0 | 2 | 4.0 | 1 | 2.0 | 6 | 12.0 | 2 | 4.0 | 3 | 6.0 | 2 | 4.0 | 2 | 4.0 | 1 | 2.0 | 5 | 10.0 | 8 | 16.0 | 2 | 4.0 | 2 | 40 | 1 | 2.0 |
| 14th | 5 | 10.0 | 8 | 16.0 | 2 | 4.0 | 2 | 4.0 | 3 | 6.0 | 3 | 6.0 | 1 | 2.0 | 1 | 2.0 | 6 | 12.0 | 1 | 2.0 | 2 | 4.0 | 6 | 12.0 | 1 | 20 | 3 | 6.0 |
| *Result* | 1st | | 14th | | 2nd | | 4th | | 7th | | 3rd | | 10th | | 5th | | 8th | | 12th | | 13th | | 6th | | 9th | | 11th | |

**Source: Primary Data**

From the above Table it is inferred that, 26 percentage of the teacher have given rank 9 for the factor-discuss situations with spouse close friends, 22 percentage of the teacher have given rank 11 for the factor-pray god, 20 percentage of the teacher have given rank 2 for the factor-set realistic targets, 18 percentage of the teacher have given rank 10,rank 12 for the factor-managing time are delegate task and break up big projects into smaller parts, 16 percentage of the teacher have given rank 4, rank 5,rank 6,rank 12,rank 14 for the factor-look for solutions than problems and prioritize work and doing mediation and doing yoga and take a warm bath or shower, 14 percentage of the teacher have given rank 1, rank 7,rank 8 for the factor- taking a mental break listening music are maintain sense feelings instead of bottling them up are have some time for self, 12 percentage of the teacher have given rank 3 for the factor-express your feelings instead of bottling them.

## 7. FINDINGS

- 28 percentage of the respondent are the teacher have given rank1, rank 4, rank 5 for the factor deadlines and targets.
- 52 percentage of the respondents have rank 1 for the factor lack of recognition and support from managers and co-workers for people and things.
- 44 percentages of the respondents have rank 1 for the facto conflicts between members of staff as causes of stress.
- 32 percentage of the respondents have rank1 for the factor lack of opportunities to participate in briefings meeting.
- 32 percentage of the respondents have given rank 1 for job performance in consistent and or ineffective evaluation and appraisal procedures target towards career development as the causes for stress.
- 34 percentage of the teachers have given rank 1 and rank 4 for the factor memory retention and inability to judge properly towards intellectual symptoms affecting minds as signs and symptoms of stress.
- 36 percentage of the teacher have given rank 1 for the factor headaches as the physical symptoms affecting body.
- 36 percentage of the teacher have given rank 5 for the factor lack of confidence as emotional symptoms affecting thoughts and feelings.
- 34 percentage of the respondents have given rank 8 for the running away from responsibility and their opinion about coping with stress.
- 26 percentage of the teachers have given rank 9 for factor take discuss situations with spouse close friends for overcoming stress.

## 8. SUGGESSTIONS

- Shift system can be introduced by school in order to reduce long hour of work.
- Every employee should be made aware of his strength and weakness, nature of his/her job and balance all problems related to his work, family and society.
- Confusions can be avoided by managing time properly and efficiently. This help in planning the work in the right way, setting priorities in work, managing time cleverly and being serious about deadlines.

- ❖ Emotional symptoms can be avoided by practicing meditation and yoga. School can practice meditation to his teachers during physical hours as workers hardly get time at home to perform meditation.
- ❖ Headache can be avoided by taking food on time and aware of the types of food and effect they have on health. Teachers can take of short break from work, relax and refresh themselves.
- ❖ Safety can be provided to women teachers
- ❖ School teachers should be dedicated work with involvement and interest to avoid stress.

## 9. CONCLUSION

Stress can be minimized if teachers take right steps. Stress free teachers perform better, work harder, feel happier and have a long term commitment to the government when compared to their counterparts. Hence it is better that teacher's take measure to eliminate stress or they evil end up paying a price.

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# IMPACT OF TRAINING AND DEVELOPMENT ON EMPLOYEE PERFORMANCE IN PRIVATE SECTOR ORGANIZATIONS IN TRICHIRAPPALLI DISTRICTS.

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## Abstract

Human resource is the life blood of any type of organization. Only through excellent-trained personnel, an organization can achieve its goals. Training is distinct as learning that is provided to get better performance on the present job. Given these flurry, this paper explores the impact of training and development on employee performance in select private sector organization. The research was intended to determine the role and impact of training on employees with emphasis on the Executives, Supervisors and Workmen of select private sector organization, who were randomly selected. The study assessed the training and development process of select private sector organization and whether training has improved employee performance. Questionnaire was designed using structured questions to collect primary data from employees of select private sector organization. The results indicated that select private sector organizations employees were not well informed about training and development programmes in

the organization. Most of the employees were of the view that training and development were effective tools for both personal and organizational success. The findings revealed that impact of training and employee satisfaction at public sector organization are not in line with the best practices regarding the planned and systematic levels of performance after training and developing employees skills and knowledge process as is generally known. It was recommended among other things, that the processes involved in training be duly followed, select private sector organization should help its organization identify their career paths and to direct them in the search of better knowledge.

## 1. INTRODUCTION

Training is always an important and integral part in furthering many kinds of human learning and development. If organizations are to make the best of the training function in their response to and promotion of change, the training function will need to be closely linked with business plans. This means that a detailed training policy needs to be agreed and implemented from the top of the organization and supported by management at all level.

Training is the process of increasing the knowledge, and skills for doing a particular job. It is an organized procedure by which people learn knowledge and skill for a definite purpose. The purpose of training is basically to bridge the gap between job requirements and present competence of an employee. Training is aimed at improving the behavior and performance of a person and also it is a never ending or continuous process.

Today, Indian organizations have realized the importance of training as a tool to achieve their strategic goals. It is not viewed by the organizations as a longer but as an investment on one of its most dynamic assets, namely, employees. Many organizations consider training as a strategic employee retention tool. It helps the organizations create a smarter force capable of meeting any situation and challenges..

## 2. REVIEW OF LITERATURE

There were various earlier studies have been done on training and development which were concerning to, impact, role of training and development, on employees performance. Chris obisi, (2011). Studied the employee training and development in Nigerian organizations some

clarification and agenda for research, Mehrdad alipour et.al (2009). Studied the degree of effectiveness of on the job training on iranian managers. D. A. Olaniyan and lucas. B. Ojo, (2008).Importuned of employees training and development in relation to organization effectiveness.

K. Karthikeyan et.al (2010). Studied the existing practices of the various aspects of training program and its effectiveness in selected public and private sector banks in tiruchirappalli district, south india. Irene ferguson laing, (2009). Considered the impact of training and development on worker performance and productivity in public sector organizations: a case study of Ghana ports and harbours authority. Jelena vemić, (2007). Importuned of employee training and development and the learning organizations.

Muir sanderson et. al studied the elevating employee performance in the public sector how to get the best from your people. Aarti, chahal, (2013). Consider of training need analysis based training and development: effect of training on performance by adopting development based strategy. Ms. Pallavi p. Kulkarni. Studied the literature review on training and development and quality of work life.

K. Pramod Gonchkar, (2012). Robert C. Merchant, Jr, (2011). Ozcan saritas, (2007). studied the relationship between the amount of training and development activities provided by insulation firms and the turnover rate is examined. He suggest as people become more conscious about using energy more effectively and efficiently, energy saving and environmental concerns will expand the insulation market capacity in Turkey.

Muhammad Farhan Akhtar,et al, (2011). studied seek to determine the impact of this training and development on motivation and job involvement along with what training methods are widely used in the banking sector of Pakistan. They suggest that by boosting the training and development activities within the banking sector the employees could be motivated and get attached with their work.

Agenda for Research. The Priority would be given to empirical analysis of the significance of identifying specific and appropriate needs before venturing into training and the reason why training fails. Aroge, Stephen Talabi (2012). Studied for to determine the contributions of

Industrial Training Fund (ITF) to employee's training and development in Nigeria. The findings, it is recommended, among other things, that more funds should be made available to the organization so it can also take care of students studying education in institutions of higher learning through its reimbursement and grant scheme.

N. Sylvia Naris and I. Wilfred Ukpere, (2009). the effectiveness of an HR code: Staff development and training at the Polytechnic of Namibia. The targeted population included 511 staff members, of which a sample size of 252 using probability random sampling was selected. A total of 230 closed ended questionnaires were distributed online and hard copies were delivered. In addition, 22 members of staff were interviewed. Karen Shelton, (2001). determined that training and development increase employee satisfaction and are significant in an employee's decision to stay with a company. It also indicated that the impact of training decreases without the organizational culture to support employees in the development process.

## 3. STATEMENT OF THE PROBLEM

This study begins from the realization of the need for optimally administering the effect of training on employee performance. Training is a systematic process to enhance employee's skill, knowledge and competency necessary to perform the job effectively. Overall, training impacts organizational competitiveness, revenue and performance. Unfortunately, the majority the governmental, organizations not recognizing the importance of training to increase their employees' productivity and when the economy slows or when profits decline, many organizations first seek to cut in their training budgets. This will lead to high job turnover then increase the cost to hire new employees which push down the organizational profitability.

## 4. OBJECTIVES OF THE STUDY

**The main objectives of the study are:-**

Analyse the impact of Training and Development Programme on employee performance in select private sector organization, and to out the opinion of the employees about the training and development programme provided by the select private sector organization.

## HYPOTHESIS

**H01:** There is no significant difference between in the position levels and Impact of Training
**H02:** There is no significant difference between in the levels of performance before and after training.
**H03:** There is no difference between in the Gender and Employee Satisfaction.
**H04 :** There is no difference between in the position levels and impact of training
**H05:** There is no difference between in the responsiveness on training objectives
**H06:** There is a significant difference between the Developing Employees Skills and Knowledge and position levels of the respondent.

## 5. METHODOLOGY

The sample size was 350 made up of 60 Executives, 63 Supervisors, and 227 Workmen. This study used both primary and secondary data. Primary data were collected from the employees of select public sector organization through structured questionnaire. Quantitative data analysis was done by using SPSS software. The techniques for quantitative data analysis were paired t test, Chi-square test and On Way ANOVA.

## 6. RESULTS & DISCUSSION

**Table -1: Impact of Training**

| Positions Levels | Executives | Supervisor | Workman | Total |
|---|---|---|---|---|
| Reduction in Time | 8 (13.3%) | 5 (7.9%) | 59 (26.0%) | 72 (20.6%) |
| Improved Inter Personal Relations | 23 (38.3%) | 18 (28.6%) | 61 (26.9%) | 102 (29.1%) |
| Discharging the Duties | 10 (16.7%) | 15 (23.8%) | 47 (20.7%) | 72 (20.6%) |
| Reduced Wastages | 15 (25.0%) | 17 (27.0%) | 34 (15.0%) | 66 (18.9%) |
| Improved Output | 4 (6.7%) | 8 (12.7%) | 26 (11.5%) | 38 (10.9%) |
| Total | 60 (100%) | 63 (100%) | 227 (100%) | 350 (100%) |

It is obvious from the table that majorities of executives (38.3%), supervisors (28.6%) and workman (26.9%) stated that training aids to improve the interpersonal relationship in the organization.

**Table – 2 Gender and Employee Satisfaction**

| Satisfaction | Female | Male | Total |
|---|---|---|---|
| Highly Dissatisfied | 4 (6.8%) | 12 (4.1%) | 16 (4.6%) |
| Dissatisfied | 3 (5.1%) | 18 (6.2%) | 21 (6.0) |
| Neutral | 19 (32.2%) | 56 (19.2%) | 75 (21.4%) |
| Satisfied | 19 (32.2%) | 163 (56.0%) | 182 (52%) |
| Highly Satisfied | 14 (23.7%) | 42 (14.4%) | 56 (16%) |
| Total | 59 (100%) | 291 (100%) | 350 (100%) |

As far as the gender is concerned 56% of the male employee s are satisfied on training programmes whereas 32.2% of the female employees are neither satisfied nor dissatisfied on training programmes and also 32.2% of the female employees are satisfied on training programmes.

**Table – 3 Training and Development Programme are sufficient for Developing employees.Skills and Knowledge**

| | Sum of squares | df | Mean Square | F | P |
|---|---|---|---|---|---|
| Between Groups | 10.945 | 2 | 5.473.618 | 8.854 | .000 |
| With in Groups | 214.483 | 347 | | | |
| Total | 225.429 | 349 | | | |

The analysis of table shows that the Developing Employees Skills and Knowledge differed significantly among three groups. The F value Shows 8.854 and the P value is less than .000. The employees having more relationship in workman categories (Mean Value = 4.01) than in executive and supervisor, as the mean values are 3.95 and 3.54 respectively.

**$H_0$**: There is a significant difference between the Developing Employees Skills and Knowledge and position levels of the respondents.

## 7. CONCLUSION

Training is a very important feature now days in making the organization gainful. Most of the organization has now days an appropriate training section program on regular basis. The main

purpose of the training is to increase the employees skills which eventually makes the organization more gainful. This study reveals that Impact of training and employee satisfaction at private sector organization are not in line with the best practices regarding the considered and systematic levels of performance after training and developing employees skills and Knowledge process as is generally known. It was recommended among other things, that the processes involved in training be duly followed, private sector organization should help its organization identify their career paths and to direct them in the search of better knowledge.

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**Research Article**

# NEW TECHNOLOGIES TO BREAK THE BARRIERS IN TRADITIONAL GURUKULAM METHOD OF EDUCATION

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## ABSTRACT

The aim of this research review paper is to study the transformation of learning paths from Gurukulam to current Web learning method. Learning the science, performing artslike dance, music, drawing, painting, yoga, martial arts, sculpturing, etc. in India has a long history. Gurukulam is the best suitable method of education in those days. But the development of information and communication technologies changes and simplifies that scenario in a better way to develop the communication between the student and learner. There are plenty of International research evidences are available throughout the world for the above statement. To reduce the physical presence of learners and teachers, to reduce the contact hours, to maximize the usage of available resources, to reduce the cost of education, etc. are possible through ICT tools such as Web Learning system, E-Learning system, Multimedia CDs and DVDs, Computer Assisted Learning, Computer Based Training, M-Learning system, etc.

***Key words: Gurukulam, Web learning, Performing Arts, Information and Communication Technology, Web Learning System, E-Learning system, Multimedia, etc.***

# 1. INTRODUCTION

The traditional Guru, Shisya method of learning is slowly changed to student centered, collaborative learning mode. Traditional way of face to face teaching and learning is changing towards "Learning anywhere, anytime and anyone by the application of ICT". It has many advantages such as flexibility, accessibility, cost, etc. It is more student centered than teacher centered. Modern technology changes the teacher and student role in the learning environment. Any expert can disseminate his knowledge with the single website and multimedia devices throughout the world. Anyone can learn, any art forms through proper explanations, tutorials, multimedia tools, CDs, etc. through online. By using the ICT tools any skilled student can create, disseminate, collaborate his expertise skills through you tube, google groups, liked in, Facebook, etc. Not only teaching and learning changes from Gurukulam methodology, but also evaluation is also changed towards online.

Learning motor skills such as driving car and flight through virtual reality and stimulation has more effectiveness and advantages. Many educational institutions throughout the world are adopting this stimulated environment for skill training. In India, many Universities have online learning system for skill training. Annamalai University, Tamil University and Bharathidasan University has Music and Dance programs through distance mode with proper face to face blended mode which gives opportunities for the Non Resident Indians to study further. It will be more useful for those who have basic skills in music, dance, art forms, etc. It will help the music lovers to enhance their skills and academic qualifications which is the base for academic job opportunities in Universities, Colleges and private educational institutions.

# 2. REVIEW OF LITERATURE

The main aim of Gurukulam method such as personal and intimate teacher and student relationship can be enhanced through using ICT tools by the way of sharing ideas through technical devices on anytime and anywhere. Smart mobiles, Tablets, Multimedia laptops and Web learning systems with more 3-D Animation clips and multimedia applications can facilitate the student and teacher communication. It will break the barriers such as shyness and fear.

Learning from many experts throughout the world will definitely enhance the skills and develop more creativity than leaning from a single teacher in a particular learning environment i.e., classroom. According to SwamiVivekananda, "educational technology should be used as an instructional procedure at the higher level of learning". He recommended free and compulsory education without caste, creed and wealth, etc. Even though he favored Gurukulam method of learning at basic levels he accepted the inclusion of science and technology at the higher level for the development [1].According to the UGC chairman's statement on 28th December 2015, "All the Universities should follow the admission procedures through online to facilitate transparency in selection and evaluation." (The Hindu Newspaper 28/12/2015). According to Gouramalik, (1979), "through new and modern communication technologies development can be achievable without going from the step by step sequence." According to him modern communication technology will bypass many stages in the development process [2]. According to Nagarajan et al, (2011), "use of proper teaching methods and teaching aids will develop the learners' interest in a learning activity. They discussed the ways to find the learners' interest by using questionnaire [3]."According to Jayasimman, (2014), "Web learning system has many advantages than traditional system which is suitable for the current generation. Web learning system motivates the educators to change from the conventional system. Enhanced Web Learning system has many solution to problems and issues related to stress level, intelligence level and attitude level, etc. This interactive online system facilitates the communication between the learner and the educator [4]."According to him, "The webbased learning system has emerged as a new medium for teaching and learning and furthermore, possibilities are there to enhance the current Web Learning System by introducing the concepts such as cognitive process [5]."According to Senthil et al. (2015), "Today's higher education system mostly focus youth, and children who belong the age between the ages eleven to thirties. From their research study it is observed that the computer graphics and animations work will strengthen the communication between the learner and educator [6]. According to Senthil et al. "multimedia technologies helps the learners and trainers irrespective of their stress level during the learning process. It helps to reduce the stress among the learners by the way of developing their interest to learn [7]." According to Mai NEO et al, "ICT tools gives flexibility to teach and learn". Educators are moved from the teacher centered methodology to student centered methodology in order to

motivate the learners which helps the learners' creativity. This can be achieved through new ICT tools and technology mediated teaching [8]." According to Cecília et al, "the use of modern technology such as virtual reality and stimulated learning environment has a potential to overcome the learning disability among the disabled learners [9]." According to Atilla "teaching through visual aids and technology has the potential to develop the interest among the biology subject learners [10]."According to Jayasimman (2014), "Individualized web learning system has the potential to improve the learners' understanding which can be solution to reaching the potential learners in higher education [11]."

## 3. OBJECTIVES OF THIS STUDY

- To study about Gurukulam system of education.
- To study about Information and communication Technology.
- To know the relationship between technology and learning.
- To study about the current research outcomes related to ICT and learning.
- To study about the possibilities to develop the current web learning system.

## 4. SCOPE OF THE STUDY

There are always possible to enhance the learning system, learning strategy, learners' satisfaction level, teaching and learning process, etc. The present study hasmany scope to understand the development of various new learning innovations in terms of new technology.

## 5. LIMITATION OF THE STUDY

This research review analysis was written with the outcome of the various research papers collected from the websites and international journals. Primary data collection from the students' views and educators' views can be a suitable way to arrive the conclusion. All the limitations related to personal view of the researcher are applicable to this review paper.

## 6. SUGGESTIONS

- Web Learning System should be developed in all the Colleges and Universities.
- The UGC should conduct and finance the Web related research works in order to increase the enrolment ratio.

- Learning job related skills are always changing this should be taught in colleges and necessary ways should be taken to develop the vocational education through online.
- The higher education and research net expenditure is not sufficient to conduct fruitful research work and research implementation in India. This trend should be removed to develop and to utilize the overall human resources available in the country.

## 7. CONCLUSION

To develop the enrolment ratio in higher education, Web learning should be implemented and vocational and skill based courses should be taught along with the conventional degree and master degree courses. This study reveals the importance of enhancing the current learning system by implementing new strategies in the learning environment. Even though some educators are favorable to Gurukulam system of education, changing the mindset of the educators and trainers are the best method for this tech-savvy new generation of learners' satisfaction. Though the investment for web and online learning system implementation and enhancement are high, steps should be taken to enhance students' satisfaction and performance.

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**Research Article**

# Research Methods and Challenges in Computer Science

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## Abstract

Research Methodology is a systematic approach to find the solutions to the unsolved problems. It describes the steps necessary for the researcher to know not only the research techniques but also the approaches to carry out research. The methodology specified in literature for social science research doesn't directly apply to the computer science research. In this article the challenges & methodology to carry out research in computer science is presented.

***Key words: - Research methodology, Literature survey, Hypothesis, Researcher.***

## 1.INTRODUCTION

Research means, its finding a problem and give the proper solution for it , that solution may be a positive or negative. And the problem may have the new one or the old problem which is already done by the researchers. Research is an art of scientific investigation and also it is an endless journey. That journey could be in any part or any branch. But the investigation should be carefully and also thoroughly. According to the topic the researcher must bring the new facts which are useful to the society. And the Research is an original contribution to the existing stock of knowledge making for its advancement. In short, the search for knowledge

through objective and systematic method of finding solution to a problem is research.

## 2. TYPES OF RESEARCH

**Research can done by various types or methods, the basic types of research are**

a)Descriptive and Analytical

b) Applied and Fundamental

c) Quantitative and Qualitative

d) Conceptual and Empirical

### 2.1) Descriptive and Analytical

In Descriptive research the surveys includes and also it is finding fact and enquiries of different ways. In social science and business research we quite often use the term ExPostFacto research for descriptive research studies. The researcher has no control over the variables is the main characteristic of this descriptive method, and the term used for descriptive studies in which the researcher seeks to measure such items like frequency of shopping, preference of people or similar data.

In analytical research on the other hand the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material.

### 2.2 Applied and Fundamental

The research can be either applied or fundamental. The applied research is known as action, that aims at finding a solution for an immediate problem which is faced by the society an industry, business organization. Fundamental research is mainly concerned with generalizations and with the formulation of a theory.

### 2.3 Quantitative and Qualitative

Quantitative research is based on the measurement of quantity or amount . It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research is concerned with qualitative phenomenon,( ie ) phenomena relating to or involving quality or kind.

## 2.4 Conceptual and Empirical

Conceptual research is that related to some idea or in abstract theory. It is used to the philosophers and thinkers to develop a new concepts or to reinterpret existing ones.

And the Empirical research is based on the experience or observation alone, often without due regard for system and theory.

## 3. RESEARCH PROCESS

There are seven levels in the research process, and the following flowchart will explain the levels of the research process.

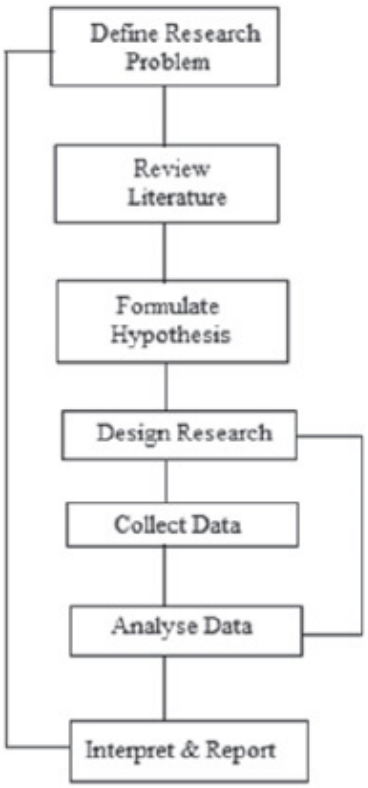


**Fig:1 Research design**

where F =Feedback(Helps in controlling the sub-system to which it is transmitted)

FF=Feed forwards (serves the vital function of providing criteria for evaluation)

From the above diagram we know that there are number of closely related activities are involved in the research process. And should remember that the various steps involved in a

research process are not mutually exclusive nor they are separate and distinct.

**Here the diagram provides a useful procedural guideline regarding the research process.**

a) Formulating the research problem

b) Extensive literature survey

c) Developing the hypothesis

d) Preparing the research design

e) Determine sample design

f) Collecting the data

g) Execution of the project

h) Analysis of data

i) Hypothesis testing

j) Generalization and Interpretation

k) Preparation of the report or presentation of the results.

## 4. CHALLENGES IN COMPUTER SCIENCE RESEARCH

The challenges phased by a researcher in carrying out research in computer science stream are as follows:

• **Time overrun:** Research is not an easy task to carry over. May researchers either don't carry our research after registration or they can't complete the research in stipulated time. This is because of lack of planning and the communication gap between the researcher and supervisor. A researcher has to make a total plan of his research by specifying time needed in each phase of his work. The researcher may take help of certain research calculators as specified in [7].

• **Vague Research Problem**: The researcher is not able to identify the proper research problem. Due to lack of extensive Literature Survey the researcher may end up in a problem which is already solved or end up with a vague or inaccurate problem statement.

• **Lack of Domain Knowledge**: It is expected that the researcher has to select the research problem in the domain to which he or she is aware. Problem arises when the domain of supervisor is different from that of the researcher.

• **Lack of identification of Allied subjects**: In order to design the solutions of hypothesis, identification of proper allied subjects is desirable. The allied and pre-requisite subject has to be properly identified before finding the solution of hypothesis.

**5. RESEARCH METHODS IN COMPUTERSCIENCE:**

**Research methods can be put into the following there groups.**

**a)**In the first group we include those methods which are concerned with the collection of data. These methods will be used where the data already available are not sufficient to arrive at the required solution.

**b)**The second group consists of those statistical techniques which are used for establishing relationships between the data and the unknowns.

**c)** The third group consists of those method which are used to evaluate the accuracy of the results obtained, research method falling in the above stated last two groups are generally taken as the analytical tools of research.

## 5.1 Phase I : Identify the Problem

The first and foremost step happens to be that of selecting a properly defining a research problem. The research problem in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. The research problem undertaken for study must be carefully selected. Every researcher must find out his own salvation for research problems cannot be borrowed. A problem must spring from the researchers mind like a plant springing from its own seed.

## 5.2 Phase II: Literature Survey

Once the problem is formulated, a brief summary of it should be written down. It is compulsory for a research worker writing a thesis for a Ph.D., degree to write a synopsis of the topic and submit it to the necessary committee or the research board for approval.

### 5.3 Phase III : Formulating a Research Problem

There are two types of research problems that are those which related to states of nature and those which relate to relationship between variables. The formulation of a general topic into a

specific research enquiry. Essentially two steps are involved in formulating the research problem, that is understanding the problem thoroughly rephrasing the same into meaningful terms from an analytical point of view.

## 5.4 Phase IV : Planning the Research

The arrangement of the ideas in an order by the researcher and write them in the form of an experimental plan or what can be described as "Research Plan" . And the planning is must be

a)Help to organize the ideas in a form.

b) It provide an inventory of what must be done and which materials have to be collected as a preliminary step.

c)It is a document that can be given to others for comment.

## 5.5 Phase V: Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combines relevance to the research purpose with economy in procedure. And it is a conceptual structure within which research is conducted. the research design has the following parts like,

a) Sampling design

b) Observation design

c) Statistical design

d) Operational design

and also the research design must at least contain

- a clear statement of the research problem.
- procedures and techniques top be used for gathering information
- the population to be studied
- methods to be used in processing and analyzing data.

### 5.6 Phase VI : Data Collection

The data collection is begins after a research problem and research design, and plan. There are two types of data collection, like

**a)Primary data collection**

**b) Secondary data collection**

Primary data's are those which are collected afresh and for the first time,

The Secondary data's are those which have already been collected by someone else and which have already been passed through the statistical process.

## 6. CONCLUSION

Research refers to search for knowledge through objective and systematic method of finding solution to a problem. The methodology for carrying out research differs from domain to domain. In the advanced research areas like computer sciences, the steps in research can't be frozen because the even after finding the solution to a hypothesis, it is to be reviewed in literature to know the similar solutions. Further as the current research problems are quiet complex in nature, it is advisable to divide the research problem into sub problems and proceed further. Further as the infrastructure availability is critical issue specially for academicians, solutions to research problem can't be tested in live environments. Hence identifying the simulators or development of simulators for experimentation is also a challenging issue. Finally publishing the ideas in right places is more important due to commercialization of various conferences and Journals

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# SOCIAL ISSUES OF WOMEN IN ANITA DESAI'S VOICES IN THE CITY

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## ABSTRACT

Anita Desai is a committed Indian woman novelist whose novels portray the problems of women in the patriarchal society. Almost all her novels contain a deep-rooted, philosophical concern about the meaning of life. The woman in her novels is not treated equally by male characters and is given least importance in both home and society. They become depressed individuals. In her novel, *Voices in the City*, Monisha, an unsettled, manic-depressive housewife, pours kerosene over herself and burns herself to death. This articles aims at probing the unspeakable problems of woman with reference to her novel *Voices in the City.*

***Key words: Anita Desai, Voices in the City, social issues.***

## 1. Introduction

Anita Desai makes a new record in the world of Indian English fiction by switching the focus from the international to the internal world. She is a receiver of several awards in India and overseas. She obtained many esteemed positions in India and other countries of the world. Her novel *Fire on The Mountains* awarded her the royal society of literature's win fires Holt by memorial prize and

the Sahitya Academy award for English for the year 1978. All her novels depicted the internal inhabits of susceptible women who are in everlasting seeking for significance of life.

## 2. Social Issues and treatment of woman in Anita Desai's Voices in the City

Desai is undoubtedly a writer who enunciates the problems faced by women in a patriarchal society. She is interested in the psychic life of her characters. Desai's Women characters rebel against the patriarchal community in order to explore their own potential or to live on their own terms, regardless of the consequences that such a rebellion may have on their lives. They criticize the cultural ideologies that obstruct their way to freedom. Her characters have the habit of withdrawal and live a life of detachment from the society. Desai's women crave for freedom within their community and within the institution of marriage. She does not envision an ideal marriage. Her married women characters, for example, Monisha in the novel Voices in the city, become suppressed, violent or self-destructive. They kill or destroy themselves when they are unable to cope with the expectation of the society, family and relationships. The women characters grow up intellectually and psychologically. 'The nemesis of these women is not private one, but an outgrowth of the complex social context, immediate family-environment and the relationships with their men". Monisha familiarity with the philosophies of Kafka, Dostoyesky helps her to free herself from the trivial talks of women in her household.

She is unable to shrug-off her emotional and psychological dependence on men. family, community and society. She maintains a diary, which gives an outlet to her suppressed feelings. She records her reactions and her by the joint-family system. She cannot stand assaulting existential forces in the family and therefore, she sets herself on fire. Monisha is strongly under the influence of the Gita, the Holy Scripture and the principle of stoicism and detachment. She does not want to long or hanker for the love the society refuses to give her. She does not passionately yearn for the husband to reciprocate her love.Consequently, she is carried away her suicidal impulses.

Monisha is in a male dominated society governed by rigid traditions, social taboos, constrictions and restrictions. She wishes to extricate herself from the obsequious servitude, inhuman torture of her husband and her-in-laws, the humiliating social taboos and the expected values of womanhood. Her

husband fails to reciprocate her love and fail to understand her emotions and feelings. Nobody cares for her tastes or appreciates her presence. She is inconspicuous by her presence. She is ignored by jiban and he knows nothing about her marriage builds harmony when there is a mutual understanding, sound compatibility, love, loyalty and forfeiture. But a Simon de Beauvoir observes," marriage is the density traditionally offered to woman by society". In Monisha's martial life, marriage offers her nothing. She derives no happiness or issues out of martial life with a " boring non-entity, this blind moralist, this blind moralist, this complacent quoter of Edmund Burke and words worth, mahatma Gandhi and Tagore, this round , minute minded and limited official".

Women have strongly opposed and incessantly fought against such double-standards and claimed equality and freedom. They fought firmly to get back their birth rights because the liberation of women necessitates the liberation of all human beings. The predicament of the entire ill-fated young brides in the Indian society' doing nothing' but simply waiting meaninglessly and doing petty household work" to sort the husk from the rice..." is explicitly portrayed in the novel. Though death is not what monisha or any young bride wants, she engulfs herself in the flame. Her suffering is unique, and she bears the brunt silently. As her barrenness, her life is also barren without a speck of greenery. She is entranced, entrapped, encased, enclosed 'in a steel container'. 'Closed in a cage.' Even her death does not present a solution to the quest for meaning existence. She is not able to carve her destiny. She is rather battered, crossed and lacerated by the society. Not able to survive, she succumbs to death.

## 3. Conclusion

Anita Desai's women are victims of circumstances in an uncongenial environment and they fight a persistent battle against her lost self and in the process of the search is doomed to degeneration and destruction. Anita Desai has dexterously portrayed the pathetic struggle the women undergo in their life. Her women refute defy the patriarchal norms to liberate them from the clutches of the traditional myths of sub junction and submission.

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# Need for User Education Programmes in Libraries

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## Abstract

This paper examines the need for user education programs in Library. It mentioned the characteristics of users and Planning for user education. The discussion focuses the Information technology, Web-Based user education and services to the users.

***Key words: User education, Characteristics of users, Planning, Library orientation, Information technology.***

## 1. Introduction

User education is an educational activity of the Library and information organization. The main task of user education is to guide, library users to maximize the use of library resources. In this Century we are surrounded by automated digital and virtual libraries. The development of new technology makes direct access to information easier for users and while information skills are required to collect and present that information. In the future, there is likely to be less of a role for information workers as intermediaries between users and information sources.

## 2. Objectives

In this paper will be able to understand that:

- To introduce the students facilities and resources in the library.

- To develop the library skills.
- To make the students independent users and learners in the library.
- To develop capabilities as self-sufficient users.
- To provide basic understanding of the library. So that the users can make efficient use of library materials and services.
- To educate users about information sources and resources and how to exploit such resources effectively and efficiently.

## 3. User education- Definition

a. User education simply means educating the library patron, whether students, faculty members or members of the public, on how to use the library and its services.

b. Should include any effort or program which will guide and instruct existing and potential users in the recognition and formulation of their information needs, in the effective and efficient use of information services and their assessment.

## 4. Characteristics of users

Lehman mentioned seven user's of characteristics that,

- Personality level
- Variability level
- Vocational level
- Capacity level
- Satisfaction level
- Functional reading level
- Visual level

This will give necessary base guidelines to librarians to serve various types of user groups.

## 5. Need for user education

User education is essential to library services. It improves the image of the library. Above all user education and training are the best ways to implement Renganathan's five laws of library science. User education and training are often fee-based, because developing the infrastructures for the

network environment is very costly. Both educational and research topics are becoming increasingly multidisciplinary in nature. There by drawing information from a wider range of sources. Lack of awareness of information leads to duplication of effort. Various estimate of extent and cost of this have been made.

## 6. Planning for user education

Programming and planning of user education is very important. The UNESCO General Information Program has been making organized efforts to promote user education and training programmers through organizing seminars, workshops and developing tools, publications and guidelines.

Several countries, particularly USA and UK have made organized efforts in promoting program for educating and training information users and extensive literature in the field is available to guide the formulation of such programs in India. Through planning is needed to ensure that all activities carried out towards meeting the institutional goals.

User education programs should aim to make all users aware of the information resources available, both directly in the library and from external sources and enable users to enjoy the search for information. In this study stressed the self-sufficiency of users through a successful user education program.

**Some specific components of user education are:**

a. Librarians introducing new students, provide specific instructions to how to use the indexes bibliographic tools, abstracts and other reference materials.
b. Exposing to the users to providing guidance to understand the features of tools and their nature of subject coverage (Pandy, 1992)

## 7. Information technology and user education

The new information technology in libraries posses a considerable challenge for librarians. Librarians have to teach users with little or no knowledge of computers how to search OPAC.

Currently, many e- journals and e- books are available to library users. The advent of information technology in library has indispensable changes in the user education Lectures, Library tour, Printed books, Guides, Seminars and Workshops, Orientation week, display and Audio-Visual methods etc.

are the techniques of user education. The users need to be introduced to different online catalogues and their search procedures.

At present, none of the libraries examined include instruction on the use of the Internet in their user education programs. Libraries should not only see themselves as user of Internet but also as providers of information from the Internet. So Internet is a growing need to support users in the form of training to provide them with skills needed for effective exploitation of online resources.

## 8. Web-based user education

Web guides and teaching tools are found on the web. Those are easily updated, accessed and printed on demand. It include color graphics and screenshots. The librarians also selected the web-links, subscription resources and libraries have developed web tutorials and training modules.

## 9. Service to the users

Service to the users can be provided as follows:

1. Search assistants
2. Dissemination
3. Notification
4. Reference
5. Referral
6. Document reproduction
7. Translation

## 10. Conclusion

At the end of the 20$^{th}$ century , the libraries faced enormous challenges and opportunities. As campuses move into the information age, the mission and role of the library is being redefined. While the amount of information need to acquire continues to increase , the resources available to do insufficient. In future, users should expect timely access to quality information. This information must be accurate, relevant, and comprehensive. This can be done successfully incorporating end-user education in academic libraries by developing, training programs for the library and information

professionals, as well as the end – users, will hopefully improve learning attitudes and network-related competence to use with information and communication technologies.

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# Application of Knot Theory in DNA Modelling

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## Abstract

In this paper we used DNA modelling in Knot theory to study enzyme mechanisms. We introduced tangles, which will be our model for enzymes. We discussed several operations which can be performed on tangles. Some theorems have used to solve tangle equations.

***Keywords: DNA modelling, Tangles, Enzymes.***

***MSC Code: 92D20, 92C45, 32S55***

## 1. Introduction

In recent years, exciting new applications of mathematics to the field of molecular biology have been developed. In particular, knot theory gives a very nice way to model DNA recombination. The relationship between mathematics and DNA began in the 1950's with the discovery of the helical Crick-Watson structure of duplex DNA. The discovery of this model opened the door for mathematical analysis of DNA. One such mathematical model is the Tangle Model for Site-Specific Recombination, which was first introduced by De Witt sumners. This model uses knot theory to study enzyme mechanisms.

Knot theory is a subset of a larger branch of mathematics called topology. Topology is an area of mathematics which involves studying the properties of geometric figures which are unaltered by elastic deformations such as stretching or twisting. To a topologist, a sphere is the same as a cube, and a doughnut is the same as a coffee cup. Knot theory is an area of topology that deals with knots

and links. A knot is a closed curve in space with no self- intersections (i.e. a knot is a simple closed curve). In layman's terms, a knot is a piece of string, tangled or not, whose ends are connected.
Knots first received scientific attention in the 1880's when Lord Kelvin hypothesized that all matter was made of a substance called ether and that atoms are knots in the ether. This began the first attempts at classification of knots and general understanding of knots in the mathematical sense. Once modern atomic theories were formulated, physicists and chemists lost interest in knot theory, but mathematicians were intrigued by the study of knots and continued in the field despite its lack of applications at the time. It wasn't until the 1980's that applications of knot theory in molecular biology were discovered.

The purpose of this article is to explain the details of this application of knot theory to DNA recombination. Of course, the reader is aware that DNA are long, thin molecules found inside the nucleus of a cell; these molecules are nature's way of encoding biological traits and are the mechanism for reproduction. To get a sense of the scale of things, imagine the cell nucleus as the size of a basketball. Inside a nucleus of that size, you would find that the DNA would resemble thin fishing line with 200 km packed inside. Because the DNA is so tightly packed into such a confined space, it is not surprising that it is a tangled and knotted mess. DNA must be topologically manipulated in order for vital processes such as replication, transcription, and recombination to take place. Nature's answer to the tangling problem is enzymes.

Enzymes act by manipulating DNA in several different ways. They may cause coiling up of DNA (supercoiling – **Fig 1**). They may switch a crossing of nearby strands of DNA (transient enzyme-bridged break – **Fig 2**), or they may break apart a pair of strands and recombine them to different ends (recombination – **Fig 3**).

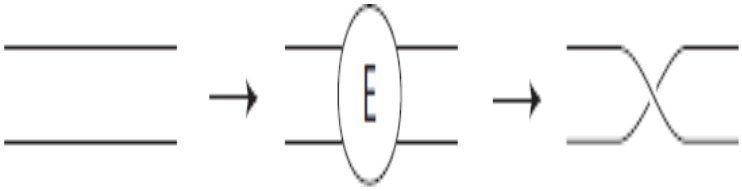


**Fig 1: An enzyme (E) induced supercoil**

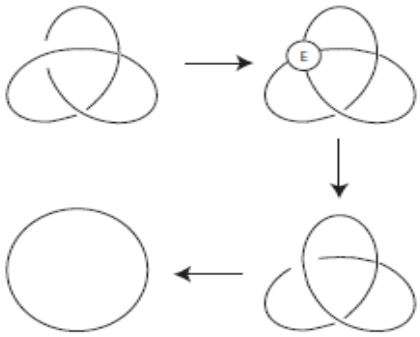


**Fig 2: An enzyme (E) induced crossing change in a DNA trefoil knot**

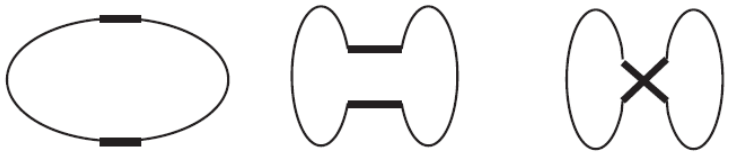

**Fig 3: Recombination**

This paper is organized as follows:

- Section 2 will introduce tangles, which will be our model for enzymes.
- Section 3 will discuss several operations which can be performed on tangles. These operations will be used to model the enzymatic actions on DNA.
- Section 4 the theorems used to solve tangle equations will be explained
- The last section we will look at an example where the tangle model has been successfully applied.

## 2. Tangles

A 2-string tangle is a pair (B, t), where B is a 3-ball and t is a pair of unoriented arcs (strings) properly embedded in B so that the end points of the arcs go to a specific set of 4 points on the equator of the ball (usually labeled NW, NE, SW, SE). A tangle diagram is the projection of the tangle on the plane of the equator as in **Fig 4**. We will label the endpoints in the diagram NW, NE, SW, SE. Rational tangles are defined as the family of tangles that can be transformed into the trivial tangle (see **Fig 4b**) by a sequence of twisting of the endpoints. Because rational tangles look like what is seen when studying DNA micrographs, they will be our focus in the paper. One should know

that there are tangles that cannot be obtained in this fashion; they are the prime tangles and locally knotted tangles.

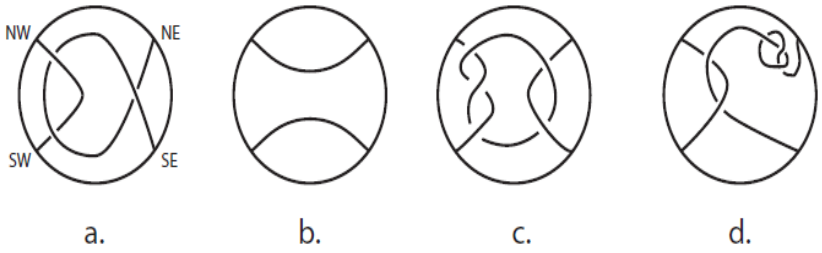


**Fig 4: Examples of tangles: a. Rational, b. Trivial, c. Prime, d. locally knotted**

Every rational tangle can be represented by a vector $(a_1, a_2, ..., a_n)$ where $a_i \in Z$ for all i. This vector can be used to draw the tangle diagram in the following way: Start with a circle with points labelled NW, NE, SW, SE and connecting the arcs (as in **Fig 4b**).

If n is even, start at the bottom (SW and SE) and do a1 half-twists (using the convention of right-hand twists for positive a1 and left-hand twists for negative a1). Next, do a2 half-twists of the NE-SE side of the diagram. Then go back to the bottom, etc. If n is odd, start on the right and repeat the procedure as before. For example, the rational tangle (2, 1, 2) is constructed in **Fig 5**.

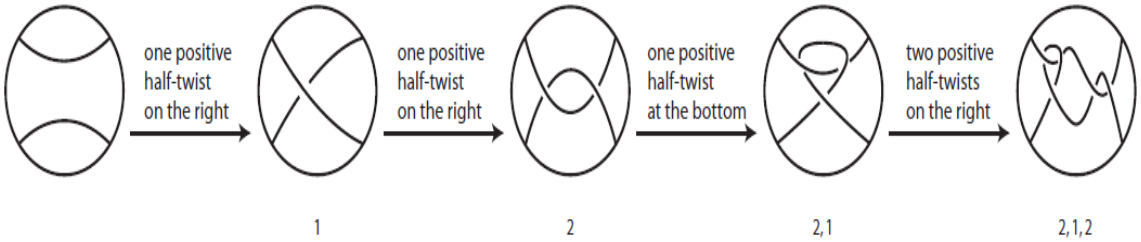


**Fig 5: Draw the tangle (2, 1, 2)**

Any vector with integer entries can be used to construct a continued fraction which is equal to a rational number β/α. If Tangle T is represented by $(a_1, a_2, ..., a_n)$, one can construct the continued fraction $a_n + \cfrac{1}{a_{n-1} + \cfrac{1}{a_{n-2} + .... + \cfrac{1}{a_1}}} = \frac{\beta}{\alpha}$. The rational number β/α is called the fraction of the tangle T.

**Theorem 2.1**

Two rational tangles are isotopic iff they have the same fraction.

**Proof**

Two tangles are isotopic or equivalent if there is a mapping (called an ambient isotopy) which deforms one tangle to the other without moving the endpoints, breaking a string, or passing one string through another. This theorem says that two tangles have the same fraction representation if and only if they are equivalent. This theorem tells us that this fraction essentially describes the tangle.

Conversely, a fraction β/a of a tangle can be expanded into a continued fraction $a_n + \cfrac{1}{a_{n-1} + \cfrac{1}{a_{n-2} + .... + \cfrac{1}{a_1}}} = \frac{\beta}{\alpha}$. From the continued fraction, you can create an integer-entry vector representation of the tangle ($a_1$, $a_2$, ..., $a_n$). Since the continued fraction expansion of a rational number is not unique, more than one vector may represent the same tangle. For example, the vectors (3,−2, 2) and (2, 2, 1) represent the same tangles. This can be seen by computing the rational number that corresponds to (3,−2, 2), which is $2 + \cfrac{1}{-2 + \cfrac{1}{3}} = \frac{7}{5}$. Then by expanding 7/5 into a continued fraction $1 + \cfrac{1}{1 + \cfrac{1}{2}}$ the vector (2, 2, 1) is obtained. By theorem 1 both vectors represent the same tangle. However, every rational tangle (with the exception of {(0), (±1), (∞)}) has a unique canonical vector representation called the Conway symbol. A vector ($a_1$, $a_2$... $a_n$) is said to be in canonical form if $|a_1| > 1$, $a_i \neq 0$ for $1 \leq i \leq n - 1$, and all nonzero entries have the same sign. The Conway symbol of the example above is (2, 2, 1).

The Conway symbol of the four tangles excluded from the canonical form is {(0), (±1), (∞)}. The next theorem, which is a direct result of Conway's theorem will, gives us a means of classifying rational tangles by way of their fractions.

**Theorem 2.2** (Rational Tangle Classification Theorem)

There exists a 1-1 correspondence between classes of rational tangles and the extended rational numbers $\beta/\alpha \in Q \cup \{1/0 = \infty\}$ where $\alpha \in N \cup \{0\}$, $\beta \in Z$ and $\gcd(\alpha, \beta) = 1$.

**Proof**

In addition to the vector notation and tangle fractions, tangles can also be represented as a matrix. This matrix representation will be used in the following Lemma. Given any even-length vector representative for the tangle β/α, we can compute a 2 × 2 matrix representative by the following equation:

$$\begin{bmatrix} u & v' \\ v & u' \end{bmatrix} = \begin{bmatrix} 1 & a_{2k} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ a_{2k-1} & 1 \end{bmatrix} \cdots \begin{bmatrix} 1 & 0 \\ a_1 & 1 \end{bmatrix}$$

Here is an example. Let $\frac{\beta}{\alpha} = \frac{23}{17} = 1 + \cfrac{1}{2 + \cfrac{1}{1 + \cfrac{1}{5}}} = (5,1,2,1)$ the matrix representative is

$$\begin{bmatrix} u & v' \\ v & u' \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix} = \begin{bmatrix} 23 & 4 \\ 17 & 3 \end{bmatrix}$$

## 3. Tangle Operations

There are several operations that can be performed on tangles. Given tangles A and B, the sum A + B is formed by connecting the NE and SE endpoints of one, to the NW and SW endpoints of the other, respectively.

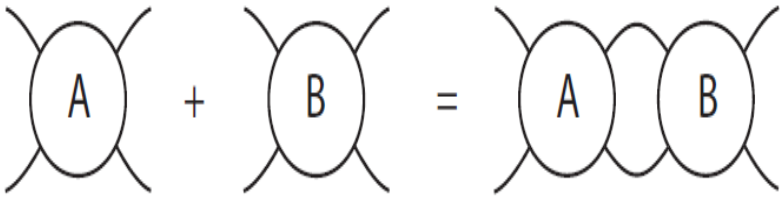


**Fig 6: Tangle Addition**

Given a tangle T, the numerator closure, N (T), is formed by connecting the NW and NE endpoints and the SW and SE endpoints.

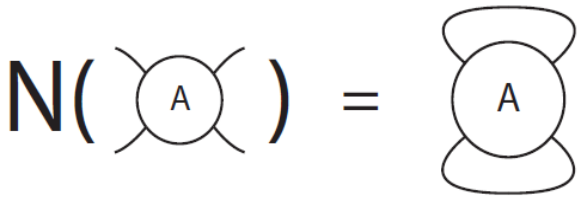


**Fig 7: Numerator Closure**

The denominator closure of T, D(T), is formed by connecting the NW and SW endpoints and connecting the NE and SE endpoints. For example, the numerator closure of the tangle (2) is the hopf link < 2 >.

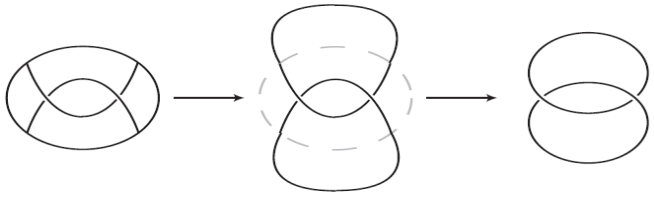

**Fig 8: Example of Numerator Closure**

The operations, tangle addition and numerator closure can be combined to form tangle equations. An example of a tangle equation is N((2, 0) + (1)) =< 3 > where < 3 > is the trefoil knot (see **Fig 9**). This equation is of the form N(A + B) = K, where K is a knot. Later in this paper we will consider tangle equations of this general form where K is a knot or link.

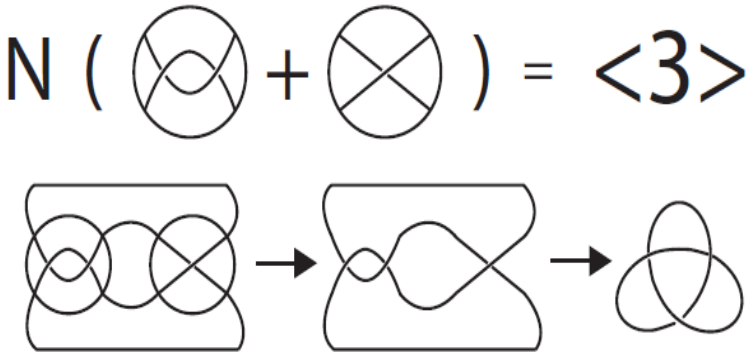


**Fig 9: Tangle Equation**

Each tangle has a parity of (0), (1), or (0, 0). If the string which starts at the NW position of a tangle T ends at the NE position, we say T has parity (0) and we denote this by T ≈ (0). If the string which

starts at the NW position ends at the SE position, then T ≈ (1). And if the string which starts at the NW position ends at the SW position, T has parity (0, 0) or (∞).

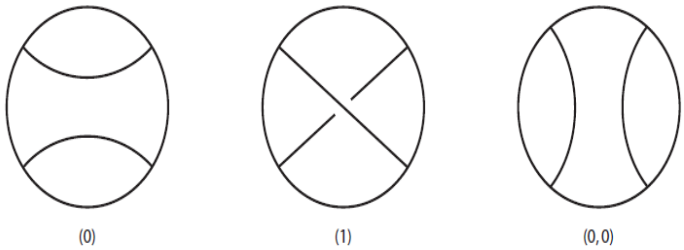


**Fig 10: Parity**

Note that if A and B are rational tangles, A+B is not necessarily rational. For example, if A and B are both of parity (0, 0), then A + B would not be a rational tangle because it would contain a circle in addition to the two arcs. For example look at the tangle (2, 0), which has parity (0, 0); the sum (2, 0) + (2, 0) is not a rational tangle (**Fig 11**).


**Fig 11: (2,0)+(2,0)**

It may seem like all hope is lost, since tangle addition is not well behaved, but although the sum of two rational tangles is not necessarily rational, the numerator closure of the sum of two rational tangles is always a well understood kind of knot called a 4-plat. A 4-plat is a type of knot which will be discussed in the following section and will be important for modelling DNA molecules.

## 4. Solving Tangle Equations

A tangle equation, introduced, is an equation of the form N(A+B) = K, where A and B are tangles and K is a knot or link. Solving equations of this type will be useful in the tangle model described, and therefore important in gaining a better understanding of certain enzyme mechanisms.

When working with tangle equations, there are several possible situations to consider. It may be that the two tangles A and B can be used to solve for the unknown knot K. But it could also be that one or

both of the tangles are unknown and the knot K is known. The following theorems are used in solving equations of these types. If the two tangles in the equation are known, Lemma 5 can be used to solve for the 4-plat that results from taking the numerator closure of the sum of the two tangles.

**Result 4.1**

Given two rational tangles $A_1 = \beta_1/\alpha_1$ and $A_2 = \beta_2/\alpha_2$, then $N(A_1 + A_2)$ is a 4-plat which is equal to $b(\alpha, \beta)$, where $\alpha = | \alpha_1 \beta_2 + \alpha_2 \beta_1|$ and $\beta$ is determined as follows:

- if $\alpha = 0$, then $\beta = 1$;
- if $\alpha = 1$, then $\beta = 1$;
- if $\alpha > 1$, then $\beta$ is uniquely determined by the following: $0<\beta<\alpha$ and $\beta \equiv ¾( \alpha_1\alpha'_2 + \beta_1\beta'_2($ mod $\alpha)$, where $¾ = \text{sign}(\alpha_1 \beta_2 + \alpha_2 \beta_1)$ and $\alpha'_2$ and $\beta'_2$ are the entries in the second column of any matrix representative for the tangle $\beta_2/\alpha_2$.

**Example 4.1**

Let $A_1 = 2$ and $A_2 = 23/17$ . Then ® = |1*23 + 17 * 2| = 57 and getting $\alpha'_2$ and $\beta_2'$ from the example of the matrix representative for 23/17, $\beta = (1*4+2*3)(\text{mod } 57) = 10$. Therefore, $N(A_1 + A_2) = b(57, 10)$. It may be that one of the tangles in the equation is unknown and the other tangle and the knot K are known.

Although we know that given tangles A and B and the tangle equation N(A + B) = K, if A and B are rational, then K is a 4-plat. On the other hand, if we have the tangle equation N(X + A) = K where A is rational and K is a 4-plat, then there is not enough information to say that X is rational. In fact, there could be infinitely many prime tangle solutions.

However, using advanced techniques one can sometimes prove in specific cases that X must be rational since the tangle model concerns only rational tangles, these are the only solutions the theory is equipped to handle. The following theorem gives all of the rational tangle solutions.

## 5. The Tangle Model

The purpose of the tangle model, which was introduced by DeWitt Sumners in 1980, is to deduce mathematically what happens during recombination. That is, given the geometry and topology of the substrate and product DNA, can we figure out exactly what the enzyme is doing? In the electron micrographs, DNA strands can be observed winding about each other. Since rational tangles and 4-plats are formed by twisting strings, we find them to be the perfect candidate for modelling DNA.

Recall that the definition of a tangle is a pair (B, t), where B is a 3-ball and t is a pair of unoriented arcs (strings) properly embedded in B. A tangle can be used to model the enzyme-DNA complex with the enzyme being the 3-ball and the two strings being the two recombination sites. Most observed products of recombination experiments are 4-plats.

Since the numerator closure of a sum of rational tangles is a 4-plat, it is conceivable that we could model the enzyme-DNA complex and the changes taking place with tangle equations. But, before we can use the tangle model to deduce the enzyme mechanism, there are several assumptions that must be made. The first assumption is that the enzyme-DNA complex can be represented as a sum of tangles. E is the enzyme, Ob is the part of the DNA which is bound to the enzyme, but unchanged during the reaction, and P is the site which is changed during the reaction.

Therefore, we can write the enzyme-DNA complex as $E = O_b + P$. We also need to consider the free DNA that is not bound to the enzyme. We'll call the tangle formed by this part of the DNA $O_f$ . We now have one tangle equation, $N(O_f + O_b + P) = K_0$, the substrate molecule. The second assumption is that recombination acts by tangle surgery where the site tangle P is replaced by the recombinant tangle R after one round of recombination. By this assumption, we can model one round of recombination by replacing the P in our equation for the substrate molecule with R. Here is this model for one recombination round:

$$N(O_f + O_b + P) = K_0 \text{ (substrate)}$$

$$N(O_f + O_b + R) = K_1 \text{ (product)}$$

Next, we must assume that the mechanism of recombination is constant, independent of substrate geometry and topology. This means that if all of the substrate molecules are all of the same knot type, then the tangles $O_f$ , $O_b$, P and R won't change from one event to another. If the substrate molecules are of different knot types, the only tangle that would change is $O_f$. The only exception to this is that we do need to consider site orientation. The last assumption will be that processive recombination acts like tangle addition.

This means after n rounds of recombination, P becomes nR = R+R+...+R. Under these assumptions, the model for processive recombination is given by the system of tangle equations is:

$$N(O + P) = K_0 \text{ (substrate)}$$

$$N(O + R) = K_1 \text{ (product of the first round)}$$

...

...

$$N(O + nR) = K_n \text{ (product of nth round)}$$

where $O = O_f + O_b$ and O, P, and R are unknown.

**Example 5.1**

When using the tangle model to analyze a specific enzyme, one first must prove rationality of the tangles in question which requires deep results in topology such as the Cyclic Surgery theorem. Once rationality is shown, the experimental results are used to set up the system of tangle equations which can be solved for the enzyme action.

In 2002, Mariel Vazquez and De Witt Sumners used the tangle model to analyze Gin site-specific recombination. This section will discuss their findings. This is just one example where the tangle model has been used to analyze a specific enzyme mechanism. Gin is a site-specific recombinase which is encoded by bacteriophage Mu. A bacteriophage is a virus that infects bacteria. The phage genome has two recombination sites, called gix L and gix R, which the Gin recognizes. Once bound to the DNA, the Gin makes a break at each site, rotates the ends, and then reconnects the ends. Gin acts by processive recombination which can result in more than one recombination event during a single binding. The results of tangle analysis of Gin recombination on unknotted substrate molecules with inversely repeated gix sites is as follows:

$K_0 =< 1 >$ (the unknot)

$K_1 =< 1 >$ (the unknot)

$K_2 =< 3 >= 31$ (the trefoil knot)

$K_3 =< 2, 1, 1 >= 41$ (the figure-8 knot)

$K_4 =< 2, 2, 1 >$ (the 5-twist knot)

In 2004, De Witt Sumners and Mariel Vazquez gave the following result which solves the simultaneous system of the first four equations above and accurately predicts the fifth equation.

## 6. Conclusion

We conclude that, DNA modelling used to study enzyme mechanisms. This is important in Knot theory. Finally we performed operations on tangles. We can develop our further research to use some other modelling in Knot theory.

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Research Article

# Fuzzy Classification in Feed-forward Neural Networks

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## ABSTRACT

This paper investigates the ability of feed-forward neural network (FFNN) classifiers trained with examples to generalize and estimate the structure of the feature space in the form of class membership information. A functional theory of FFNN classifiers is developed from formal definitions. The properties of discriminant functions learned by FFNN classifiers from sample data are also studied.

***Key Words: Discriminant function, feed-forward neural network, fuzzy classification, learning, membership profile, uncertainty.***

***MSC Code:92B20, 28E10, 62A86***

## 1. INTRODUCTION

Feed-forward neural networks (FFNNs) have been a natural choice as trainable pattern classifiers because of their function approximation capability and generalization ability [2, 5, 6]. Model-free estimation of the functional relationship between the input and the output, together with other desirable properties such as generalization ability, robustness to outliers and ease of design have motivated several applications for FFNN classifiers [1]. Feed-forward neural networks are often trained to function as classifiers by minimizing an objective function through gradient descent. In general, any gradient-descent-based algorithm is prone to behave erratically when used to train FFNNs to classify overlapping classes of feature vectors.

Pal and Mitra trained a multilayered FFNN to function as a fuzzy classifier for a data set consisting of overlapping classes of data. The input vector to the network was formed by applying the actual n-dimensional feature vector to a 3n-dimensional space, with each component of the actual feature vector being mapped to

three fuzzy sets representing high, medium and low values in its domain. This allowed the network to handle uncertain and ambiguous information as well as to take linguistic inputs. The `desired output' for training the network was computed from membership functions chosen a priori for each pattern class. The grade of membership values given by the network, together with any incidental contextual information, can be used to make a hard decision later. In both training schemes described above, the membership functions have to be estimated or chosen a priori. More significantly, a classifier decision function for a given feature space needs to be determined over the entire feature space, or at least over a dense subset of the feature space. The given data set is a finite subset of this dense subset of the feature space.

Suppose a conventional FFNN is trained on this finite subset of data points. It is expected that the network will learn the value of the unknown classifier decision function at least for all the points of a dense subset of the feature space. It is in this sense that the FFNN is expected to `generalize' [2, 5, 6]. Suppose the class membership functions are known and represent a measure of the extent to which a certain feature vector belongs to each class. Then the input-output function is exactly known over the entire feature space. This information is available in a functional form, with all the parameters already estimated. Therefore, in this scheme the network is capable of handling uncertain (linguistic) inputs, but does not necessarily perform an estimation task. However, model-free estimation of the input-output relationship is the main import of the neural processing paradigm.

However, this approach may not be valid when the classes of data are closely spaced or overlapping, as is often the case in practical situations [3]. In general, the ability of FFNNs trained by examples to function as fuzzy classifiers by themselves is sensitively dependent on the following. 1) their size, 2) the training data set, and 3) the learning algorithm.

## 2. FEED-FORWARD NEURAL NETWORK (FFNN) CLASSIFIERS

Consider a FFNN with $n_i$ inputs, no output units and one layer of $n_h$ hidden units. Let $v^T_j = [v_{j1}, v_{j2}, \ldots, v_{jni}]$ be the weight vector connecting the $j^{th}$ hidden unit to the inputs and $w^T_i = [w_{i1}, w_{i2}, \ldots, w_{inh}]$ be the weight vector connecting the $i_{th}$ output unit to the hidden units. Let **V** be the matrix with the vectors $v_j$ as its columns, and **W** the matrix with the vectors $w_i$ as its columns. Let the activation function of the hidden units be the Sigmoidal function g : R · [0, 1].

**Definition 2.1**

A conventional feed-forward neural network is defined as the function $N$. $R^{ni} \cdot R^{no}$ which maps $x = [x_1, x_2, \ldots, x_{ni}]^T$ to $N(V, g, W; x)$, such that

$$\cdot_i \; N(V, g, W; x) = \text{for all } i, j \qquad \ldots\ldots (1)$$

where $v_{j0}, w_{i0}$ · **R** for all j, i, and $\cdot_i$ is the $i^{th}$ co-ordinate function $\cdot_i : \boldsymbol{R}^{no}$ · $\boldsymbol{R}$.

$$g(v^T_j x + v_{j0}) =$$

is called the response of the $j^{th}$ hidden unit for the input x. Similarly,

is called the response of the $i^{th}$ output unit for the input x. As a matter of convention, *N(V, g,W; x)* will be henceforth denoted as *N(x).*

**Theorem 2.1**

Suppose $F : R^{ni}$ · $R^{no}$ is any Borel-measurable function defined on a compact subset *K* of $R^{ni}$ and is a set of m samples of this function. Given an · > 0, there exist a conventional FFNN *N(.)* with $n_h$ hidden units and an integer $n^0_h$ such that … …(2)

and for any metric $d_{no}$ on $R^{no}$ . The quantity · includes the representation, generalization and optimization errors in the realization of *N* .

**Theorem 2.1** proves that FFNNs with a single layer of nonlinear hidden units are adequate for most practical applications and, as such, research efforts often focus on FFNNs with a single hidden layer [2, 5, 6]. Given a sufficient number of samples of a Borel-measurable function F defined on a compact set *K*, the process of finding a N(.) which approximates F to a desired amount of accuracy is called training a conventional FFNN. Therefore, the process of training a conventional FFNN to learn a given function is essentially the search for the appropriate number of hidden units $n_h$ and the corresponding weight matrices **V** and **W**.

**Definition 2.2**

Suppose $F : R^{ni}$ · $R^{no}$ is any Borel-measurable function defined on a compact subset *K* of

$R^{ni}$ and

is a set of m samples of this function. A conventional FFNN is said to have learned F from the given samples to within an error · > 0 if it has $n_h$ hidden units and weight matrices **V** and **W** such that

… … (3)

According to Definition 2.2, any FFNN which is a "close" approximator of a given function can be said to have learned the function. It is noted here that for most nontrivial Borel-measurable functions, the amount of approximation accuracy achievable with a fixed number of hidden units cannot be pre-determined. In addition, for many functions the number of hidden units required may be physically unrealizable [2, 5, 6]. If the number of hidden units is fixed, the desired amount of approximation accuracy may not be achievable and the training process may not terminate. On the other hand, carrying out a simultaneous search for the appropriate number of hidden units and the weight matrices V and W is a difficult task for most functions of practical significance. In practice, most training algorithms for FFNNs chose the metric $d_{no}$ in equation (2)

as the Euclidean norm and train the network till · is some very small value. These training algorithms necessarily adapt the synaptic weights, and in some cases they also adapt the number of hidden units [8].

Therefore, the termination criterion for the training process can be stated in general terms as follows. Train the network till the condition,

… … …. (4) is satisfied.

Consider a data set of *m* feature vectors *x* · ·, where · is an N-dimensional feature space. Suppose $C_1$, $C_2$, . . . , $C_n$ · X are n known classes of feature vectors in the feature space ·. Let · be a compact metric subspace of $R^N$ and $C_1$, $C_2$, . . . , $C_n$ be Borel sets of $R^N$. Therefore, · is a Borel set of $R^N$ and so are · - $C_i$ for i = 1, 2, . . . , n. This data set of feature vectors may be simply referred to as the set ·.

**Definition 2.3**

The classifier for the data set · is defined as the function F : ·· $\{0,1\}^n$ such that for i = 1, 2, . . . , n,

*{ 1 if x · $C_i$ … …. ….. (5)*

*0 otherwise }*

Definition 3 takes into account the case of overlapping classes of data sets also. In particular, suppose the classes $C_p$ and $C_q$ are overlapping, i.e., *Cp · Cq* · ·.

In this case, Definition 2.3 implies that for all *x · $C_p$ · $C_q$*, ·$_p$*F(x) =* ·$_q$*F(x) = 1.*

**Definition 2.4**

The conventional FFNN classifier for the data set · is defined as the con- ventional FFNN that has learned the classifier function of the data set ·.

**Definition 2.5**

A conventional FFNN is said to have learned to consistently partition the feature space of a given data set if for i = 1, 2, . . . , n, ·$_i$N(x) · [0, 1] and

·$_i$N(x) = … … … (6)

where · ·(0,1). Usually, for symmetry and simplicity, the value of · may be taken to be 1/2.

**Proposition 2.1:**

Suppose F :$R^{ni}$ · $[0, 1]^{no}$ is any Borel-measurable function defined on a compact subset *K* of $R^{ni}$ and is a set of m samples of this function. Given an · > 0, there exist a bounded FFNN *N* with $n_h$ hidden units and an integer $n^{th}$ such that

, … … … (7)

and for any metric $d_{no}$ on $R^{no}$ . The quantity ・ includes the representation, generalization and optimization errors in the realization of *N*

**Proof:**

Since ・: R ・ [0, 1] is a sigmoidal function, it is 1-to-1, continuous, and increasing. Therefore, ・$^{-1}$ : [0, 1] ・ R is also 1-to-1, continuous, and increasing. Define $G : R^{ni}$ ・$R^{no}$ as ・$_i$G = ・$^{-1}$ ( ・$_i$F) for i = 1, 2, . . . , $n_o$. G is Borel-measurable and is defined on the same compact set as F. Since ・ is continuous, given an ・ > 0, there exists a ・ > 0 such that

… … … (8)

By Theorem 2.1, there exist matrices V and W and an integer $n^o_h$ such that

… … … (9)

## 3. CONCLUSION

This paper presented the development of a theoretical study of FFNN classifiers from formal definitions of known and measurable network parameters. The training and learning aspects of the FFNN classifiers were considered first. When a conventional FFNN is trained to function as a classifier, the network learns an approximation to the classifier function (Definition 2.3). This implies that the network learns to approximate the classifier function with responses ranging between 0 and 1 over the entire feature space. This has been interpreted as the ability of the network. The theoretical study presented in this paper proves that the nature of the intermediate response values generated by the FFNN (i.e., response values ranging from 0 to 1) is often respective of the hardness of training that the FFNN is subjected to. In other words, these intermediate responses could very well be due to the approximation error in the FFNN fit to the classifier function, and may not always correspond to valid membership values (i.e., class membership values consistent with the distribution of data on the feature space)

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# MARINE ACTINOMYCETES- A POTENTIAL FREE RADICAL SCAVENGER

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## ABSTRACT

Natural products remain the greatest sources of drugs and drug leads. Our search aims at probing a microbe, from marine environment, having competence to overcome the oxidative stress caused by several reasons. Hence the present study was carried out to evaluate the, antioxidant ability of marine actinobacteria, isolated from the sediments of coral reef and mangrove environment of the Gulf of Mannar. Five actinobacterial strains (S1, S2, S3, S4 and S5) were isolated, identified and tested for the antioxidant property using standard methods. Among the five trainsS1 and S2 proved to have excellent antioxidant activity. From the present findings, it was conformed that the marine actinobacteria have strong antioxidant activity which can be utilized in preventing or slowing down the progress of various oxidative stresses.

***Key words: Actinobacteria , Antioxidants, Actinomycetes , Antimicrobial***

## 1. INTRODUCTION

Despite incredible improvements in health since 1950, there are still a number of diseases are challenging the human community. 36 million deaths each year are caused by non-communicable diseases, such as cardiovascular disease, cancer, diabetes and chronic lung diseases. Among this cancer is one of the most daunting public health challenges. Half of all cancer deaths each year are due to lung, stomach, liver, colorectal and female breast cancers (WHO, 2004) an estimated 12.7

million new cancer cases occurred in 2008. One of the causes of cancer is excessive free radical damage in the cells that harms the DNA and results in some cells mutating into cancerous cells. Antioxidants are chemicals that block the activity of other chemicals known as free radicals. Free radicals are highly reactive and have the potential to cause cell damage including damage that may lead to cancer. Free radicals are formed naturally in the body. In addition, some environmental toxins may contain high levels of free radicals or stimulate the body's cells to produce free radicals. Antioxidants play an important role in inhibiting and scavenging free radicals, thus providing protection to humans against various infections and degenerative diseases (Sharma *et al*., 2008). Laboratory and animal research has shown that exogenous antioxidants can help prevent the free radical damage associated with the development of cancer.

The sea, covering more than 70% of the surface of planet Earth, contains an exceptional biological diversity, accounting for more than 95% of the whole biosphere (Qasim 1999). Microbial diversity constitutes an infinite pool of novel chemistry, making up a valuable source for innovative biotechnology (Berdy, 2005; Fenical and Jensen, 2006). In this respect, researchers switched over to new environments for novel pharmaceutical compounds and for combating human pathogens. (Subramani.,2012)

It appears that much unique form of microorganisms widely distributed throughout the ocean and found in intertidal zones, seawater, animals, plants, sponges and in ocean sediments. Dunlap *et al.,* 2003 reported that marine organisms are exposed to particularly high levels of ROS through a combination of photosynthesis, symbiotic oxygen production, and intense sunlight intensities leading to UV induced free radical production. So it could be expected that organisms which highly exposed to ROS should be have an effective antioxidant mechanisms. Many of them contain powerful plantlike or completely novel— antioxidant compounds so that marine organisms could be expected to be an interesting source of antioxidant compounds. Among the marine microbes Actinomycetes plays an important role. Actinomycetes are the most economically and biotechnologically valuable prokaryotes. They are responsible for the production of about half of the discovered bioactive secondary metabolites, notably antibiotics; antitumor agents, immunosuppressive agents, antioxidants and enzymes (Lam 2006). Actinomycetes may have different characteristics from terrestrial Actinomycetes and therefore might produce novel bioactive compounds and new antibiotics. The research to date shows that marine Actinomycetes produce novel types of new secondary metabolites. Many of these metabolites possess novel biological activities and have the

potential to be developed as therapeutic agents. These properties of Actinomycetes make them a more valuable in the field of research.

Hence in our current research an attempt is made to isolate marine Actinomycetes having potential antioxidant property.

## 2.MATERIALS METHODS

### 2.1 Sample collection and pretreatment

Sediments from the coral reef pichavaram mangroves environment, Kurusadai Island of the Gulf of Mannar Biosphere Reserve, south east coast of India, were collected with a corer. The collected samples were transferred to a sterile polythene bag and taken immediately to the laboratory. The sediment samples were aseptically air-dried in a laminar air flow and pretreated by incubating them at 55ºC in a hot air oven for ten minutes.

### 2.2 Isolation of Actinobacteria

After the pretreatment, 10-fold serial dilution of the sediment sample was prepared, using filtered and sterilized 50% sea water. Serially diluted samples were plated in the Kuster's agar medium in triplicate. To minimize the bacterial and fungal contaminations, all the plates were supplemented with Nystatin (20 mg/ml) and Cycloheximide (100 mg/ml) respectively. The Actinobacterial colonies were counted from $14^{th}$day onwards up to 28 days and the colonies were picked up and grown separately by streaking in Yeast extract, Malt extract dextrose agar. Subcultures were maintained in slants.

### 2.3 Identification of Actinomycetes

The potent actinomycete isolate was characterized and identified by morphological and cultural characters. The microscopic characterization was done by slide culture method (Williams and Cross, 1971). The mycelium structure, colour and arrangement of spores on the mycelium were observed through light microscope. Five different types of Actinomycetes were identified and names as S1, S2, S3, S4, S5 based upon the morphology and color type.**Table:1**

### 2.4 Fermentation and extraction of secondary metabolites

Actinomycetes were inoculated in nutrient agar containing 50ml conical flask and incubated at rotator shaker 220 rpm at 30°c 8 days then the culture was collected and centrifuged 4000 rpm for 30 minutes and supernatant was collected to test the antimicrobial activity.

## 2.5 Antioxidant Activity of Actinomycetes Extract

### 2.5.1 Total antioxidant activity

Total antioxidant activity of the Actinobacterial crude extracts was determined according to the method of Prieto *et al.,* 1999. Briefly, 0.3 ml of sample was mixed with 3.0 ml of reagent solution (0.6 M sulphuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). Reaction mixture was incubated at 95ºC for 90 min in a water bath. Absorbance of all the sample mixtures was measured at 695 nm. Ascorbic acid (100 µg/ml) was used as positive control.

### 2.5.2 Total reducing power

Total reducing capacity of the Actinobacterial extracts was determined according to the method of Oyaizu *et al.,* 1986. Actinobacterial extracts (100 µg/ml) in phosphate buffer (0.2 M, pH 6.6) were mixed with 1% potassium ferricyanide and the mixture was incubated at 5 ºC f or 20 m in; 2.5 ml of 10% trichloro acetic acid was added to the mixture and centrifuged at 5000 rpm for 10min. The upper layer of solution (2.5 ml) was mixed with 2.5 ml of distilled water and 0.5 ml of 0.1% ferric chloride and the colour developed was measured at 700 nm. Ascorbic acid (100 µg/ml) was used as positive control.

### 2.5.3 Scavenging of hydrogen peroxide

Ability of the Actinobacterial extracts to scavenge hydrogen peroxide was determined according to the method of Ruch *et al.,* 1984 with the slight modification of Green *et al.,*1994, 40 mM hydrogen peroxide was prepared in phosphate buffer (7.4) and the hydrogen peroxide concentration was determined spectrophotometrically by measuring the absorption with the extinction co-efficient for hydrogen peroxide of $81M^{-1}cm^{-}1$. Extract (100 µg/ml, positive control) was added to 0.6 ml of 40 mM hydrogen peroxide solution and the absorbance was determined at 230 nm after 10 minutes incubation against a blank solution containing phosphate buffer without hydrogen peroxide. Percentage of scavenging of hydrogen peroxide was calculated as follows:

Percentage of Inhibtion (I %) = (A *R*bland*R*– A *R*sample*R*) / A *R*blank*R*x 100

### 2.5.4 DPPH

The DPPH radical scavenging activity of Priya *et al.,* 2010 was done with few modifications. The crude extract of marine Actinobacteria were dilution in milli Q water to make 10, 20, 40, 60 , 80, and 100 Mg / ml dilution. Two milliliters of each dilution was mixed thoroughly with 1 ml of DPPH solution (0.2Mm/ ml). The mixture was incubated in dark at 20°C for 40 min. Absorbance was measured at 517 nm using UV- vis spectrophotometer with methanol as blank. Gallic acid was used positive control. The percentage scavenging of DPPH by the extracts was calculated according to the following formula:

$$\% \text{ DPPH Radical scavenging} = \{(AC-At)/AC\} \times 100$$

AC –absorbance of the control (DPPH)

At –absorbance of test sample

## 3. Result and Discussion

Marine soil sample was collected at shallow depth region of Gulf of Manner and pichavaram mangroves environment. Actinomycetes was frozen and transported to the laboratory and subsequently stored and identified. Table 1-4 shows the total antioxidant assay of the marine Actinomycetes.

### 3.1 Total reducing power

The reducing capacity of the Actinobacterial extracts equivalent to the ascorbic acid was tested at 700 nm. Graph 2 and table 3 shows the total reducing power assay. Among the five extracts, S1showed a strong activity of 117.8±0.577µg/ml, equivalent to the standard ascorbic acid whereas, the strain S2 (55.8±0.60) and S3 (46.4±0.05) showed moderate activity followed by the least activity of the strain S4 (29.0±0.26) and S5 (13.9± 0.076). **Janardhan *et al.,* 2014** isolated, an actinomycete *N. alba* and screened its bioactive compound with the help of Total reducing power. The bioactive compounds produced was predicted as "(Z)-1-((1-hydroxypenta-2,4-dien-1-yl)oxy) anthracene-9,10-dione". The extracted bioactive compound has shown good antioxidant properties.

### 3.2 Scavenging of hydrogen peroxide

The percentage scavenging activity (**graph-3**) of the five Actinobacterial extracts (S1, S2, S3, S4 and S5) with the standard ascorbic acid (20-100µg/ml) shown in table 4. Among them, S1 exhibited a maximum $H_20_2$ scavenging activity (140.00 ± 0.4) followed by S2 (67.00 ± 0.31) which are lesser than the standard L-ascorbic acid. The S3, S4, and S5 the scavenging activity is negligible Poongodi *et al.,* 2012 evaluated total antioxidant activity of actinobacterium, KRCR1 found to have a maximum activity. **Kamala *et al.,* 2013** evaluated the in vitro antioxidant activity of actinobacteria isolated from the sediments of coral reef environment of the Gulf of Mannar Biosphere Reserve, India. Among 86 strains, five actinobacterial strains (PM15,PM16, PM17, PM18 and PM19) were tested for antioxidant potential, using standard methods. The most active strain PM17 was identified using chemotaxonomical and molecular taxonomical methods. Scavenging of hydrogen peroxide of PM17 was found to be 66.29% which is equivalent to our S2 strain.

### 3.3 DPPH free radical scavenging assay

**Table-5** and **graph-4** shows the results of the DPPH scavenging potential of isolates. DPPH is, a relatively stable organic radical has been widely used in demonstration of antioxidant activity. DPPH radical scavenging is visually noticeable as a color change from yellow to orange. The scavenging ability of the CFE (cell free extract) of the isolated Actinomycetes was compared with the standard antioxidant –ascorbic acid. The maximum antioxidant activity was observed with S1 strain (112.00 ± 0.566 µg) followed by strain S2 with the activity of (82.3± 0.866 µg). S3 showed activity in the range of (75.1 ± 0.55 µg) followed by S4 and S5 with 65.7 µg and 29.6 µg respectively. Thenmozhi *et al.,* 2010 evaluated antioxidant activity of intracellular and extracellular metabolites of *Streptomyces sp.* VITTK3 isolated from marine soil sample collected at the Bay of Bengal coast of Puducherry, India. The results of their study indicated that *Streptomyces* sp. VITTK3 possess significant DPPH free radical scavenging activity and it is mainly due to intracellular and extracellular metabolites produced by *Streptomyces sp*. Preeti *et al.,* 2013 studied the antioxidant nature of the melanin pigment produced by the garden soil *Streptomyces Species* through solid state fermentation and found to be potential source of antioxidant.

**Table-1:Color of the Actinomycetes Strains**

| STRAIN NAME | ACTINOMYCETES |
|---|---|
| **S1** | YELLOW |
| **S2** | GREEN |
| **S3** | WHITE |
| **S4** | RED |
| **S5** | ASH |

**Table-2: Total antioxidants assay of Actinomycetes strains**

| STRAIN NO | AVERAGE OPTICAL DENSITY AT 700nm | CONCENTRATION (µg/µl) |
|---|---|---|
| **Blank** | **0.079** | _ |
| **S1** | **0.785** | **98.50 ± 0.408** |
| **S2** | **0.588** | **73.83 ± 0.866** |
| **S3** | **0.570** | **71.93 ± 0.759** |
| **S4** | **0.541** | **67± 0.249** |
| **S5** | **0.329** | **33.3 ± 0.249** |

**Table 3: Reducing Power assay of Actinomycetes Strains**

| STRAIN.NO | AVERAGE OPTICAL DENSITY AT 700nm | CONCENTRATION (µg/µl) |
|---|---|---|
| **Blank** | **0.117** | _ |
| **S1** | **1.393** | **117.8±0.577** |
| **S2** | **0.601** | **55.8±0.60** |
| **S3** | **0.544** | **46.4±0.05** |
| **S4** | **0.340** | **29.0±0.26** |
| **S5** | **0.280** | **13.9± 0.076** |

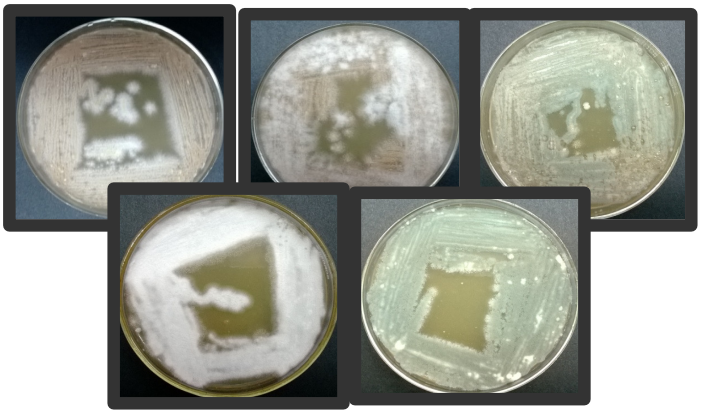
**Table-4: Hydrogen peroxide assay of Actinomycetes strains**

| STRAIN. NO | AVERAGE OPTICAL DENSITY AT 520nm | CONCENTRATION (µg/µl) |
|---|---|---|
| Blank | 0.033 | — |
| S1 | 0.465 | 140.00 ± 0.4 |
| S2 | 0.390 | 67.00 ± 0.31 |
| S3 | 0.361 | 53.12± 0.11 |
| S4 | 0.250 | 41.23± 0.21 |
| S5 | 0.240 | 39.00± 0.12 |

**Table-5: DPPH assay of Actinomycetes strains**

| STRAIN . NO | AVERAGE OPTICAL DENSITY AT 520nm | CONCENTRATION (µg/µl) |
|---|---|---|
| Blank | 0.052 | — |
| S1 | 0.637 | 112.00 ± 0.566 |
| S2 | 0.480 | 82.3± 0.866 |
| S3 | 0.443 | 75.1 ± 0.55 |
| S4 | 0.394 | 65.7± 0.33 |
| S5 | 0.206 | 29.6± 0.13 |

**PLATE -1: Marine Actinomycetes**



## 4. Conclusion

Continuous discovery of new drugs is essential due to the ever-growing resistance of microorganism to existing drugs. Immense environmental and biological diversity of the marine world remained plausible attention in context of vast chemical diversity of marine microbial metabolities. Marine actinomycetes have developed the greatest genomic and metabolic diversity in their voyage of evolution. In our present research it is proved that the marine Actinomycetes proved their potential as a source of novel antioxidant, this is mainly due to their unique metabolic pathways. In future bioactive antioxidant compound will be purified and these secondary metabolites can be used as natural antioxidant drugs to replace the artificial drugs that are currently available for the same treatment. Hence continuous exploration of unexploited marine fields may reveal more molecular entities with better antioxidant agent. This sort of research will confront the emergence of new drugs which save human community from oxidative stress.

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**Research Article**

# Isolation and Morphological Identification of Micro Algal Strains from Various Freshwater Niches

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## Abstract

Twelve samples were collected from various habitats in the outskirts of Tiruchirappalli district, Tamil Nadu, India during monsoon season. About, six microalgal strains were successfully made axenic. The identification of the isolated strains was explored by their morphological and ecological characteristics. Out of six isolates, four were identified as green algal strains – *Microspora* (three strains) and *Hydrodictyon* (one) and the two were identified as cyanobacterial strains belonging to the genera *Oscillatoria*.

***Keywords: Micro algae, freshwater, Taxonomy, Cyanophaceace, Chlorophyceace***

## 1.Introduction

Microalgae are the most ancient, versatile and robust forms of microorganism in freshwater environments, that are able to grow in a wide range of climatic conditions. Microalgae (algae and cyanobacteria), being a primary producer have main role in the nutrient cycling of the environment (Palmer, 1997). Freshwater ecosystems comprises wide variety of habitats namely, the sediments of running waters (rivers and streams), lentic bodies (ponds and lakes), groundwater zones, and ecotonal water bodies, where two aquatic habitats meet (e.g., hyporheic zones, wetlands, marshes and estuaries), and microbiological mats (Palmer, 1997, Skacelova et al. 2013). Micro algal cultures

in these ecosystems were identified primarily on the basis of readily-observable morphological features. Thus, the algae have been classified into 11 classes based on the shape, motility, cell wall structure and colonial form, number and mode of attachment of flagella in the motile cells, chemical nature of pigments, thallus structure, reserve food materials, reproduction method and life cycle variation (Bellinger and Sigee, 2010, Sharma et al. 2014).

The major micro algal diversity are chlorophyceae, xanthophyceae, chrysophyceae, bacillariophyceae, rhodophyceae, cyanophyceae, pheaophyceae, chyrptophyceae, chloromonodinae, euglinophyceae and dinophyceae (Mohanapriya and Geetharamani, 2014). The tropical climatic conditions prevailing in India favors wide range biodiversity of algae, which is desirable to be explored for their environmental and industrial applications (Sharma et al. 2014). In the present study, microalgal strains were impressively isolated from various habitats of Tiruchirappalli district, Tamil Nadu, India and their morphological features were evidenced by bright field microscopy and phase contrast microscopy.

## 2. Materials and Methods

Algal samples were collected randomly from three sampling sites of Tiruchirappalli district during November - December 2015 through several collection trips. Samples were collected using forceps and needle. All micro algal samples were immediately transferred to the laboratory in a pre-sterilized specimen bottle with voucher number. The replica of each samples were grown in the culture media in the laboratory. Single cells were isolated using standard microbiological isolation procedure. The axenic cultures of freshwater cyanobacteria were grown in BG11 media and green algal cultures were grown in Bold Basal Media(BBM) at 25 ºC ± 2 ºC under the illumination of white fluorescent light (14:10 h light/dark) at an intensity 2.20 $Wm^{-2}$.

Microscopic analysis of the selected strains was carried out using (Motic, USA); images were documented with MoticamPro 252A. The organisms were identified using relevant monographs for various micro algal groups. The identification of cyanobacteria was carried out initially according to the classical taxonomy of cyanophyta (Desikachary 1959, Komarek 2005, and green algae (Prescott 1970, John 2002).

## 3.Results

Six algal strains were isolated and cultivated in pure forms from the collected samples and the strain numbers were assigned (Table 1). The bright field microphotographs of the isolated algae were represented in Fig. 1. The phase contrast microphotographs of the isolated algae were represented in Fig. 2. The morphological features of the isolated strains were as follows.

## 3.1 Strain-FAC 10101

Order-Oscillatoriales

Family- Oscillatoriaceae

***Oscillatoria anguina*** Bory ex Gomont 1892 (Fig. 1a and 2a)

Thallus thin, membranaceous, mucilaginous, dark blue green; trichomes 4.5 (5.5) - 8 µm wide, straight, motile with quite gliding without rotation, not or rarely somewhat constricted, at sometimes distinctly finely granulated cross walls, screw like twisted and gradually attenuated at the ends, rarely nearly straight or variously curved. Cells 1.5 - 4µm long, end cells capitate with a slightly thickened membrane.

Habitat: Rice field of Karambakkadu village of Manapparai Taluk, Tiruchirappalli,

## 3.2 Strains-FAC 31201

Order-Oscillatoriales

Family-Oscillatoriaceae

***Oscillatoria sp.*****Vaucher** (Fig. 1b and 2b)

Trichome single or forming a flat or spongy free- swimming thallus, sheath absent, rarely with a more or less very delicate sheath, motile, mostly by a creeping movement causing rotation on the longitudinal axis; end of trichomes distinctly marked, pointed, bent like a sickle or coiled more or less like a screw. Harmogones formed by the division of the trichome.

Habitat: Stagnant water at Mathur village, Tiruchirappalli.

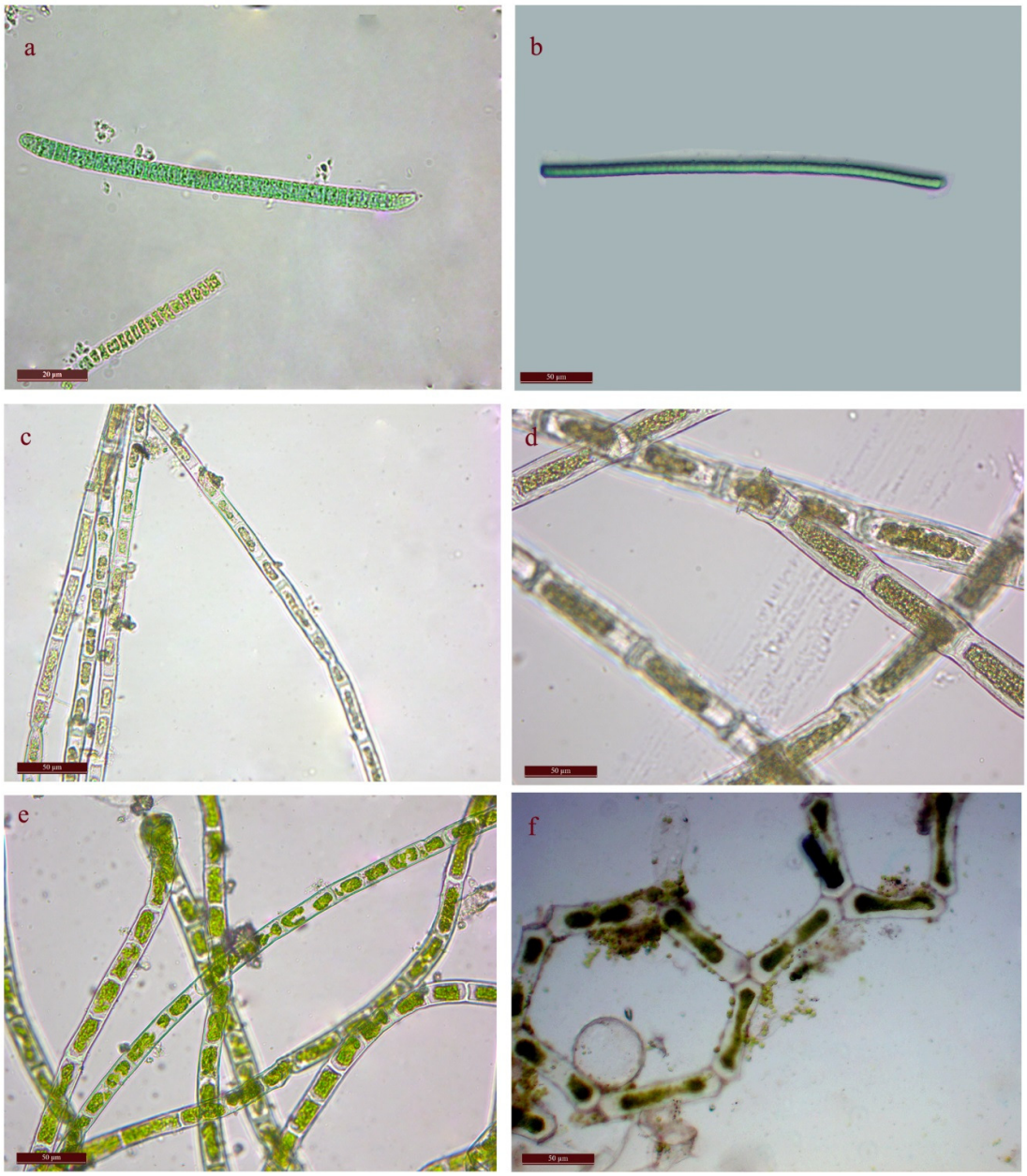


Figure 1: Bright field photomicrographs of a. ***Oscillatoria anguina*** **FAC 10101**. b. ***Oscillatoria sp.*** **FAC 31201** c. ***Microspora amoena var gracilis*** **FAC 10401,**. d. ***Microspora amoena var gracilis*** **FAC 30901**. e. ***Microspora amoena var gracilis*** **, FAC 11101**. f. ***Hydrodictyon reticulatum*** **FAC 20201** Scale bar: 1000µm.

## 3.3 Strains-FAC 10401, FAC 30901, FAC 11101

Order- Microsporales

Family- Microsporaceae

***Microspora amoena var gracilis*** (Wille) De Toni 1889 Synonym: ***Microspora elegans*** Hansgirg 1891 (Fig. 1c, 1d,1e); (Fig. 2c, 2d,2e)

Cell wall usually >1.5 µm thick with an evident junction between the H shaped segment. Cells 12-18µm wide. 1.5-4 times longer than wide, Chloroplast granular, nearly filling cells.

Habitats of FAC 10401- Garden canal of Karambakkadu village Manapparai Taluk, Tiruchirappalli, FAC 30901- Fish pond of Mathur village, Tiruchirappalli, FAC 11101-Canal of Karambakkadu village Manapparai Taluk, Tiruchirappalli.

## 3.4 Strain-FAC 20201

Order-Chlorococcales

Family-Hydrodictyaceae

***Hydrodictyon reticulatum***(Linnaeus) Lagerhaim

Coenobium closed, a sac like network of cells reaching to over 50cm long, meshes upto 10 -15 mm across and clearly visible in large colonies; cells vary considerably in size, sometimes reaching to 10 -15 mm long in large colonies, three commonly connected by their edges to form five sided meshes.

Habitat: Stagnated water in the rice field of Vadugapatti village, Manapparai,

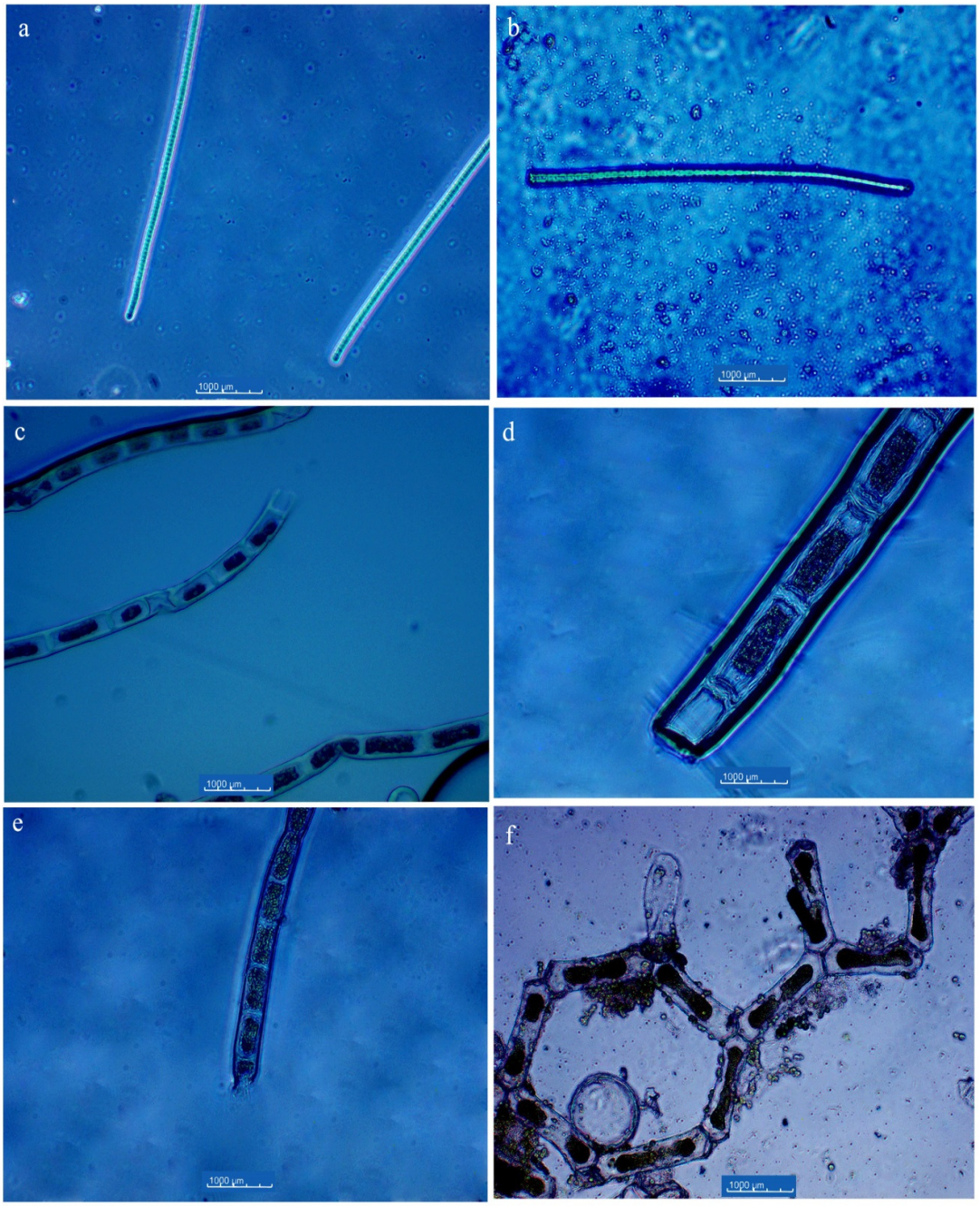


Figure 2: Phase contrast photomicrographs of a. ***Oscillatoria anguina*** **FAC 10101**. b. ***Oscillatoria sp.*** **FAC 31201** c. ***Microspora amoena var gracilis*** **FAC 10401,**. d. ***Microspora amoena var gracilis*** **FAC 30901**. e. ***Microspora amoena var gracilis*** **, FAC 11101**. f. ***Hydrodictyon reticulatum*** **FAC 20201** Scale bar: 1000µm

**TABLE 1. STUDY ISOLATES SHOWING THE GEOGRAPHICAL ORIGIN AND TAXON DESIGNATION.**

| Voucher No | Taxon designation | Strain number | Geographical origin |
|---|---|---|---|
| **C1** | *Oscillatoria anguina* | FAC 10101 | Karambakkadu village, Manapparai (Tk), Tiruchirappalli district |
| **C2** | *Hydrodictyon reticulatum* | FAC 20201 | Vadugapatti village, , Tiruchirappalli district |
| **C4** | *Microspora amoena var gracilis* | FAC 10401 | Karambakkadu village, Manapparai (Tk), Tiruchirappalli district |
| **C9** | *Microspora amoena var gracilis* | FAC 30901 | Mathur village, Tiruchirappalli district |
| **C11** | *Microspora amoena var gracilis* | FAC 11101 | Karambakkadu village, Manapparai (Tk), Tiruchirappalli district |
| **C12** | *Oscillatoria sp* | FAC 31201 | Mathur village, Tiruchirappalli district |

## 4.Discussion

Among the six isolated strains, two were cyanobacterial strains FAC 10101 and FAC 31201 belongs to Oscillatoriales and four were green algal strains FAC 10401, FAC 30901, FAC 11101 synchronized to Microsporales and FAC 20201 falls under Chlorococcales order. *Oscillatoria anguina* FAC 10101 and *Oscillatoria sp* FAC 31201 perfectly fits to description proposed for *Oscillatoria sp*. *Hydrodictyon reticulatum* is an index organism for a high pH and it grows ideally in the irrigation reservoir and nutrient rich water (Prescott 1970, John 2002). Since our isolate also belongs to the stagnated water of rice field its ecology suits best with the reported morphological description, thus confirming their generic epithet. It was also reported that *Microspora amoena* is a cold water form and most abundant in the winter season (John 2002). Hence, the present study authenticates the predominance of *Microspora* forms during the winter season i.e, November – December, which was in concurrent with the previous reports.

## 5. Conclusion

The present study have analyzed morphological and ecological characteristics of the microalgal strains at the outskirts of Tiruchirappalli district in monsoon season and clearly picturizes the seasonal blooming strains. Further, analysis of morphologically identified organisms is essential to characterize these strains at the genetic level through molecular approach which would give a lead for further biotechnological applications of these strains.

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**Research Article**

# Studies on Isolation and Identification of Rhizobium from Agricultural Soil and Its Effect on Vigna Mungo, l. in Pot Culture Experiments

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## ABSTRACT

The present study was carried out to know the effect of *Rhizobium* on growth, yield and some biochemical parameters of *Vigna mungo* crops. Four dissimilar *Rhizobium* species were isolated from the leguminous crop soil samples of two different regions namely Okkanadu Keelaiyur and Pinnayur at Thanjavur Dist by using yeast extract mannitol agar (YEMA) medium. The isolated *Rhizobium* sp were characterized and identified on the basis of morphological, biochemical, cultural and pathogencity tests. The *Vigna mungo* seeds were treated with different sps of *Rhizobium* and grown on pots containing sterilized soil. The parameters like plant weight, root length, number of lateral roots and length, number of nodules and the biochemical parameters like soluble protein; total free amino acids and carbohydrate content were estimated and compared with the control plants. Among all treatments, rhizobium treated plants get a good result than control plant, So the *Rhizobium* sp treated legume crops fix large amount of nitrogen and also act as a good bio fertilizers for eco-friendly in farmers.

***Key words: Vigna mungo crops, soil sample, Rhizobium sp, Root nodules, Bio fertilizer.***

## 1. INTRODUCTION

All living things mainly depend upon food for survival. So the food is an essential component for life. It serves to regulate the some physiological and morphological changes of the body such as synthesis of energy, maintaining the cells and tissues and stabilize the organ function. These needs to be satisfied by the nutrients present in the food. Mainly, cereals and pulses are the basic vegetarian food source for Indian society. Among this, the pulses are designated as poor man's meat as they contain considerable amount of proteins. Black gram (*Vigna mungo*) is the third important pulse crop in India. It is annual pulse crop, native in central Asia and it's also extensively grown in West Indies, Japan and other tropics/subtropical countries. Black gram seeds are highly nutritious containing higher amount of protein (24-26%) and are reported to be rich in potassium, phosphorus and calcium with good amount of sodium. Green gram (*Vigna radiata* L.) and Black gram (*Vigna mungo* L.) constitute the important group of grain legumes which form a major source of dietary proteins of high biological value, energy, minerals and vitamins (Taylor *et al*., 2005). Black gram and Green gram are the evolution of the legumes (Fabaceae), the third largest family of flowering plants but there is no obviously identifiable nodules associated with fossils that it can be accurately described as legume roots (Hirsh et al., 2001). Being leguminous crops, possessing root nodules which is used for fixing atmospheric nitrogen to the plants. So the plants couldn't depends upon industrial nitrogen fixation process and add up to 30 kg. of nitrogen/ hectare and its improve the soil fertility in agricultural land. Annually 22 million hectares were utilized to cultivate the pulse crops in India and the production value is about 11-12 million tonnes were recorded. Access to mineral nitrogen often limits plant growth, but the symbiotic relationships between plants and a variety of nitrogen-fixing organisms have evolved to improve the plant growth and also increase the yield of grains. These associations, responsible for reducing 120 million tonnes of ammonia per year. In agriculture, independence form of nitrogenous fertilizers expand crop production and minimizes the water pollution of water table, lakes and rivers. Black gram (*Vigna mungo*) pulses were taken for this study to find out the impact of artificial inoculation of bacterium on the production of grains over the non inoculated one.

Since the identification of Rhizobium by Hellriegel and Wilfarth (1888) which is used as sole source of nitrogen that means of fixing atmospheric nitrogen to the root nodules of

legumes, people have wondered whether or not plants outside the Fabaceae could be manipulated to associate with *Rhizobia*. It is well-known that the rhizobia-legume interaction falls into cross inoculation groups, whereby certain rhizobial strains nodulate only certain legumes. For example, *Sinorhizobium meliloti* effectively nodulates species of *Medicago*, *Melilotus*, and *Trigonella*, whereas *Rhizobium leguminosarum* by *viciae* induces nitrogen fixing nodules on *Pisum*, *Vicia*, *Lens*, and *Lathyrus* spp. Closely related to the pea (*Pisum sativum*) strain is *R. leguminosarum* by *trifolii,* which initiates nodules only on species of clover (*Trifolium*). Weaver (1974) postulated that the presence of nodules on roots does not mean that the sufficient nitrogen is being fixed to the plant, but it secrete the plant growth substances such as indole acdetic acid ,gibberllin etc.,

Stimulate the good growth of the host plant. Inoculation with effective strains of *Rhizobium* have increased pod yield in ground nut (Sundara Rao, 1971). Inoculation of *Rhizobium* sp. causes a greater increase in growth and yield and the number of nodules per root system is significantly higher in plants inoculated with *Rhizobium* sp. compared to plants without *Rhizobium* sp. under field condition (Akhtar *et al*., 2009). The *Rhizobia* fix substantial quantities of nitrogen symbiotically between 80 to 150 kg N ha in 90 days. Rhizobacteria that advantage the growth of plant and also encourage the development of plant growth promoting Rhizobacteria (PGPR). Even though dissimilar nodules on the same plant might contain different strains (Koo, 2009 and Malika 2004).

## 2. MATERIALS AND METHODS

### 2.1 Physico-chemical characteristic of soil sample

The soil samples were collected from leguminous crop (***Vigna mungo)*** growing two different regions namely Okkanadu Keelaiyur and Pinnayur at Thanjavur Dist .The physico-chemical properties of soil samples were tested by standard method (Jackson,1973).

### 2.2 Isolation of *Rhizobium* from *Vigna mungo*

Strains of *Rhizobium* sp. were obtained from root nodules of field grown *Vigna mungo* plants collect from Thanjavur (Dt). Root nodules were sterilized in 0.1% (w/v) sodium hypochloride for 5min and immersed in 95% (v/v) ethanol for 10 s, and then washed six times with distilled water and streaked on yeast extract mannitol agar (YEMA) medium containing 0.0025% (w/v) congo red (Vincent, 1970). After 3 days of inoculation at 30$^{o}$C, single colony was selected and re-streaked in a YEMA medium for purification.

## 2.3 Identification

Initial inoculums of $10^{8}$ cells $ml^{-1}$ were prepared in YEMA with a pH initially adjusted at 6.8. Colony morphology (colour, nature, transparency, borders) was evaluated by streaking a loop of the initial inoculums on YMS medium and allowing the bacteria to grow in the dark at 30$^{o}$ C for 3, 5 and 7 days (Vincent, 1970).

## 2.4 Gram staining (Gram, 1884)

A thin smear of test isolates was separately made on a clean glass slide and heat fixed. Then the smear was stained using crystal violet for 1 min. and then washed with water followed by flooding with Gram's iodine. After 1 min. the slide was washed again in tap water and decolorized with alcohol. After decolourization, the smear was counterstained with safrannin for 1 min. Then the slide was washed, air dried and finally observed under microscope.

### 2.5 Biochemical Tests

All the collected samples were processed through different biochemical tests viz, Catalase Test, Indole Production Test Methyl Red Test, Vogas Proskauer Test, Citrate Utilization Test as described by (Lowe,1962) and Starch hydrolysis Test, and Motility Test as mentioned by (Arora, 2003) and ONPG Test (O-Nitrophenyl-D Galacto- Pyranoside) as described by (Cappuccino, 2007).

### 2.6 Pot culture experiment

A pot culture experiment was conducted at Srimad Andavan Arts and Science College Terrace garden, Trichy. In order to determine the efficiency of rhizobial isolates on the test crop of *Vigna mungo*.

### 2.7. Germination and Growth effect studies (Turnbull and Martensz, 1981)

Seeds of the *Vigna mungo* were washed and surface sterilized with 30% $H_2O_2$ for 15 minutes. They were rinsed three times with sterile water for 15 minutes. The soils were packed in the pots (plastic bowl). The seeds were sown in to pots. These experiments were run up to conducted in 21$^{th}$ day and the results were obtained at seven days intervals.

**Experimental set up**

| | |
|---|---|
| Treatment –0 | Soil + *Vigna mungo* (Control) |
| Treatment –1 | Soil + *Vigna mungo+AR1 (Rhizobium)* |
| Treatment- 2 | Soil + *Vigna mungo+AR2 (Sinorhizobium)* |
| Treatment –3 | Soil + *Vigna mungo+AR3 (Bradyrhizobium)* |
| Treatment -4 | *Soil +Vigna mungo+AR4 (Mesorhizobium)* |

At each treatment triplicates pot were maintained.

The plant growth parameters for every 7$^{th}$ day of intervals, with measured morphometric and biochemical parameters. The morphometric analysis with initials of 7$^{th}$ day and 21$^{st}$ day were measure in manually and scale (cm) units. Biochemical Estimation was carried out by the standard methods of proteins (Lowry *et al*. 1957), carbohydrate (Dubios *et al*., (1956) and amino acids (Jayaraman, 1981).

### 2.8 Analysis the abundance of Rhizobia in the experimental soil and root nodules

The soils after the examination were subjected to the quantitative examination of *Rhizobium*. The samples were serially diluted the number of colonies were enumerated and tabulated. To find out the impact of the rhizobial population on the soil samples and root nodules, they are concurrent to control.

**Table - 1 Physico Chemical properties of two different soil samples of *Vigna mungo* cultivated field**

| S.No | Name of the parameter | SAMPLE DETAILS | |
|---|---|---|---|
| | | **Okkanadu Keelaiyur** | **Pinnayur** |
| 1 | Ph | 7.5 | 7.3 |
| 2 | Electrical conductivity ($dsm^{-1}$) | 0.49 | 0.52 |
| 3 | Organic Carbon (%) | 0.23 | 0.34 |
| 4 | Organic Matter (%) | 0.52 | 0.64 |
| 5 | Available Nitrogen (Kg/ac) | 120.3 | 118.2 |
| 6 | Available Phosphorus (Kg/ac) | 3.75 | 4.25 |
| 7 | Available Potassium(Kg/ac) | 111 | 121 |
| 8 | Available Zinc (ppm) | 0.84 | 1.023 |
| 9 | Available Copper (ppm) | 0.69 | 0.84 |
| 10 | Available Iron (ppm) | 4.54 | 4.23 |
| 11 | Available Manganese (ppm) | 2.19 | 2.56 |
| 12 | **Cat ion Exchange Capacity** (C. Mole $Proton^{+}$/kg) | 19 | 20.5 |
| **Ex changeable Bases** (C. Mole $Proton^{+}$/kg) | | | |
| 13 | Calcium | 16 | 14.5 |
| 14 | Magnesium | 7.9 | 7.4 |
| 15 | Sodium | 1.45 | 1.05 |
| 16 | Potassium | 0.19 | 0.25 |

**Table - 2 Cultural Characteristics of Rhizobial Isolates**

| S.No | Test name | Isolates |
|---|---|---|

| | | AR1 | AR2 | AR3 | AR4 |
|---|---|---|---|---|---|
| 1 | CRYEMA | + | + | + | + |
| 2 | Gram staining | - | - | - | - |
| 4 | Shape | Rod | Rod | Rod | Rod |
| 5 | Motility | + | + | | |
| 6 | YEM (Bromothymol blue) | Yellow colour (fast growing) | Blue colour (slow growing) | Yellow colour (fast growing) | Blue colour (slow growing) |
| 7 | Hofer's alkaline | - | - | | |
| 8 | Glucose peptone agar | - | - | | |
| 9 | Indole test | + | + | - | - |
| 10 | Methyl red test | - | + | | |
| 11 | Voges-Proskauer test | - | - | + | - |
| 12 | Citrate utilization | + | - | + | - |
| 13 | Catalase Test | + | + | + | + |

**(+) positive (-) negative**

**Table - 3 7th Day Morphometric Analysis**

| S. No | Parameters | T0 | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|---|
| 1 | Shoot height | 3.4 | 3.7 | 2.8 | 2.8 | 2.9 |
| 2 | Root height | 3.8 | 7.9 | 3.5 | 3.5 | 6.2 |
| 3 | No of leaf | 2 | 2 | 2 | 2 | 2 |
| 4 | No of hairy roots | 9 | 24.3 | 10.3 | 10.3 | 12.5 |
| 5 | Leaf length | 4.2 | 3.9 | 4.8 | 4.3 | 4.2 |
| 6 | Leaf width | 1.4 | 1.4 | 1.3 | 1.3 | 1.8 |
| 7 | Shoot grifth | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 8 | No of nodules | - | - | - | - | - |

**Table - 4 14th Day Morphometric Analysis**

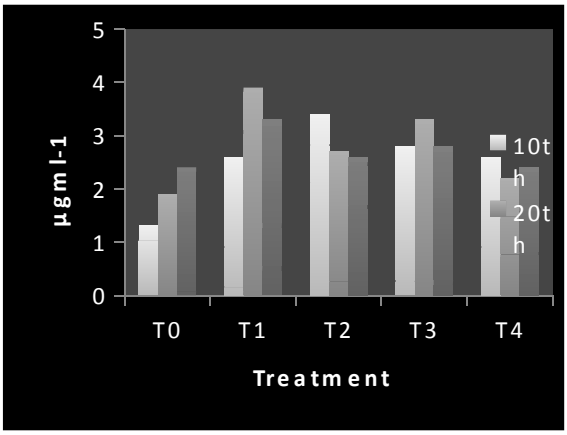
| S. No | Parameters | T0 | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|---|
| 1 | Shoot height | 3.6 | 3.6 | 3.5 | 3.2 | 2.7 |
| 2 | Root height | 5.4 | 8.6 | 3.8 | 8.2 | 3.5 |
| 3 | No of leaf | 5 | 5 | 5 | 5 | 5 |
| 4 | No of hairy roots | 9.3 | 24.6 | 19 | 22 | 15.3 |
| 5 | Leaf length | 5.3 | 6.2 | 6.3 | 4.8 | 5.6 |
| 6 | Leaf width | 2.5 | 2.9 | 2.6 | 2.3 | 2.8 |
| 7 | Shoot grifth | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 8 | No of nodules | 12.3 | 12.7 | 12 | 17.7 | 10.3 |

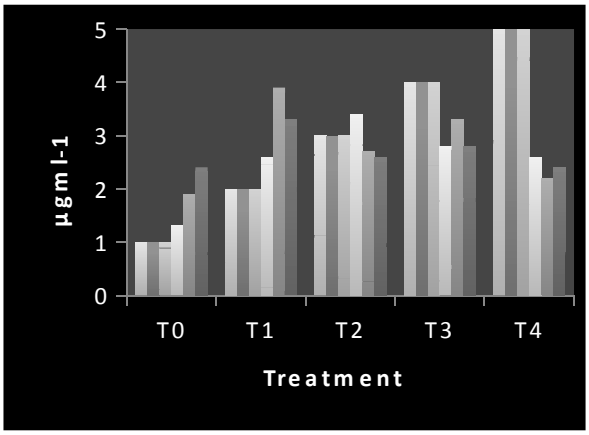
**Table – 5 21st Day Morphometric Analysis**

| S. No | Parameters | T0 | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|---|
| 1 | Shoot height | 3.9 | 4.5 | 4 | 3.5 | 3 |
| 2 | Root height | 5.6 | 9.6 | 4.5 | 8.3 | 3.8 |
| 3 | No of leaf | 7 | 8 | 8 | 8 | 8 |
| 4 | No of hairy roots | 16.3 | 23.3 | 20.6 | 25 | 20 |
| 5 | Leaf length | 6.1 | 6.5 | 6.4 | 5.3 | 6.8 |
| 6 | Leaf width | 2.5 | 3.0 | 2.8 | 2.6 | 3.1 |
| 7 | Shoot grith | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 8 | No of nodules | 17.3 | 18.3 | 14.6 | 23 | 11 |

**Table - 6 Mean Density of soil and root nodules amended *Rhizobium* sp**

| S.No | Treatment | Dilution | Soil sample | Root nodules |
|---|---|---|---|---|
| **1** | T0 | $10^{-6}$ | **52** | **15** |
| **2** | T1 | | **121** | **67** |
| **3** | T2 | | **85** | **109** |
| **4** | T3 | | **86** | **126** |
| **5** | T4 | | **95** | **67** |



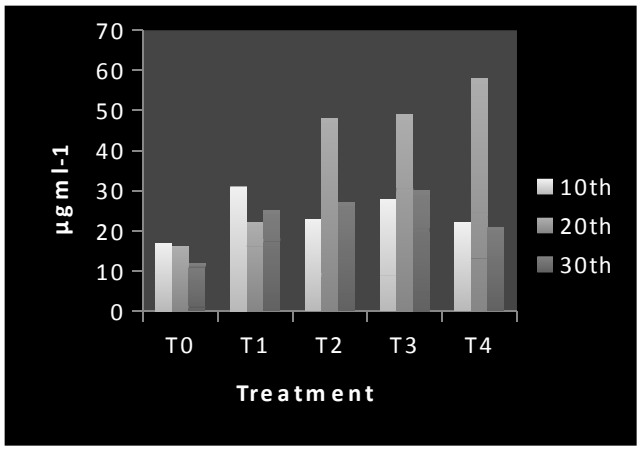




**Fig.1: Biochemical Estimation of (a) Carbohydrates, (b) Protein and (c) Aminoacids**

## 3. RESULT AND DISCUSION

In this present work, the physicochemical analysis of the soil samples collected from Okkanadu Keelaiyur and Pinnayur in Thanjavur Dist. These two soil samples give a more or less similar report in all physicochemical studies (Table 1). Totally ninety two colonies were isolated from site 1 and one hundred and twenty three colonies from site 2. All the positive samples were also streaked on Bromothymol blue (BTB) added Yeast Extract Mannitol (YEM) selective media for further confirmation. Similarly the positive samples from all target areas showed hazy appearance in the motility media and also were positive for catalase, Tests. The samples found negative for methyl red (MR), voges-proskauer (VP), indole, citrate utilization test, hydrogen sulphide production and urea hydrolysis test (Table 2). These findings are in close agreement with (Elsheikh and Wood, 1989) who also characterized the *Rhizobium* from soil and sunflower root nodules with the same positive biochemical tests. Similarly, the nodulation pattern in forage legume bacteria by screening through the same tests results and characterized *Rhizobium* strain from the roots of *Trigonella foenumgraecum.*

The concentration of tryptophan in the medium increases at a certain extent, the amount of IAA production is increased. Different legume modulating rhizobial strains preferred different vitamins sources for IAA production reported (Ghosh *et al*., 2014 and 2015). Combined application of L-TRP and *Rhizobium* species (Cp3, Br3 and Lt2) promoted the fodder yield by enhancing biosynthesis of auxins in the rhizosphere might be the reason for enhanced growth through precursor-inoculum interaction (Zahir *et al*., 2005; 2010). Maximum percentage seed germination of *V. mungo* was showed in T4 inoculated pots. When compared with *Rhizobium* inoculated pots the uninoculated control pot seed was showed only in minimum level of germination. On 21$^{st}$ day the number of hairy roots was slightly increased as well as the nodules in T3 inoculated plant.T3 inoculated plants showed better results than the other Rhizobia inoculated plants with the increased number of hairy roots and nodules. This study represented that the effective *Rhizobium* is one of the factor for the formation of nodules. The previous studies related on rhizobia were reported in respect of soil population of rhizobia (Chaudri *et al.*, 1992), nodulation and nitrogen fixation (Ibekwe *et al.,* 1996). Protein content in the treatment, with the increase in age of plant and also in the increase of concentration up to a certain period and the protein content showed slightly reduction. Reduction of carbohydrate content was observed in after 10th day growth of the

plants. Similarly, amino acids content was appeared on all the experiment plant. Increased chlorophyll content (a & b) might be attributed to enhanced photosynthetic leaf area of plant by PGPR inoculation compared to control having less flag leaf width and length (Han and Lee, 2005). The Rhizobial density observed in control plant soil was $52x10^6$ CFU and the number of nodules showed with 15. In $T_1$, $T_2$, $T_3$ and T4 strains of *Rhizobium* inoculated pots the population density of soil was recorded as 121, 85, 86 and $95x10^6$ CFU. The root nodules of the Rhizobial inoculated plants showed 67, 109, 126 and 67 respectively by the strains.

## 4. CONCLUSION

From this study, a novel biofertilizer was developed using a species of *Rhizobium*, which was isolated from the leguminous soil, it is inferred that application of four different strains of *Rhizobium* has to be increase physiological growth, dry matter production, and chlorophyll content, N content, yield, yield attribute and raise the economic values of Black gram. So, therefore, it can be recommended as a good source of nutrients for organic cultivation of Black gram.

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**Research Article**

# PRODUCTION OF POLYHYDROXYBUTYRATES FROM RHIZOBIUM SPECIES

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## ABSTRACT

Polyhydroxybutyrates (PHBs) are synthesized and deposited as cytoplasmic inclusions in various bacteria like *Rhizobium* sp.,. This work was focused on isolating a PHB-producing bacterium capable of growing in conventional media used for industrial biopolymer production, its physiological and Biochemical identification characterization. Thus, a bacterial isolation process was carried out from samples of root nodules of various leguminous plants. Synthetic plastics pose a number of serious problems. Therefore, there is an urgent need to have a biodegradable alternative to these synthetic polymers. *Rhizobium* spp. is able to produce PHB which can be used as biodegradable plastic. Although, the cost of production is high because of high cost of media ingredients and chemicals used for their extraction from the cell. In the present study, attempts have been made to isolate and characterize the *Rhizobium* isolates capable of producing PHB and to analyze the effect of cheap carbon and nitrogen sources on their growth and PHB production.

***Key words: Polyhydroxybutyrate, biodegradable plastic, Rhizobium.***

## 1. INTRODUCTION

Our life is dependent on synthetic polymers as these are used in manufacturing of number of goods used by us in our daily life. But these synthetic polymers are major pollutant in the environment in the present scenario. They are highly stable and thus remain persistent in environ-ment for decades. Polyhydroxybutyrate

(PHBs) are thermoplastics belonging to class polyhydroxy-alkanoate (PHA), a polymer. PHB are produced intracellularly by various organisms such as *Bacillus megaterium*, *Rhizobium* spp., *Azotobacter* spp., *Pseudomonas* spp., etc under physiological stress conditions.

PHB has the properties similar to that of synthetic plastics. Major advantage of PHB over conventional plastics is their biodegradable nature. In the last few years, various attempts have been made to use PHB for the production of biodegradable plastics (bioplastic). The major limitation in use of biodegradable plastics of plant origin is their high cost of production as compared to the synthetic plastic.

In the present study, attempts have been made to produce bioplastics from *Rhizobium* spp. *Rhizobium* belongs to the family *Rhizobiaceae.* These are Gram negative, motile, non-endospore forming. *Rhizobium* species are symbiotically associated with several leguminous plants like *Pisum sativam*, *Glycine max, Alfa* , etc.

They also play a major role in nitrogen fixation. They are cultured in Yeast Mannitol Agar medium. *Rhizobium* gives colorless gummy appearance when grown on YEMA medium supplemented with congo red. The gummy appearance is because of extracellular polysac-charide production. Most importantly, they are able to accumulate a high amount of PHB intracellularly.

## 2. MATERIALS AND METHODS

### 2.1 Isolation of microbial strains

Root nodules from different areas of Trichy (Dt), Tamilnadu were collected. Pink colored healthy root nodules were selected from the roots of various leguminous plants and sterilized with 0.1% mercuric chloride, crushed and a loopful of crushed material was streaked on YEMA medium containing Congo red. Colorless gummy colonies were selected and were sub cultured to obtain pure culture. Pure culture was maintained in agar slants.

### 2.2 Morphological examination of the isolates

***Gram staining***

The overnight grown **c**ultures were stained with Gram reagents as per Gram (1884) to determine their Gram reaction. Only Gram negative isolates were selected for further studies.

***Carbol fuchsin staining***

Carbol fuchsin staining was performed to determine the intracellular production of PHB by the isolate. A thin smear of all the isolated were stained with carbol fuchsin stain for 45 s. The isolates capable of producing PHB showed dark colored granules of PHB intracellularly (Aneja, 2001).

***Sudan black B staining***

PHB producing bacteria was further confirmed using Sudan black B staining method (Schlegel et al., 1970) with some minor modifications. Sudan black B stain was prepared as 0.3% solution (w/v) in 60% ethanol. The smear of cultures was prepared on glass slides and heat fixed. The samples were stained for 10 min with Sudan black solution, rinsed with water and counter stained with 0.5% safranin for 5 min and observed at 1000x magnification.

**Media ingredients and culture condition**

To determine the growth pattern of various isolates and, cultures were grown in yeast extract mannitol media (YEM) broth (Mannitol- 10 g/l, yeast extract- 0.5 g/l, K2HPO4- 0.5 g/l, KH2PO4- 0.5 g/l, MgSO4.7H2O- 0.2 g/l, NaCl- 0.1 g/l, CaCl2.2H2O- 0.06 g/l) at 30 and 37°C for a period of 66 h in a shaker incubator at 150 rpm. A sample of 1 ml was withdrawn at a constant time interval to check the optical density at 600 nm. The different carbon and nitrogen sources were tested in minimal media (Na2HPO4.7H2O- 30 g/l, KH2PO4- 15 g/l, NaCl- 2.5 g/l, NH4Cl- 5 g/l, MgSO4- 2 mM, CaCl2-0.1 mM, glucose- 0.4%). To analyze the effect of cheaper carbon and nitrogen sources on PHB production, jaggery and damaged food grains was used. Damaged food grains was used at different concentrations varying from 0.2 to 1.0%. The effect of carbon to nitrogen ratio was also analyzed. All the cultures were inoculated with equal volume of inoculums and grown at 28°C. At an equal time interval, OD at 600 nm was checked to study the effect of different carbon and nitrogen sources on the growth assay and PHB production of isolates.

**Biochemical tests**

To determine the ability of isolates to reduce litmus milk, the cultures were grown in litmus milk at 28°C for 24 to 48 h. Afterwards, litmus milk was checked for change in its pH, reduction and peptonization. To examine gelatinase activity of the isolates, plates and deep tubes containing gelatin agar were inoculated and incubated (28°C for four to seven days) and examined for formation of clear zone after treatment with mercuric chloride (Goyal and Dhingra, 2011; Goyal et al., 2012). Urease activity was determined on urea broth tubes, incubated at 28°C for 24 to 48 h. These tubes were observed for change in color (from red to pink). Catalase activity was determined by the method of Graham and Parker (1964). Oxidase activity was determined by the method of Kovaks (1956). Hydrogen sulfide production was determined by inoculating SIM agar deep tubes and incubating at 28°C for 48 h (Hunter et al., 1938). Tubes were observed for appearance of black coloration along the line of stab inoculation. Production of amylase was determined on starch agar medium, incubated at 28°C for 48 h. Iodine was used as an indicator. Plates were observed for the formation of clear zone around the line of growth.

To determine cellulase production, Czapek-mineral salt agar medium was inoculated and incubated at 28°C for 2 to 5 days. The plates were flooded with hexadecyltrimethyl ammonium bromide and observed for formation of zone around the growth. For hydrolysis of casein, skim milk agar medium was inoculated and incubated at 28°C for 24 to 48 h and observed for clear zone around the line of growth. Carbohydrate catabolism was determined by Hugh and Leifson's (Aneja, 2001) medium deep tubes in both aerobic and anaerobic condition, incubated at 28°C for 24 to 48 h.

## 3. EXTRACTION AND QUANTIFICATION OF PHB

PHB was extracted using the dispersion method of sodium hypochlorite and chloroform (Chang et al., 1994; Law and Slepecky, 1961; Singh and Parmar, 2011) with minor modifications. Cells were collected by centrifugation at 10,000 rpm for 15 min at room temperature. Pellet was washed with phosphate buffered saline (pH 7.4). Cell pellets were air dried for 1 to 2 h and their weights were taken. Chloroform and 4% sodium hypochlorite were added to the cell pellet in a ratio of 12.5 µl chloroform to 12.5 µl 4% sodium hypochlorite per mg of pellet weight. The mixture was kept at 30°C overnight. The dispersion was then centrifuged at 8,000 rpm for 10 min at room temperature resulting in the formation of different phases. The bottom phase of chloroform contains PHB. This phase was transferred to another fresh tube and its volume measured. 5x volumes of a mixture of methanol and water (7:3 v/v) was added to the chloroform solution. The mixture was centrifuged at 10,000 rpm for 15 min resulting in the formation of a precipitate of PHB. The amount of PHB present was quantified by determining the weight of precipitate obtained. Addition of concentrated sulfuric acid to this pellet converts PHB into crotonic acid which appears as crystals in brown color solution.

## 4. RESULTS

### 4.1 Isolation of microbial strains

A loopful of crushed root nodule was streaked on YEMA plates and incubated at 28°C for one to two days. A total of six isolates that produced colorless gummy colonies on media plates were collected and preserved on slants with 20% glycerol.

### 4.2 Morphological examination and screening for PHB production

***Gram staining***

All the samples were stained with Gram's reagents for detection of their Gram reaction. Pink colored rod shaped cells were observed. They were thus, found to be Gram negative (Fig1).

***Carbol fuchsin staining***

To distinguish PHB producers from non-producers, carbol fuchsin staining was carried out. Upon staining with carbol fuchsin, all the isolates were found to have dark colored granules of PHB within their cell.

***Sudan black B staining***

To further confirm PHB producers, these isolates were stained with Sudan black B dye (Schlegel et al., 1970). Dark black to purple granules were observed intracellularly with pink background when counterstained with safranin. This showed that all isolates were able to accumulate PHB intracellularly (Fig 2).

***Biochemical tests***

The results of various biochemical tests are summarized in Table 1. Most of the biochemical tests were giving same results as reported for Rhizobium spp.in literature (Shahzad et al.,2012).

**Table 1.** Biochemical characteristics of different isolates of *Rhizobium.*

| | Observation | | | | |
|---|---|---|---|---|---|
| **Biochemical test** | **M2** | **M3** | **M4** | **M5 Control (*Cupriavidus necator*)** | |
| Catalase test | + | + | + | + | + |
| Oxidase test | - | - | - | - | - |
| Litmus milk | + | + | + | - | + |
| Hydrogen sulfide production test | - | - | - | - | + |
| Urease test | + | + | + | + | + |
| Casein hydrolysis | - | - | - | - | - |
| Gelatin hydrolysis | - | - | - | - | - |
| Amylase production | - | + | - | - | - |
| Cellulase production | - | - | - | - | - |
| Carbohydrate catabolism | + | + | + | - | + |

## 4.3 Optimization of growth and PHB production

The effect of temperature on the growth of *Rhizobium* isolates was determined by inoculating different tubes containing YEM broth with same quantity of inoculum. These tubes were incubated at different temperature ranging from 22 to 37°C. It was found that maximum growth was achieved at 30°C in most of the isolates (Fig 3 and 4).

To minimize the cost of production media, different low cost C and N substitutes were evaluated for the growth of isolates. In this study, jaggery was used mainly as carbon source and damaged food grains as nitrogen source. Different concentration of jaggery ranging from 0.4 to 1% and different concentration of damaged food grains ranging from 0.2 to 1% was used. It was found that use of 1% jaggery and 0.2% damaged food grains in minimal media proved to be the most effective combination for the maximum production of PHB.

PHB was extracted using the dispersion method of sodium hypochlorite and chloroform (Chang et al., 1994; Law and Slepecky, 1961; Singh and Parmar, 2011) with minor modifications. The amount of PHB present was quantified by determining the weight of precipitate obtained Table 2). Addition of concentrated sulfuric acid to this pellet converts PHB into crotonic acid which appears as crystals in brown color solution.

## 5. DISCUSSION

PHB and other PHAs have been considered comer-cially important because of possible use as biodegradable thermoplastics (Lee, 1996). Although, previous research has shown that a large number of bacterial species, both Gram positive and negative, produce PHBs (Verlinden et al., 2007), not much work has been done with *Rhizobium*. In the present study, attempts were made to produce PHB from *Rhizobium* species. The use of Sudan black B to determine the accumulation of PHB by bacteria was demonstrated by Hartman (1940) and Burdon et al. (1942). In the present work, 0.3% solution of Sudan black B in 60% ethanol (w/v) was used and PHB was observed as dark black to purple granules against pink background when counterstained with safranin.

Sadowsky et al. (1983) examined various fast and slow growing Rhizobia for their biochemical relatedness.

They showed that almost all the members of both groups are catalase, oxidase, urease positive and H2S negative. In case of gelatinase production only fast growing *Rhizobium* gave positive result. In the present study, it was found that the biochemical tests gave results in accordance with the previous research, except oxidase test which gave negative result for all the isolates.

Allison et al. (1939) showed that the maximum growth rate for *Rhizobium trifolii, R. phaseoli* and *Rhizobium leguminosarum* occurs at approximately 29 to 30°C; with *Rhizobium* from Dalea at about 30 to 33ºC; and with *Rhizobium meliloti* at 35 to 39ºC. Some investigators (Buchanan and Fulmer, 1930; Dhingra, 2012) have emphasized that the optimum temperature varies somewhat with the composition of the medium. In the present study, it was observed that when *Rhizobium* is grown in YEM broth, maximum growth is obtained at 30°C. In solid media (YEMA), maximum growth is obtained at 28°C.

The limiting factor for PHB production is high cost of substrate used and its downstream processing. In previous researches, attempts have been made to cut down the cost of production of bio plastics so that its use can be enhanced. Various low cost carbon and nitrogen sources such as molasses (Chaijamrus et al., 2008), whey (Khanafari et al., 2006), damaged food grains, pea shells, starch (Lillo and Valera, 1990) and dairy wastes like cheese whey (Yellore and Desai, 1998) has been used for PHB production. In the present study, jaggery and damaged food grains was used as low cost substitute of carbon and nitrogen. It was observed that when 1% of jaggery was used in the original minimal media, PHB production was significantly increased. Use of jaggery (1%) and damaged food grains (0.2%) in minimal media proved to be the most effective combination for the maximum production of PHB. In this piece of work since attempt has been made to reduce the cost of production of PHB, the use of jaggery and damaged food grains looks promising in future work.

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**ACCUMULATION OF PHB IN BACTERIAL CULTURE SHOWN AT 1000X MAGNIFICATION. PHB GRANULES ARE SHOWN AS DARK PURPLE GRANULES STAINED WITH SUDAN BLACK B DYE.**

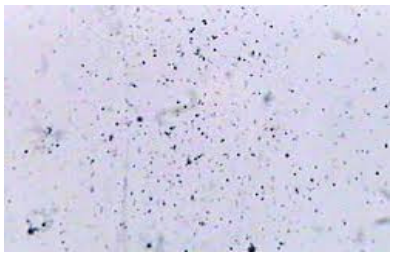

Fig-1

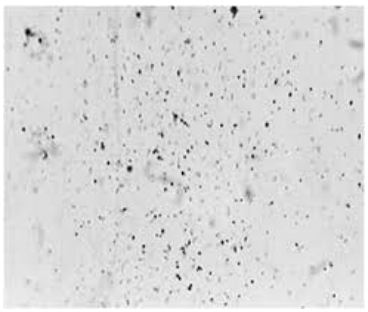

Fig-2

**GRAM NEGATIVE ROD SHAPED RHIZOBIUM CELLS SHOWN AT 1000x MAGNIFICATION**

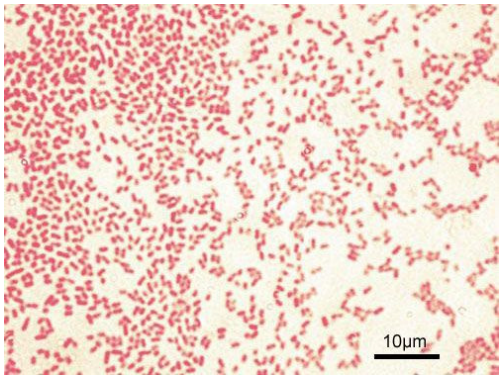


Fig-3

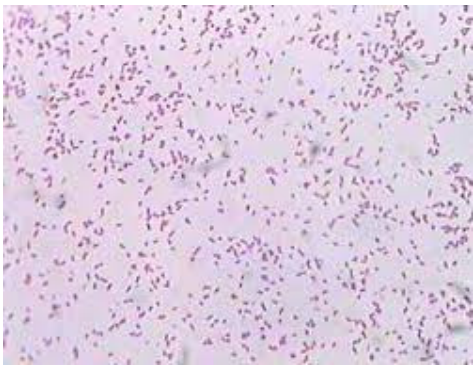

Fig-4

**Table 2. Production of Rhizobium cells and PHB with different combinations of carbon and nitrogen sources.**

| Concentration of agro-industrial C and N sources in Minimal media | Yield Dry cell weight (g/L) | PHB (%) |
|---|---|---|
| 0.2% Jaggery + 0.2% damaged food grains | 0.71±0.18 | 12.10 |
| 0.4% Jaggery + 0.2% damaged food grains | 0.99±0.04 | 17.30 |
| 0.6% Jaggery + 0.2% damaged food grains | 1.27±0.11 | 25.80 |
| 0.8% Jaggery + 0.2% damaged food grains | 1.60±0.16 | 32.00 |
| 1.0% Jaggery + 0.2% damaged food grains | 1.88±0.10 | 54.21 |
| 1.2% Jaggery + 0.2% damaged food grains | 1.64±0.44 | 46.10 |

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**Research Article**

# Rights of the Differently Abled Persons

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## Abstract

Disability is a class ill itself that any one may fall victim at any time. It calls come about as a result of a sudden accident, a fall down a flight of stairs or disease. Disability maintains no socio-economic boundaries."

Persons with physical and mental impairment constitute the weakest segments of our population. These People are excluded and prevented from participating fully on equal terms in mainstream society. Recognition, preservation and enforcement of human rights of disabled person are necessary. Legislation forms an important component in the care and protection of the differentially abled This includes the right to non discrimination and all other rights founded upon the three fold fundamental human rights,i.e. dignity, autonomy and liberty ". Here the presenter focuses on mainly on the rights of the differently abled and legal areas related to it.

***Key Words:- Differently abled, rights, legal aspect***

## 1. Introduction

Disability refers to the disadvantage or restriction of activity caused by the way society is organized which takes little or no account of people who have physical, sensory or mental impairments. As a result such people are excluded and prevented from participating fully on equal terms in mainstream society. Disability is an unfortunate

part of human life which can effect not only the natural way of living but also despair component strength and power. Persons with disability are most disadvantaged section of society, they are also neglected in their family. As per an estimate of World Health Organization, ten percent of the world's population suffers from one or other disabilities and almost one fifth of the disabled person of the world lives in India. According to Census 2001, nearly 5% of people in India are affected with impairment or disability.

***Impairment****:* Any loss of abnormality of psychological or anatomical structure or function.

***Disability****:* Any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.

***Handicap****:* A disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents the fulfillment of a role that is normal, depending on age, sex, social and cultural factors, for that individual.

Handicap is therefore a function of the relationship between disabled persons and their environment. It occurs when they encounter cultural, physical or social barriers which prevent their access to the various systems of society that are available to other citizens. Thus, handicap is the loss or limitation of opportunities to take part in the life of the community on an equal level with others.

The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 incorporates a medical definition. According to section 2(t) 'person with disability' means a person suffering from not less than forty percent of any disability as certified by a medical authority. Further, the meaning of disability is described in section 2(i) stating that disability means:

**i.Blindness,**

**ii. Low vision;**

**iii. Leprosy-cured;**

**iv. Hearing impairment;**

**v. Locomotor disability;**

**vi. Mental retardation;**

**vii. Mental illness**

## 1.1 Origin, Nature and Degree of Disability

The Federal Government advisor in the field of disability, the Office of Disability, in its document *Disability, Society and Change* considered the origin, nature and degree of disability.

## 1.2 On origin, *Disability, Society and Change* states that:

***The origin, or causes of disability are many and varied, but it is possible to identify some broad differences and similarities between them. Some disabilities, such as cerebral palsy, deafness or Downs Syndrome may be there from the moment a person is born. Other disabilities can result from illnesses such as multiple sclerosis, polio, asthma, diabetes, epilepsy, which may develop either during adulthood or childhood. Accidents are another major cause of disability.***

The nature of the disability describes just what a disability means for a person in his or her everyday life. For example, some disabilities make it difficult, or impossible, for a person to walk or use his or her arms. Other disabilities mean that a person may not be able to see, hear or talk. For some people, learning new things does not come easily or quickly. Still other disabilities mean that a person has difficulty thinking logically or being able to control emotions.

The degree of disability is how much a person's life is affected by the disability. It is a way of describing the levels of difficulty a person experiences and therefore the level of support that may be required. The degree of disability is often described with labels such as 'mild', 'moderate', 'severe' or 'profound'.

# 2. Approaches to Disability

***Welfare based*** - people with disabilities are **objects** of state charity in need of medical treatment and social protection. ***Rights based*** - people with disabilities are **citizens** with rights, equally capable of claiming these rights and making autonomous decisions based on their free and informed consent as well as being active members of society.

## 2.1 International Initiatives-

All human rights instruments affirm fundamental and inalienable rights to all persons who are physically disabled. Article 1 of the Universal Declaration of Human Rights, 1948, states that, “all human beings are born

free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood".

In the year 1969 an international awareness programme has been adopted in the name of Declaration on the Social Progress and Development by UN General Assembly.

In 1971 the General assembly adopted the Declaration on the Rights of Mentally Retarded Persons, taking into account the necessity of providing help to mentally retarded persons in order to enable them to develop their abilities and promoting their integration in the normal life. The Declaration recommends a frame work within which national and international actions should initiated for the advancement of rights such as medical care, education, training, rehabilitation, economic security, right to have qualified guardian, protection from exploitation, abuse, degrading treatment etc.

The year 1981 was announced as the 'International Year for Disabled Persons', some important objectives have been taken to implement in national, regional and international level.

Another declaration was adopted by the general assembly for mentally retarded persons in the year 1975, keeping in view, "the necessity of preventing physical and mental disabilities and of assisting disabled persons to develop their abilities in the most varied fields of life".

The General Assembly in its resolution in 1982, decided to observe the period of 1983-1992 as United Nations Decade of Disabled Persons and requested the member states to utilize this period for implementing the World Programme of Action for Disabled Persons.

India was a member State to the Proclamation on the Full Participation and Equality of People with Disabilities in the Asian and Pacific region, which was adopted at the meeting to launch the Asian & pacific Decade of Disabled persons 1993-2002 convened by the Economic and social Commission for Asia and Pacific at Beijing in 1992.

## 2.2 United Nations Convention on the Rights of Persons with Disabilities (UNCRPD)

The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) which India signed on 30.03.2007, was ratified and came into force on 03.05.2008. At its core, the convention ensuthat persons with disabilities enjoy the same human rights as everyone else, and are able to lead their lives as full-fledged citizens who can make valuable contributions to society if given the same opportunities. It covers rights

such as equality, non-discrimination and equal recognition before the law; liberty and security of the person; accessibility, personal mobility and independent living; right to health, work and education; and participation in political and cultural life. Under the UNCRPD, a number of obligations have been accepted by India to provide facilities, options and opportunities to persons with disabilities to live their lives with dignity. This Government has been consistently taking efforts to translate the lofty ideals enshrined in the UN Charter through various workable measures.

## 2.3 National Policy and Legislative Framework

The National Policy recognizes that Persons with Disabilities are valuable human resource for the country and seeks to create an environment that provides those equal opportunities, protection of their rights and full participation in society. The focus of the policy principle includes prevention and rehabilitation measures.

## 2.4 The Rights of People with Disabilities

**Issues of Concern**

- Disability as a reason for discrimination
- Lack of education opportunities both at the primary and higher levels
- Lack of employment and livelihood opportunities
- Lack of physical Access in the built infrastructure
- Lack of access to information in accessible formats
- Denial of rights to promotion and emoluments to those who do find employment
- Denial of reasonable accommodation in employment, education and so on
- Denial of access to most Civil and Political rights
- Marginalization and discrimination faced by women with disabilities

**The Declaration on the Rights of Disabled Persons stipulates that people with disabilities have the right to:**

- Respect and dignity;
- Assistance to enable them to become as self-reliant as possible;
- Education, training and work;
- Family and social life;
- Protection from discriminatory treatment.

**The Declaration on the Rights of Disabled Persons states further that:**

*Disabled persons have the inherent right to respect for their human dignity. Disabled persons, whatever the origin, nature and seriousness of their handicaps and disabilities, have the same fundamental rights as their fellow citizens of the same age, which implies first and foremost the right to enjoy a decent life, as normal and full as possible.*

The three instruments detailed above form schedules to the *Human Rights and Equal Opportunity Commission Act 1986.* The Commission may investigate complaints about the breach of such rights in certain circumstances. It may then endeavour to conciliate the complaint or conduct an inquiry into a matter.

**Constitutional concerns**

The Constitution of India has guaranteed the full protection to the rights of disabled people. The Preamble of the Constitution embodies the concept of social justice and equality of status and opportunity to all the people of India.

Article 14 & 16 of the Constitution guarantee equality of opportunity to all citizen of India.

Article 15(1) enjoys on the Govt not to discriminate against any citizen of India (including disabled) on the ground of religion, race, castes or place of birth

Article 15 (2) states that no citizen (including the disabled) shall be subjected to any disability, liability condition on any of the above grounds in the matter of their access to shops, public restaurants, hotels and places of public resort maintained wholly or partly out of govt funds or dedicated to the use of the general public.

No person including the disabled irrespective of his belonging can be treated as an untouchable. It would be an offence punishable in accordance with law as provided by article 17 of the constitution.

**Article 21** includes the right to live with human dignity and right to health.

**Article 23:** There can be no traffic in human being (including disabled) and beggar and other forms of forced labour is prohibited and the same is made punishable in accordance with law

**Article 32 :**Every disabled person can move the supreme court of India to enforce his fundamental rights and the rights to move the supreme court is itself guaranted

**Article 38** of the Constitution which falls within Directive Principles of State Policy, requires the State to promote the welfare of the people by securing a social order in which social, economic and political justice can inform to all institutions of national life and the State is required to make efforts to eliminate inequalities in status, facilities and opportunities amongst individuals..

.**The Indian disability laws and Convention for the Rights of Persons with Disability (CRPD):**

1. **Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995**

The act is divided into 14 chapters with 74 sections. The Acts defines the responsibilities of the Central and State govt. with regard to the services for disabled persons. Provisions have been made in this Act for the prevention of disabilities, protection of rights, provision of medical care, education, training, employment and rehabilitation of disabled persons. The Act also recommends creating a barrier free environment by removing all type of discrimination against persons with disabilities where they can share the development benefits which a normal person enjoys.

2. **National Trust for Welfare of Persons with Autism, Cerebral palsy, Mental Retardation and Multiple Disability Act, 1999**

As certain groups among the disabled are more vulnerable than others, a special enactment for the protection of such persons, their property and well-being was felt necessary. The enactment of the National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999 (referred to as the National Trust Act) aims to fulfill a common demand of families seeking reliable arrangement for their severely disabled wards. The specific objectives of the Act are:

- To enable and empower persons with disabilities to live as independently and as fully as possible within and as close to the community to which they belong;
- To promote measures for the care and protection of persons with disabilities in the event of death of their parent or guardian; and
- To extend support to registered organizations to provide need based services during the period of crisis in the family of disabled covered under this Act.

**3. Rehabilitation Council of India Act, 1992**

It was passed to regulate the man power development programmes in the field of education of persons with special needs. The main objectives are to regulate the training policies and programmes in the field of rehabilitation of people with disabilities, to standardize training courses for rehabilitation professionals, to recognize institutions/universities running degree/diploma/certificate courses in the field of rehabilitation of the disabled and to recognize and equalize foreign degree/diploma/certificate courses.6he RCI Act has amended in 2000 to entrust the additional responsibility of promoting research in rehabilitation and special education deals with the development of manpower for provision of rehabilitation services.

**4. The Mental Health Act, 1987** This is only law referring directly to mental health issues. Salient features of the mental health act are services into 10chapters consisting of 98 sections. Objectives of the act

- Establish central and state authorizes for licensing and supervising the psychiatric hospitals
- Establish such psychiatric hospitals and nursing homes
- Check on working of these hospitals
- Custody of mentally ill persons
- Protect society from dangerous manifestations of mentally ill
- Regulate procedure of admission and discharge of mentally ill persons
- To safeguard the right of these detained individuals
- To protect citizens from being detained unnecessarily
- Maintenance charges of mentally ill persons undergoing treatment in such hospitals
- Provide legal aid to poor mentally ill criminals at state expenses
- Change offensive terminologies of Indian Lunatic act to new soother ones.

## 3. Right to Education

Education is the most effective vehicle of social and economic empowerment. In keeping with the spirit of the Article 21A of the Constitution guaranteeing education as a fundamental right and Section 26 of the Persons with Disabilities Act, 1995, free and compulsory education has to be provided to all children with disabilities up to the minimum age of 18 years. According to the Census, 2001, fifty-one percent persons with disabilities are illiterate. This is a very large percentage. There is a need for mainstreaming of the persons with disabilities in the general education system through Inclusive education.

The National Policy on Education (N.P.E.) brought the fundamental issue of equality centrestage. Section 4.9 of the Policy clearly focusses on the needs of the children with disabilities. The objective should be to integrate the physically and mentally handicapped with the general community as equal partners, to prepare them for normal growth and to enable them to face life with courage and confidence.

Sarva Shiksha Abhiyan (SSA) launched by the Government has the goal of eight years of elementary schooling for all children including children with disabilities in the age group of 6-14 years by 2010. Children with disabilities in the age group of 15-18 years are provided free education under Integrated Education for Disabled Children (IEDC) Scheme.

Under SSA, a continuum of educational options, learning aids and tools, mobility assistance, support services etc. are being made available to students with disabilities. This includes education through an open learning system and open schools, alternative schooling, distance education, special schools, wherever necessary home based education, itinerant teacher model, remedial teaching, part time classes, Community Based Rehabilitation (CBR) and vocational education.

IEDC Scheme implemented through the State Governments, Autonomous Bodies and Voluntary Organizations provides hundred percent financial assistance for various facilities like special teachers, books and stationery, uniform, transport, readers allowance for the visually handicapped, hostel allowance, equipment cost, removal/ modification of architectural barriers, financial assistance for purchase/ production of instructional material, training of general teachers and equipment for resource rooms.

Government of India is providing scholarships to students with disabilities for pursuing studies at post school level. Government will continue to support the scholarships and expand its coverage. Persons

with disabilities will be provided access to the Universities, technical institutions and other institutions of higher learning to pursue higher and professional courses.

### 3.1 Freedom of Movement

The right to liberty and freedom of movement is part of the fundamental rights that are available to all citizens under article 21 and article 19 of the Indian Constitution. Article 14 of the Constitution provides equality before the law and equal protection of the laws to all persons With respect to persons with disabilities however; the right movement and liberty must be examined in Conjunction with the provision of special measures that enable persons with disabilities to exercise the right to the freedom of movement. A limited number of efforts have been made across the country to ensure ease and liberty of movement for persons with disabilities. Some cities have made progress in this area, with Mumbai introducing disabled-friendly buses after being ordered to do so by a Bombay High Court order, and Delhi's Metro Rail Corporation opening one accessible transportation route. The goal of barrier free design is to provide an environment that supports the independent functioning of individuals so that they can participate without assistance, in every day activities. Therefore, to the maximum extent possible, buildings/ places/transportation systems for public use will be made barrier free. Transportation continues to obstruct the free entry and exit of persons with disabilities.

## 4. The Right to Housing

Non-discriminatory housing subsidies mean that programmes for public or social housing in the form of incentives in the form of subsidy and tax rebate to builders with the sole condition that the buildings conform to accessibility housing standards. The National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act (1999) strives to enable persons with disabilities to live independently and be included in their communities. Provisions for achieving this goal are contained within the Persons with Disabilities Act, 1995, which states that Governments and local authorities should work to offer affirmative action schemes as well as ensure the accessibility of housing, public facilities, and transportation. Read together, these Acts provide a broad framework for protecting the rights of persons with disabilities to live independently. However, the situation on the ground shows that many of these goals have yet to be achieved, and indicates the need for policies containing more specific strategies aimed at ensuring that those with disabilities can live within their communities. Some progress has been made here -- examples being the launch of a pilot health care program for those with disabilities, or the city of Delhi's attempts to make public places accessible -- but there are many areas which still need vast improvement. In addition, this kind of legislation needs to include punitive

measures when state or local governments do not adhere to its requirements -- for example, by funding the construction of public buildings that remain inaccessible to persons with disabilities

## 4.1 Political and Cultural Rights

Though the appropriate policies are in place to ensure that persons with physical Disabilities can participate in political life; the situation on the ground demonstrates that the difficulty lies in enforcement of these policies. While in 2005 the Election Commission directed the Chief Secretaries of all States/Union Territories to construct permanent ramps in each public building containing a polling station to ensure that persons with physical disabilities could exercise their right to vote, the Disabled Rights Group, along with other NGOs, alleged that these instructions had not been carried out in all areas. In contrast to even he spirit of the efforts to ensure access to polling places for those with physical disabilities, however, are the policies in place in both the Constitution and the Representation of People Act (1950)47, which can actively prohibit those with mental disabilities or mental illness from participating in political life by voting or standing for elections. Full equality will not be achieved until these policies are altered to avoid the disenfranchisement of large groups of voters with disabilities.

State policy (particularly in the form of the *Persons with Disabilities Act*, 1995, and the *National Policy for Persons with Disabilities*, 2006) is supportive of the need for individuals with disabilities to participate in sport, recreational and leisure activities, and includes provisions designed to both encourage development of special recreation centers and ensure accessibility to all public Places. However, the situation on the ground remains mixed. Persons with physical disabilities are unable to enjoy leisure activities on an equal basis with others as long as transportation systems and public buildings continue to lack barrier-free access, a problem which has not been addressed on a consistent basis by the Government. However, organizations and establishments like the Wheelchair Sports Federation of India, the Indian Blind Sports Association, and the Special Olympics Bharat do provide opportunities for physically and mentally differently-abled athletes to participate in sporting activities. Unfortunately, there remains no institution available to coach elite differently-abled athletes in India, leaving a gap in attainment of the goals outlined in State policy. In order for persons with disabilities to be able to participate in leisure activities at the level described in government policies, stricter enforcement of these laws is needed.

## 4.2 Health

The *Persons with Disabilities Act* focuses merely on the prevention and detection of disabilities. The provisions entail that the appropriate government and authorities take steps for the prevention of occurrence of disabilities.

The right to enjoyment of highest attainable standards of health should include accessible hospitals and primary health care centers in rural areas that are closer to the communities. There should be provisions of proper care and informed consent for treatment of persons with disabilities.

## 5. The Right to Work

The right to work is not only guaranteed in Article 41 of the Constitution of India, but has also been declared by the Supreme Court to be included in the "right to life" provided by Article 21. In addition, the Persons with Disabilities Act outlines specific measures to be taken by the Government to better incorporate persons with disabilities in the workforce. These include

- The development of schemes providing for the training of persons with disabilities
- The reservation of posts in Government establishments for members of community of persons with disabilities and
- The policy that employers must offer individuals who have acquired a disability a different job with equal benefits and pay In recent years, tangible steps have been taken by the government

In general, the Indian courts have consistently insisted on enforcement of the provisions included in the Persons with Disabilities Act, thereby upholding a comprehensive "right to work." However, contradictions still exist between the respect for the right to work in the *Persons with Disabilities Act* and provisions in Indian labour laws. While the *Persons with Disabilities Act* protects the rights of those who have developed a disability to continue as an employee at the same establishment in a position of equal benefits and pay, thereby protecting their right to work, other labor laws (like the Industrial Disputes Act and Workmen's Compensation Act) at best approach the differently-abled from a charitable perspective by awarding compensation, and at worst provide for complete termination of service without any payment. Since provisions in these laws remain intact even after the passage of the Persons with Disabilities Act, 1995, the state of the right to work remains uncertain.

**Critical Appraisal**

Though number of programmes and policies are there for the differently abled persona following are the basic amenities for the successful completion

- Need of monitoring implementation
- Need for defining goals
- Need of holistic approach
- Need for manpower planning
- Develop indigenous methods to serve DAPs

- The power of love and affection for DAPs

## 6. Conclusion

One of the most significant advancement of policy and practice in the latter half of the twentieth century has related to the right of people with disabilities to live and participate in their communities, and to secure the maximum possible support so that services related to rehabilitation, education, and employment are all provided through systems that comply with minimum standards of quality. In this context, it is also important to realize that disability rights cannot be fought for and secured in a vacuum. Inevitably, the issue of disability is related to many other social, economic and political issues, including those of chronic poverty, gender equity and environmental damage. While it may be possible to discuss the issue of disability rights in much greater length and depth, the issue is ultimately a simple one. As human beings, in addition to access, education, health care, rehabilitation services and employment, all people with disabilities need a safe, secure and accessible environment which is respectful of their dignity. We need to learn to care for all human beings as human beings, with due respect for all their differences.

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**Research Article**

# Porous Materials: A Review

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## ABSTRACT

The presence of voids of controllable dimensions at the atomic, molecular, and nanometer scale makes them scientifically and technologically important. They are widely applied for various applications in industry, environmental applications, medicine, but also in other applications like sensors, packing materials for high performance liquid chromatography, mirrorless lasers, food additives, etc. In each of these application areas, porous materials often serve different goals depending on their engineered design and synthesis. The results from literatures are summarized to give a picture of metal assisted chemical etching and various etching behaviour are explained.

***Key Words:- porous materials, metal assisted chemical etching, Silicon***

## 1. INTRODUCTION

Porous materials are known for more than a century. The pore widths of porous adsorbents are classified by the IUPAC as

- Micropores, pore diameter between 0.3 and 2 nm
- Mesopores, pore diameter between 2 and 50 nm
- Macropores, pore diameter greater than 50 nm

Nanoporous materials play an important role in chemical processing as, in many case, they can successfully replace traditional, pollution-prone, and energy-consuming separation processes. These materials are widely used as sorbents, catalysts, catalyst supports, and membranes, and form the basis of innovative technologies, including high-temperature molecular sieve membrane separations and low-temperature reverse sorption membrane separations (hydrogen production, carbon dioxide capture and conversion, alkane/alkene separation, methane conversion, hydrogen storage, FCC catalysis etc.). This is mainly due to their unique structural or surface physicochemical properties, which can, to an extent, be tailored to meet specific process-related requirements. Any equilibrium or dynamic process taking place within the nanopores of a solid is strongly influenced by the topology and the geometrical disorder of the pore matrix. The ancient and well-known porous material is zeolite. It was synthesized by mixing silicate and aluminate solutions, which is then treated hydrothermally to give the crystalline product(s) aluminosilicate gel precursor.

Despite the long-known and applied porous inorganic materials like fumed silica or alumina, zeolite, and activated charcoals, new materials with well-defined pore sizes, surface areas, and functionalities were developed during the last decades [4]. Materials like porous silicon, porous, covalently bound, and fully organic polymers, metal organic frame works, metal foams etc., are few examples of emerging materials. Examples of everyday commodities are polyurethane foams in furniture and automobile seats or polystyrene foams used as insulating and packing materials. Templated mesoporous polymers, hypercross-linked polymers (HCPs), polymers of intrinsic microporosity (PIM), and covalent organic frameworks (COFs) were introduced and a fast increasing amount of novel structures, synthetic schemes, and applications for this class of porous materials were reported[5,6]. In this review, an overview on the fabrication of porous materials like porous silicon and microcellular structures are presented.

## 2. BASIC PHENOMENON

Silicon (either n- or p-type) wafers can be etched, to form porous structures, using electrochemical or chemical etching method. To control the electrochemical etching process, the important parameters are current density, electrolyte composition and homogeneity, light intensity (for n-type silicon) and temperature. Two most commonly used chemical methods to prepare porous silicon are a) stain etching b) metal-assisted chemical etching [7]. The etch rate remains low if only hydrogen fluoride (HF) is present in aqueous solution, but the rate can be considerably enhanced by the addition of oxidizing agents, such as hydrogen peroxide ($H_2O_2$), nitric acid ($HNO_3$) or chromic oxide ($CrO_3$) [8]. This method is called stain etching. In this method, the oxidizing equivalents to derive the reaction are delivered by a chemical oxidant rather than a power supply. The second non-electrochemical method is metal-assisted etching, in which the pores are nucleated and propagated by means of metal nanoparticles previously deposited on the wafer surface [9, 10]. Commonly used oxidant in this case is hydrogen peroxide.

## 3. REVIEW OF LITERATURE ON ELECTROCHEMICAL ETCHING PROCESS

E.Vazsanyi et al. (2001) [20] carried out an empirical study on the porous silicon layer formation process by stain etching on p- and n-type silicon wafers having different doping concentrations ($2x10^{15}$ atoms/$cm^3$ of boron on $p^+$ and $n^+$ type ones with $5x10^{18}$ atoms/$cm^3$ of phosphorous). As discussed earlier, $HNO_3$ is used as an oxidizing agent along with HF. Here, two additives were mixed into the solutions namely sodium-nitrate, to reduce the incubation time of porous silicon layer formation [21] and a surface-active substance to ensure that the evolving bubbles to the silicon surface [22]. A porosity gradient was observed in the porous layers formed on p-, $p^+$-, n- and $n^+$-type silicon because stain etching, as a wet chemical etching method attacks the pore walls. The total mass of the silicon dissolved from the top surface and from the pores, was measured by gravimetry. During the formation, mass of dissolved silicon strongly depends on the composition of the etching solution. $HNO_3$ concentration has high impact and the additive substance $NaNO_2$ has a lower effect.

Yan-Yan song et al.(2005) [23] has reported a simple but fast method to synthesize large area nanostructured nobel-metal films with high yields and various morphologies. The p-type single-crystal silicon (100) wafers with a resistivity in the range 1-15 Ω cm were used. Three metals (Pt, Au and Ag) were deposited. In each case, a 20 mm metal ion, 5M HF solution was used at 45°C. Silver deposited at short time (less than 2 minutes) adheres strongly to the substrate. At long deposition times the deposit begins to branch, giving three dimensional structures. An exchange reaction driven by a galvanic cell which is formed between silicon and the deposited metal in a solution containing the noble metal ions are discussed.

Similarly, metal-particle induced, highly localized site-specific etching of Si and formation of single crystalline Si nanowires in aqueous fluoride solution was reported by Peng et al. in 2006 [24]. A corrosion-like mechanism was proposed for the formation of aligned silicon-nanowire arrays on silicon in aqueous HF/$AgNO_3$ solution. Here, the etching process features weak dependence on the doping of the Si wafer and thus, provides an efficient method to prepare silicon nanowire with desirable doping characteristics. High quality Si nanowire arrays are produced on the Si wafer by immersing the wafer into HF/$AgNO_3$ solution for an appropriate etching time [25]. P-type (111) Si wafer were used with the etching solution containing 4.6 $M^{-1}$ HF and 0.01$M^{-1}$ silver nitrate. After treatment, the etched substrates were wrapped with thick silver dendritic film. After peeling off the dendritic film, large-area vertically aligned Si NWs was observed. The samples were studied by using a SEM and TEM equipped with EDX.

The same research group have reported a novel strategy for preparing large-area, oriented silicon nanowire (SiNW) arrays on silicon substrates at near room temperature by localized chemical etching. The strategy is based on metal-induced (either by Ag or Au) excessive local oxidation and dissolution of a silicon substrate in an aqueous fluoride solution [26]. The etching technique shows little dependence on the orientation or doping type of the Si wafer. They have also discussed about the dependence of the density and size of SiNWs on the distribution of the patterned metal particles on the Si surface. In this investigation, high-

density metal particles facilitate the formation of SiNWs. (Kuiqing Peng, 2006) [27].

Chia-Yun Chen et al. (2008) [28] reported the fabrication of [100] preferentially oriented single-crystalline silicon nanowire arrays using a statistical electroless metal deposition method. The experiment was performed on three kinds of single-crystal silicon wafers: B-doped Si (100) (1-100 Ω cm), B-doped Si(110) (1-10 Ω cm), and B-doped Si (111) (1-30 Ω cm). In this method, the formation of SiNWs is initiated by silver-induced etching on the silicon surface exposed to the $AgNO_3$/HF solution. Millions of nanometer-scaled silver nuclei acted as local cathode oxidize the silicon beneath, and subsequently the HF etchant dissolve the formed silicon oxide. Also, the localized etching occurs at the Ag/Si interface and extends further along the preferred direction, dominated by the crystallographic nature of silicon, leaving dense SiNW arrays. Further, the authors estimated the SiNW diameters by scratching the sample and dispersing in ethanol in an ultrasonic bath and performing SEM measurement.

Hence the metal assisted chemical etching is versatile and fastest technique for the preparation of silicon nanowires, researchers are mostly interested in this method. Investigations are further extends to study the effect of silicon wafers resistivity, dopant (p- or n-type), orientation of Si wafer, etchant concentration, etching time, oxidizing agents, different metal depositions etc. Even though various techniques like vapour-liquid-solid (VLS) growth [29], solid-liquid-solid growth [30], oxide assisted growth [31], vapour-solid-solid growth [32], catalytic chemical vapour deposition[33] and reactive ion etching [34] are available, metal assisted chemical etching of silicon is highly attracted by the researchers working in this area due to its fast and robustness.

Nacera Megouda et al. (2009) [35] investigated the metal assisted etching of p-type silicon substrate and the dependence of the crystallographic orientation, the concentration of etching solution and the silicon resistivity on morphology of etched layer. Studies shows that the etched rate increases with silicon resistivity, which is attributed to the increase of electron concentration in the conduction band with silicon resistivity. Also it is noticed that nanowires or macropore formation depends on the etchant concentration. Formation of low

concentration of holes creates nanowires and the high concentration of holes leads to the formation of macropores.

## 4. CONCLUSION

Due to its scientific and technological importance, porous materials are investigated vastly and development of new kind of porous materials is of current interest. A brief introduction about the porous materials is discussed based on its pore size, structure and origin. Pore classification in solids such as intrinsic and extrinsic pore and the formation of those pores were discussed. Further the discussion is limited to the porous silicon, organic porous polymers, metal organic frame works and metal foams. Due to its versatility, metal assisted chemical etching process of porous silicon formation was elaborated. Introduction of noble metals on the surface of the silicon wafer enhances the whole injection process and it is due to the oxidation of silicon. Review of literatures was discussed in the case of porous silicon formation, in which metal assisted chemical etching is predominant when compare with stain etching method.

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# Ākhyāna retold

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## Abstract

The origin of Ākhyānas is traced to the dialogue hymns of the Ṛg Veda. The Ākhyānas have a tendency to incorporate religious ideas. Elements of values, memories of heroic deeds of ancestors, archaic traits in the form of myths are successfully interwoven in them. In the Ṛg Veda there are fifteen dialogue hymns (संवाद सूक्त). The most famous of these legends are of Purūravas and Ūrvaśī (X.95) Śaramā and Phāṇi (X.108), Yamā and Yamī (X.10), Indra and Indrāṇī and Vṛuşakapi (X.86)

An Ākhyāna is defined as a grand narrative to be presented through recitation of a text, songs and abhinaya. It stands in close relationship with Upākhyāna, which has been defined as a minor story occurring within the framework of a discourse, a tale retold by one of the characters of the Ākhyāna for enlightenment of another character. Both Rāmāyāna and Mahābhārata have been termed as Ākhyānas, as they were presented through recitation of a text, songs and abhinaya.

Bhāsa, the Father of Indian drama has authored two dramas Pratimānāţaka and Abhisekhanāţaka based on the Rāmāyaṇa. Bhāsa has taken a variety of themes from the Mahābhārata as a plot for his six dramas –Karnabhāram, Ūrūbhaṅgam, Dūtavākhyam, Madhyamavyāyogam, Dūtagaţotkacam and Paňcarātram. The Raghuvamśa of Kālidāsa agrees closely with the Rāmāyaṇa of Vālmīki. The Kumārasambhava of Kālidāsa, the Kiratārjunīya of Bhāravi,

Śiśupālavadha of Māgha Abhijňāśākuntalam of Kālidāsa, the Veṇīsamhāram of Bhattanārayaṇa, are based on the Mahābhārata. The episode of Nala and Damayanti is a source for various authors. Nalacampu of Trivikramabhatta of 10th Century A.D., Naiṣadhīya caritam of Srīharṣa of 12th Century A.D. and Nalacaritanāţakam of Nilakantadīkṣita of the 17th Century are some of them. Prose writers like Bāṇa and Subhandu have embellished their works by alluding to the various legends of the epic.

Thus the two great epics, along with the Purāṇas, preserve thousands of Myths, legends and stories that have been in vogue since prehistoric times. On the other hand, stories of moral and spiritual character are included in the Upaniṣads. In a subsequent age, the Paňcatantra incorporated the moral tales and fables, traces of which are revealed in the epics and the Upaniṣads, while romantic tales were generated as a result of the impact of the Bṛhatkathā in Sanskrit literature. Thus the ākhyānas provide a popular imaginative frame for projecting a world view or a moral code or a deeper spiritual truth.

## 1. Introduction

The origin of Ākhyānas is traced to the dialogue hymns of the Ṛg Veda. The Ākhyānas have a tendency to incorporate religious ideas. Elements of aristocratic values, kinship, memories of heroic deeds of ancestors, archaic traits in the form of myths are successfully interwoven in them. In the Ṛg Veda there are fifteen dialogue hymns (संवाद सूक्त). The most famous of these legends are of Purūravas and Ūrvaśī (X.95) Śaramā and Phāṇi (X.108), Yamā and Yamī (X.10), Indra and Indrāṇī and Vṛuṣakapi (X.86). The story of Śunaşepa elaborated in the Aitareya Brāhmaṇa is the longest and most remarkable of Vedic legends. The touching tale of the love and separation of Purūravas and Ūrvaśī is fully related in the Śatapatha Brāhmaṇa, which is a store house of old narratives.

## 1.1 Definition of Ākhyānas / Upākhyānas

An Ākhyāna is defined as a grand narrative to be presented through recitation of a text, songs and abhinaya. It stands in close relationship with Upākhyāna, which has been defined as a minor story occurring within the framework of a discourse, a tale retold by one of the characters of the

Ākhyāna for enlightenment of another character. Both Rāmāyāṇa and Mahābhārata have been termed as Ākhyānas, as they were presented through recitation of a text, songs and abhinaya.

Indians are not consistent in the use of the expressions **इतिहासः, पुराणम् or आख्यानम्**, as they use them sometimes as synonyms and sometimes to denote different kinds of tales. The epic Mahābhārata is called even in the introduction sometimes as **इतिहासः, पुराणम् or आख्यानम्. (**A History of Indian Literature, M.Winternitz, Vol.I, P.291)

It is defined in the Viṣṇu Purāṇa, that a Purāṇa contains Upākhyānas, Ākhyānas, Gāthas and Purāṇas.

आख्यानैश्चाप्युपाख्यानैर्गाथाभिः कल्पशुद्धिभि : ।

पुराणसंहितां चक्रे पुराणार्थविशारदाः ॥ **( Viṣṇu Purāṇa 3.6.15)**

In the Śrīdhara Swāmi commentary of the Viṣṇu Purāṇa it is found that a difference is stated between an Upākhyāna and Ākhyāna.

स्वयं दृष्टार्थकथनं प्राहुराख्यानकं बुधाः । श्रुतस्यार्थस्य कथनमाख्यानं प्रचक्षते ॥

"An Ākhyāna is a narration witnessed by the speaker; Upākhyāna is heard by the speaker but not witnessed. Gāthā refers to stories and songs about the forefathers and earthly beings". Upākhyānas or ākhyānās are the narration of stories of great kings or Gods in the past.

Ākhyānas cover all types of legends, historical as well as mythological and is put in a narrative form. Our Vedas, Smṛtis, Itihāsas and Purāṇās sow the seeds of Dharma in the minds of the people through the medium of Upākhyānas.

There is no essential difference between atīta, ākhyāna, purāṇa and itihāsa. Together with the more general kātha, all these words mean ordinarily an old tale, story, legend or incident.

### 1.2 Structure of Upākhyānas

The epic Mahābhārata employs the story within a story structure, otherwise known as frame tales, popular in many Indian religious and non-religious works. It is recited by sage Vaisampāyana, the disciple of Vyāsa, to the King Janamejaya who is the great-grandson of the Pāndava prince Arjuna. The story is then recited again by a professional story teller named Ugrasrava Sauti, many years later, to an assemblage of sages performing the 12-year sacrifice for the king Śaunaka Kulapati in the Naimiśa forest. Sometimes an Upākhyāna presented independently as a grand narrative assumes the form of an Ākhyāna and vice versa. There are a large number of Upākyānas in the Mahābhārata, like Śakuntalā Upākhyāna, Sāvitryupākhyāna, Nalopākhyāna, Yayātyupākhyāna. They have subsequently assumed the form of Ākhyānas. On the contrary, Rāma's story, a grand narrative, becomes an Upākhyāna, Rāmopākhyāna, within the body of the Mahābhārata.

## 2. Ākhyānas in the Vedas

The Ṛg Veda contains hymns of a narrative character and short legends in prose and in verse called Gāthās. There was no essential difference between अतीतः, आख्यान , पुराण and इतिहास and generally they meant ordinarily an old tale, story, legend or incident and they were often interchangeable.

There is a minute difference in the definition of a legend and a myth.

- A legend is an unauthenticated story from early times, preserved by tradition and popularly thought to be historical.
- A myth is a story, presented as historical dealing with the cosmological and supernatural traditions of a people, their Gods, culture, heroes, religious beliefs etc.

Ākhyāna has been an ingredient of Vedic ritual. In Aśvamedha Yajňa, the horse having been sent out for the digvijaya, various Ākhyānas, named as Pariplava Ākhyānas, were presented continuously or one year at the place where the ritual was initiated. The Ākhyānas of Purūravas and Ūrvaśī, Hariśchandra etc. occur in Vedic literature.

Most of the early Vedic ākhyānas which were developed into Purāṇic lore have symbolic significance. The Vedic ākhyānas have taken the cue and have taken a firm footing in the Upaniṣads, Sūtras, Rāmāyaṇa and Mahābhārata.

## 3. Ākhyānas in the Upaniṣads

The Upaniṣads are philosophical mystical treatises forming the third division of the Vedas; the preceding portions being the Mantras and hymns, which are largely prayers and the Brāhmaṇas or sacrificial rituals, the utterance, successively of poet, priest and philosopher. The fundamental thought about the reality of Brahman is elaborated through Ākhyānas of the Upaniṣads. The Kenopaniṣad contains the story of the Gods and the blade of grass, the Kaṭhopaniṣad explains the episode of the dialogue between Yama and Naciketa, the Cāndogya Upaniṣad contains the story of Satyakāmā Jābāla, Raikva the cart driver, the Bṛhadāranyakopaniṣad describes the colloquy between Bālāka and King Ajātaśatru just to name a few.

## 4. Upākhyānas in Epics

The Rāmāyana describes itself as Kāvya, Carita and Ākhyāna. The Mahābhārata characterizes itself as an Ākhyāna, Itihāsa, Purāṇa. Kathā, Samhitā, Upākhyāna, Jaya, Śāstra, samvāda etc. In the Sarpayāga of Janamejaya the ṛṣis wanted to hear the wonderful ākhyānas of the kings, ṛṣis, etc. which would wash away their sins. Then Vaiśampāyana narrated the Mahābhārata as he heard it from his preceptor Vyāsamuni. The Mahābhārata is also called as Itihāsa, Purāṇa, Mokṣa Śāstra, Dharma Śāstra, etc. This work contains more than a lakh verses along with Upākhyānas and is known as the Mahābhārata.

अर्थशास्त्रमिदं पुण्यं धर्मशास्त्रमिदं परम् । मोक्षशास्त्रमिदं प्रोक्तं व्यासेनामितबुद्धिना ॥

इदं शतसहस्रं तु श्लोकानां पुण्यकर्मणाम् । उपाख्यानैः सह ज्ञेयमाद्यं भारतमुत्तमम् ॥

(Adi Parva Ch.56.21, Ch.1.100)

## 5. Purpose of Ākhyānas

In the Ayodhyā Khānda of the Rāmāyaṇa, Kathā and Nātaka are mentioned in a single verse as two distinct genres. It is said that prince Bharata was entertained by his friends by narrating

stories, arranging dance performances and also humorous plays and Nātakas. Hence drama had already been evolved from various styles of narrating story literature.

The Rāmāyaṇa contains several interesting episodes though, far less than the Mahābhārata. Some of them are the descent of the Ganges, the conflict of Vaśiṣţa and Viśvāmitra (Ch I 52-65), the story of Ṛiśyaśṛnga etc.

The Upākhyānas of the Mahābhārata are interspersed with Dharma. Some of the Upākhyānas are in the form of incidents, some are in the form of the incidents of their previous births, whereas some Upākhyānas justify their purpose, some Upākhyānas codify Dharma, some Upākhyānas reflect duties of a son, some Upākhyānas are narrated by ṛşis to Pāndavas etc. It is stated in the Mahābhārata that the main purpose of the Upākhyānas is to solace one who depressed with grief. It is said that he who is afflicted with sorrow should be consoled by the recitation of old history.

**यस्य बुद्धि: परिभवेत् तमतीतेन सान्त्वयेत् ।**(Adi parva-140-74)

The special feature of old legends is that it relates the story of great Kings or Gods and their acts in the past. Dyumatsena is solaced by the help of tales of former Kings. Then the aged ascetics surrounding the old man together with his wife began to console him with stories of wonderful import about the Kings of by gone ages.

आश्वासितोऽपि चित्रार्थै: पूर्वराज्ञां कथाश्रयै: । (Vana parva 298-7)

## 6. Upākhyānas in later literature

Upākhyānas provide the source material for the later Mahākāvyas and dramas. In short, Poems, Dramas and other works have grown from these ākhyānas. The Upākhyānas form the story base in later literature. Bhāsa, Kālidasa, Bhavabhūti, Srīharşa and many others have created their immortal works based on these episodes. As the body depends on the food it takes, so all the stories current in the world depend on the Mahābhārata. Further, just as servants wishing to have elevation, always depend on their noble masters, so do all poets depend on the Mahābhārata.

अनाश्रित्यैतदाख्यानं कथा भुवि न विद्यते । आहारमनपाश्रित्य शरीरस्यैव धारणम् ॥

इदं कविवरै: सर्वैराख्यानमुपजीव्यते । उदयप्रेप्सुभिर्भृत्यैरभिजात इवेश्वर: ॥(Adi Parva Ch.2.386.287)

One of the Vedic Ākhyānas, i.e., the Ākhyāna of Purūravas and Urvaśī, was taken up by Kālidāsa in his Vikramorvaśīyam to be developed into a complete drama. Bhāsa, the Father of Indian drama has authored two dramas Pratimānāṭaka and Abhisekhanāṭaka based on the Rāmāyaṇa. Bhāsa has taken a variety of themes from the Mahābhārata as a plot for his six dramas –Karnabhāram, Ūrūbhaṅgam, Dūtavākhyam, Madhyamavyāyogam, Dūtagaṭotkacam and Paṅcarātram. The Raghuvamśa of Kālidāsa agrees closely with the Rāmāyaṇa of Vālmīki. The Kumārasambhava of Kālidāsa, the Kiratārjunīya of Bhāravi, Śiśupālavadha of Māgha Abhijñāśākuntalam of Kālidāsa, the Veṇīsamhāram of Bhattanārayaṇa, are based on the Mahābhārata. The episode of Nala and Damayanti is a source for various authors. Nalacampu of Trivikramabhatta of 10$^{th}$ Century A.D., Naiṣadhīya caritam of Srīharṣa of 12$^{th}$ Century A.D. and Nalacaritanāṭakam of Nilakantadīkṣita of the 17$^{th}$ Century are some of them. Prose writers like Bāṇa and Subhandu have embellished their works by alluding to the various legends of the epic.

## 7. Conclusion

Thus the two great epics, along with the Purāṇas, preserve thousands of Myths, legends and stories that have been in vogue since prehistoric times. On the other hand, stories of moral and spiritual character are included in the Upaniṣads. In a subsequent age, the Paṅcatantra incorporated the moral tales and fables, traces of which are revealed in the epics and the Upaniṣads, while romantic tales were generated as a result of the impact of the Bṛhatkathā in Sanskrit literature.

Thus the ākhyānas provide a popular imaginative frame for projecting a world view or a moral code or a deeper spiritual truth.

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# An Overview on Gold Market

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## ABSTRACT

Gold is popular not only in India but also all over the world. The radiance of it attracts everyone and the symbol of wealth gives a pride. In India, gold jewellery is a hoard of value, a mark of wealth and status and a primary part of many rituals. In the country's rural population, a deep kinship for gold goes hand in hand with practical considerations of the portability and security of jewellery as an investment.

In China, younger members of the family are often gifted with gold for special occasions. The children of rich Chinese are said to be born with 'golden chopsticks' in their mouths rather than silver spoons and there is a tradition of wearing gold to new born babies in the form of tiny necklaces or bracelets.This paper gives an Overview of Gold Market. The seasonal pattern for 30 years, demand and supply, world gold rate and gold rates interms of grams are examined. The present trend of the gold market favours to buy gold only for ornamental use and not for the short term investments. The increasing demand for this precious metal from the year 2015 may lead a price hike with result of low dollar value in future.

***Key words : World Gold Council, Caratage,Gold Market, Demand and Supply***

## 1. Introduction

In India, gold jewellery is a hoard of value, a mark of wealth and status and a primary part of many rituals. In the country's rural population, a deep kinship for gold goes hand in hand with practical considerations of the portability and security of jewellery as an investment. This, in part, explains how India's desire for gold defies market conditions: regardless of a 400 per cent rise in the rupee gold price over the last decade, gold demand from Indian consumers continues to grow.

Gold is considered to be propitious, particularly in Hindu and Jain cultures. The ancient law-giver Manu decreed that gold ornaments should be worn for important ceremonies and occasions. Across the country, regional festivals are celebrated with gold: in the south, Akshaya Tritiya, Pongal, Onam and Ugadi; in the east, Durga Puja; in the west, Gudi Pavda; in the north, Baisakhi and Karva Chauth. In China, younger members of the family are often gifted with gold for special occasions. The children of rich Chinese are said to be born with 'golden chopsticks' in their mouths rather than silver spoons and there is a tradition of wearing gold to new born babies in the form of tiny necklaces or bracelets. Gold is also bought during the Chinese New Year. The zodiac symbols such as dragons, snakes, tigers and horses are purchased for their investment value as well as their beauty.

Gold has been present in Chinese history since the Han Dynasty (206 BC-220 AD), but demand for the metal firmly took hold during the Six Dynasties (222-589 AD) with the arrival of Buddhism. Worshippers made gold offerings, and built golden pagodas and statues of the Buddha. Today, China is the world's fastest-growing market for gold jewellery, driven by a society that is becoming steadily more affluent but which holds the view that purchasing gold jewellery demonstrates sound financial foresight and promises to bring good fortune. World Gold Council research shows that 82 per cent of Chinese agree that 'gold jewellery is as much an investment as a fashion statement'. It is not surprising that the majority of Chinese consumers still buy high purity 24 carat gold jewellery, giving their purchases more enduring financial value.[1]

The price drops are often taken as buying opportunities. This was obvious in the spring of 2013 when a flurry of purchasing generated long queues at department store jewellery counters. Some Hong Kong stores placed advanced orders from waiting shoppers, many of whom could not manage to fit through the store doors before the entire stock of gold jewellery sold out.

Growing affluence has paved to acquire beautiful gold jewellery. The rising generation of Chinese millennials are turning to gold to show their aspirations and identity, seeking out fresh, modern takes on distinctively-Chinese designs. The young Chinese have now become a central force in the gold and luxury goods market and look set to be the drivers of gold jewellery demand in the coming years.

The US market for gold jewellery has shifted away from mass market gold sales to the designer gold jewellery brands, particularly in yellow gold which has become increasingly fashionable on the East and West coasts.Weddings are also a key driver of American demand for gold jewellery today. The US market for engagement rings and wedding bands is more than US$9.7 billion.The modern American tradition of the gold wedding band took off during the Second World War, when soldiers fighting overseas wore rings to remind them of their loved ones back home.

Gold's dominance in the market is derived from its claim to being the original and authentic metal of love. Its physical beauty, strength and intrinsic value have made it the definitive choice for wedding bands for almost two thousand years. These qualities are still the reason why over 77 per cent of women choose gold for their own wedding band today.

On average, couples spend between US$1,500 and US$2,000 on the bride's wedding band, and there is a growing trend towards more premium, customised products. Gold's malleability means it is very workable, making it easy to resize and personalise with engravings.

## 2. Colour

Yellow gold is still the most popular colour, but today gold is available in a different range. The process of alloying—mixing other metals with pure 24 carat gold—gives malleable gold more durability, but can also be used to change its colour.

White gold is made through alloying pure gold with white metals such as palladium or silver. In addition it is usually plated with rhodium to create a harder surface with a brighter shine. White gold has become the intense choice for wedding bands in the US.

The inclusion of copper results in the soft pink complexion of rose gold while the more unusual colours such as blue and purple can be obtained from the addition of patinas or oxides on the alloy surface. Black gold for example derives its colour from cobalt oxide.

## 3. Caratage

The weight of gold is measured in troy ounces (1 troy ounce = 31.1034768 grams) and its purity is measured in 'carats'.

'Caratage' is the measurement of purity of gold alloyed with other metals. 24 carat is pure gold with no other metals. Lower caratages contain less gold; 18 carat gold contains 75 per cent gold and 25 per cent other metals, often copper or silver.

The minimum caratage for an item to be called gold varies by country. In the US, 10 carat is the legal minimum accepted standard of gold caratage, 14 carat being the most popular. In France, the UK, Austria, Portugal and Ireland, 9 carat is the lowest caratage permitted to be called gold. In Denmark and Greece, 8 carat is the legal minimum standard.

## 4. Fineness

Fineness is another way of expressing the precious metal content of jewellery, and represents the purity in parts per thousand. When stamped on jewellery, usually this is stated without the decimal point.

## 5. Gold Demand and Supply

**Table 1: Global Supply/ Demand gold**

| Global supply/demand balance gold (tonnes) | | | | | |
|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 (e) | 2015 (f) |
| Supply | 3,994 | 4,464 | 4,273 | 4,278 | 4,100 |
| Demand | 4,067 | 4,589 | 4,088 | 3924 | 4,350 |
| Stock flow | -73 | -125 | 186 | 355 | -250 |
| Price/oz | $1,572 | $1,669 | $1,411 | $1,266 | $1,200 |

*Source: FastMarkets, WGC, Thomson Reuters GFMS*

The above table illustrates the Global Demand and Supply of gold. As per the statemet by lbn Teyiyyah, if desire for goods increases while its availability decreases, its price rises. On the other hand, if the availabity of the good increases and the desire for it decreases, the price comes down. In

the year 2013 and 2014 the stock flow is on its positive side particularly in the year 2014, the excess of 355 tonnes. The Price/oz is also low during the periods 2013 and 2014 that may be due to the increased availabilty with low desires. The Price/oz is $ 1,200 in the year 2015 is also low compared to previous years where the demand is high, say 4,350 tonnes, may be due to the impact of low desire and expectation of increased Dollar value. The following graph shows the price trend for 5 years.


**Chart 1: Gold Prices in Indian Rupees**

**Source : www.bullion-rates.com**[2]

India imports the bulk of its gold requirement. So, a decline in world prices automatically reflects into lower prices here. The rupee's value also plays an important role. The day gold prices in Mumbai hit a record high of Rs 33,265/10 g — on August 28, 2013 — was also when the rupee value switched to an intra-day low of 68.85 to the dollar. Again, the demand for gold in India as an investment option peaked when the rupee was seen as a weak currency, both externally as well as in terms of domestic purchasing power. It is the opposite today, with a strong rupee in combination with relatively low inflation making the yellow metal not a very good investment.[3] The huge outflows from gold exchange-traded funds testifies that gold is not a wise investment at present.Gold has very little utility other than being raw material for jewellery and it does not generate income like rentals from land and dividend of shares. However, in future the possiblities of price rise in two years due to the increase in demand.

The following graph shows the Historical Seasonal Pattern of gold Prices over 30 years. Gold prices are low during summer seasons that fall on march and April, but prices are at peak in October and November months.

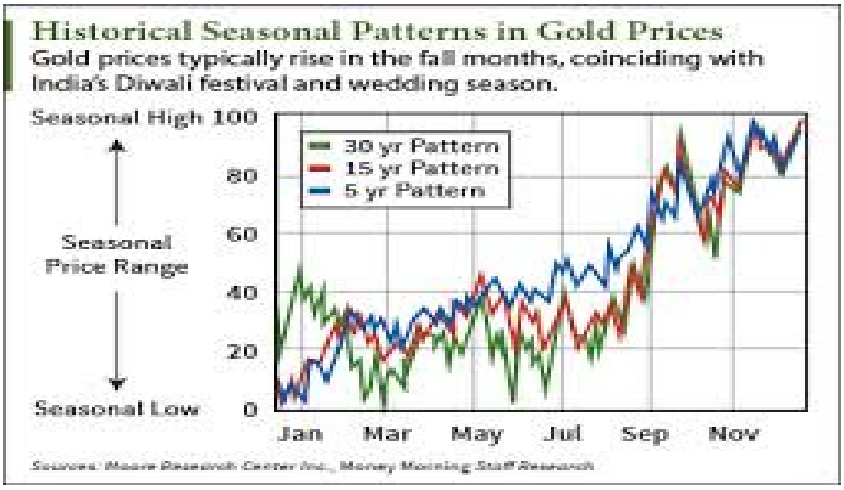


**Chart 2: Historical Seasonal Patterns in Gold Prices**

## 6. Inferences

1. The Demand for gold is in increasing trend from the year 2015 but the dollar rate maintains its level and the hike in gold price may be possible only after a long period.

2.For short term profit, investments on gold are not recommended at this time.

3. In general, it is desirable to buy gold in March and sell it in the months of Oct or Nov to get a minimum level of profit.

4.Gold may be purchased because of its lower price for ornament purpose and not as an investment now.

## 7. Conclusion

The unique property of the gold attracts all walks of people in the world and in many countries it is believed that wearing of this metal bequeaths them good health and prosperity. This paper concludes that the present trend of gold market would fetch acceptable level of profit in a longer duration.

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# EVALUATION OF PHYTOCHEMICAL CONSITITUENTS IN *Chenopodium album* Linn.

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## ABSTRACT

The aim of the present study was to analyze the phytochemical constituents and physicochemical studies including fluorescence analysis of ***Chenopodium album Linn.*** This investigation also summarizes the characters of phytoconstituents, procedures for extraction of herbal drugs and treatment of drug residue after extraction. Standardisation of crude drug plays a very important role in identifying the purity and quality of crude drugs. The present investigation reveals standardization which includes Moisture content, total ash, acid insoluble ash, water soluble ash, water soluble extractive value, alcohol soluble extractive value. Phyto-screening for secondary metabolites revealed the presence of **saponin, tannin, flavanoid, coumarin, quinine, alkaloid, glucosides, sugar and phenols.**

***KEYWORDS: Physicochemical, Phytochemical, Phenols, Chenopodium album Linn.***

## 1. INTRODUCTION

The medicinal plants are useful for healing as well as for curing human diseases because of the presence of its phytochemical constitutents.[1] Physicochemical and phytochemical characterizations are required to be carried out for establishing their identity, purity, and quality standards.[2] Therefore, there is a need for documentation of standardization studies for profiling the quality control parameters of plant-derived crude/herbal drugs.

The genus ***Chenopodium album*** Linn. (Family- ***Chenopodiaceae***) is a native plant of Western Asia. Vernacular name is Paruppu kirai & Chakkaravarthi kirai. In India, it is represented by about 21 species of which some are cultivated for vegetable and few for grains. Chemical constituents of ***Chenopodium album*** **Linn** are found to be calcium, phosphorus, vitamin-C, vitamin-A, Niacin, protein flavonoid as phenolic amide, saponin, iron, cinnamic acid, alkaloid chinoalbicin,

apocortinoid, xyloside phenols and lignans. [3] ***Chenopodium album*** **Linn** is not employed in herbal medicine, though it does have some gentle medicinal properties and is a very nutritious and healthy addition to the diet.

The leaves are anthelmintic, antiphylogistic, antirheumatic, mildly laxative, odontalgic. A decoction of aerial parts, mixed with alcohol, is rubbed on the body affected by arthritis and rheumatism. The leaves are applied as a wash or poultice to bug bites, sunstroke, rheumatic joints and swoolen feet, whilst a decoction is used for carious teeth. The seeds are chewed in the treatment of urinary problems and are considered useful for relieving the discharge of semen through the urine. The juice of the root is used in the treatment of bloody dysentery**.**[4]

## 2. MATERIALS AND METHODS

### 2.1 PLANT MATERIAL

Plant ***Chenopodium album*** **Linn**. selected for the present study was collected from areas in and around Trichy, identified with the help of Flora of Presidency of Madras[5] and authenticated with the specimen deposited at **RAPINAT Herbarium**, Department of Botany, St.Joseph's college, Trichy.

### 2.2 DETERMINATION OF FOREIGN MATTER

The collected aerial part of the plant material was taken and spread it in thin layer and the pieces of foreign matter were stored out by visual inspection. All portion of the foreign matter was pooled and weighed.

### 2.3 PHYSICOCHEMICAL PARAMETERS[6]

The determination of various physicochemical parameters such as total ash, acid insoluble ash, water soluble ash, water soluble extractive value, alcohol soluble extractive value and moisture content were calculated as per Indian Pharmacopoeia.

### 2.4 PREPARATION OF PLANT EXTRACT

Fresh plant material aerial parts used was shade dried and powdered coarsely using electric blender. The plant powder 200gm *of* ***Chenopodium album*** **Linn.**was taken and extracted with water. To one part of the material six parts of water was added, boiled and reduced to one third and filtrate was evaporated to dryness. Paste form of the extract obtained was subjected to pre-clinical screening.

### 2.5 PHYSICO CHEMICAL CONSTANTS[7]

Determination of moisture content, Total Ash, Acid Insoluble Ash, Water Soluble Ash, Extractive Values, Water Soluble Extractive Value, Hexane Soluble Extractive Value, Chloroform Soluble Extractive Value, Alcohol Soluble Extractive Value and Fluorescence Analysis[8]

## 2.6 PRELIMINARY PHYTOCHEMICAL SCREENING OF VARIOUS EXTRACTS

Preliminary phytochemical screenings of various extracts and drug powder were carried out as per the standard textual procedure[9] presence of saponin, tannin, steroids, terpenoid, flavonoid, coumarin, quinine, alkaloid, glucosides, sugar and phenols were tested.

## 3. RESULTS AND DISCUSSION

The preliminary phytochemical analysis of aqueous extracts of *chenopodium album* Linn. revealed the presence of **saponin, tannin, flavanoid, coumarin, quinine, alkaloid, glucosides, sugar and phenols** as illustrated in **Table-1**

**TABLE 1 - PRELIMINARY PHYTOCHEMICAL SCREENING OF VARIOUS EXTRACTS OF *Chenopodium album* Linn.**

| S.No | Test for | Drug | Hexane | Chloroform | Ethyl acetate | Ethanol | Water |
|---|---|---|---|---|---|---|---|
| 1 | Saponin | + | + | + | - | - | + |
| 2 | Tannin | - | - | - | - | + | + |
| 3 | Sterol | - | + | - | - | + | - |
| 4 | Terpene | - | - | - | - | - | - |
| 5 | Flavanoid | + | - | - | - | + | + |
| 6 | Coumarin | + | - | - | - | - | + |
| 7 | Quinone | + | - | - | - | + | + |
| 8 | Lignin | - | - | - | - | - | - |
| 9 | Alkaloid | + | + | + | + | + | + |
| 10 | Glycosides | + | - | + | + | + | + |
| 11 | Sugar | + | + | + | + | + | + |
| 12 | Phenols | - | - | - | - | - | + |

**Note: (-) Absence, (+) Presence**

The preliminary phytochemical screening of the test drug was tabulated (**Table 1**), which revealed the presence of saponin, flavanoid, coumarin, quinone, alkaloid, glycosides, sugar and absence of tannin, steroids, terpene, lignin and phenols.

The preliminary phytochemical screening of various extracts of the drug powder ***Chenopodium album* Linn.** revealed the presence of alkaloid in chloroform, ethyl acetate and water

extract. The water extract was found to have **saponin, tannin, flavanoid, coumarin, quinine, alkaloid, glucosides, sugar and phenols**. The results of the study were tabulated in **Table 1**

**TABLE 2 - PHYSICOCHEMICAL CONSTANTS**

| S.No | PARAMETERS | VALUE % W/W |
|---|---|---|
| 1 | Foreign Matter | 2.45 |
| 2 | Moisture content | 12.06 |
| 3 | Total Ash content | 6.89 |
| 4 | Water soluble Ash | 5.81 |
| 5 | Acid insoluble Ash | 1.08 |

**TABLE 3 - SUCCESSIVE EXTRACTIVE VALUES**

| S.No | PARAMETERS | VALUE % W/W |
|---|---|---|
| 1 | Hexane | 1.78 |
| 2 | Chloroform | 2.57 |
| 3 | Ethyl acetate | 1.73 |

**TABLE 4 - SOLUBILITY**

| S.No | PARAMETERS | VALUE % W/W |
|---|---|---|
| 1 | Alcohol | 8.0 |
| 2 | Water | 19.65 |

From the **Table 2** it was found that the ash content of the plant material was 5.81 % and acid insoluble ash was found to be 1.08 %, which indicated the purity of the test drug taken under study.

**Table 3** depicted that the hexane and chloroform extractive values were 1.78 % and 2.57 % respectively, which indicated the presence of low polar compounds such as sterols, terpenes, fatty substances. Solubility of water was found to be higher than that of alcohol (**Table 4**)

### 3.1 LOSS ON DRYING

The active chemical compounds in the crude drug are mentioned on air dried basis. Determination of water loss of plant by drying will prevent contamination and deterioration[10]**.** The result obtained revealed low moisture content of the test drug.

### 3.2 ASH VALUE

Ash value aids to decide quality and purity of crude drugs. Total ash, acid insoluble ash and water soluble ash % were determined. The results showed that there is higher values of total ash and lesser acid insoluble ash indicates the purity[11]

### 3.3 EXTRACTIVE VALUES

Water extractive value is significantly more when compared to other extractive values, indicates the presence of high polar compounds in selected drug[10]**.**

The results of physicochemical properties indicate that different parts of Chenopodium album Linn.(aerial part) have different content of moisture, total ash, acid and water insoluble ash, alcohol soluble extractives and water soluble extractives (Table 2). The moisture contents and ash value were found within the normal recommended range (moisture contents 6% and ash value 20%). The value of water soluble extractives was higher as compared to alcohol soluble extractives.

Acid insoluble ash is a part of total ash and measures the amount of silica present, especially as sand and siliceous earth. Water soluble ash is the water soluble portion of the total ash.[12]

From results, it is clear that the amount of water soluble ash is less than that of acid insoluble ash, whereas the amount of total ash was almost double the quantity of water soluble ash. The ash content gives an idea about the inorganic content of powdered leaves under investigation and thus the quality of the drugs can be assessed. On the other hand, the water soluble extractive value of the drug was found to be 5.81% which indicates the presence of water soluble components such as sugar, acids and inorganic compounds.

**TABLE 5 - FLUORESCENCE ANALYSIS OF DRUG POWDER**

| S.No | Treatment | *Chenopodium album* Linn. | | | |
|---|---|---|---|---|---|
| | | **Day light (24 hrs)** | **UV light (24 hrs)** | **Day Light (48 hrs)** | **UV light (48 hrs)** |
| 1 | Drug powder | Green | Greenish white | Light green | Green |
| 2 | Drug powder+aq. 1 N NaOH | Flu green | Light green | Yellowish green | Yellowish green |
| 3 | Drug powder+alc. 1 N NaOH | Brownish yellow | Light green | Flu green | Flu green |
| 4 | Drug powder+1 N Hcl | Black | Black | Light brown | Yellowish green |
| 5 | Drug powder+ 50% $H_2SO_4$ | Black | Black | Black | Brown |
| 6 | Drug powder+ chloroform | Black | Black | Green | Green |
| 7 | Drug powder+ Hexane | Light green | Green | Light green | Green |
| 8 | Drug powder+ Ethyl acetate | Dark green | Dark green | Brownish green | Brownish green |
| 9 | Drug powder+acetone | Blackish green | Blackish green | Dark brown | Green |
| 10 | Drug powder+Benzene | Dark green | Blackish green | Brownish green | Dark green |
| 11 | Drug powder+alcohol | Dark green | Dark green | Yellowish green | Dark green |
| 12 | Drug powder+water | Yellowish green | Light green | Green | Yellowish green |

**Table 5** depicted the fluorescence analysis of the drug powder. The fluorescence behavior of the drug powder with the above mentioned chemicals was observed in the day light and UV light, which was found to give various shades of green, brown and yellow. The brown and yellow fluorescence indicates the presence of Alkaloids and Flavones. The green fluorescence indicates the presence of sterols.

Crude drugs are often assessed qualitatively for their fluorescence features and it is an important parameter to evaluate the nature of chemical constituents present in drug[13].

**TABLE 6 - QUANTITATIVE ANALYSIS OF MAJOR SECONDARY METABOLITES**

| S.No | Particulars | Amount (mg/g) |
|---|---|---|
| 1 | Alkaloids | 5.3 |
| 2 | Flavanoids | 27.2 |
| 3 | Phenol | 64.2 |

Quantitative estimation of three important secondary metabolites was carried out and the results were tabulated in **Table 6**. The phenol content was found to be higher when compared to alkaloids and Flavanoids. The level of phenol was 64.2mg/g the higher amount of phenol is important in the regulation of plant growth, development and disease resistance. Consumption of diets rich in plant polyphenols offers protection against the development of cancer, cardiovascular diseases, diabetes, osteoporosis and neurodegenerative diseases.

## 4. CONCLUSION

In the present study, has been carried out to investigate the aqueous extract of ***Chenopodium album*** Linn. The present finding of phytochemical screening of the plant extract confirmed the presence of several bioactive compounds like **flavanoid, alkaloid, and phenols** which could be responsible for the versatile medicinal properties of the selected plant.

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