Message

I am glad to present the current issue of our University Academic Journal- VIDYA. The Journal would speak volumes of the appreciable research activities on almost all fronts of academics in the university academic ambience. I express my pleasure over the enthusiastic interest among the academia of the University. As usual, the current issue will attract the attention of its readers not only within the University and also outside. I congratulate the efforts put in preparing this issue and making it so informative.

Digital India is a campaign launched by the Government of India to improve online infrastructure and Internet connectivity and making the country digitally empowered in the field of technology. Gujarat University has taken initiatives to provide next generation Wifi services to create a digital campus which will provide lightning speed internet connectivity and innovative sources. I urge everyone to join us in fostering a healthy, peaceful and engrossing atmosphere at the University campus, colleges and affiliated institutions. We have a mammoth task of employing higher education as a means of attaining peace and development. All are invited to contribute actively and enrich the University with your intellectual resources, rich experiences and fruitful suggestions.

With Best Wishes

[Signature]

(Dr. M.N. Patel)
From The Editors Desk

At the outset, I would like to express my deep sense of gratitude to the Honorable Vice Chancellor, Dr. M. N. Patel for appointing me as the Chief Editor of Vidya Academic Journal of Gujarat University.

“Vidya” has entered in the 11th successful year with this issue. The team of Vidya has tried its best to amass and fetch to highlight the research and academic achievements of the staff members and research scholars of the Gujarat University.

Among the recent initiatives of government “Make In India” has attracted widespread attention and debate. The major objective behind the initiative is to focus on job creation and skill enhancement. Most of us like to lead settled lives and are averse to taking risks. A major clean up of our mindset is essential before we can “Make In India” campaign succeed. The system has to identify and encourage risk takers. Our young generation has to be motivated to think out of the box. To start a movement, you need a strategy that inspires, empowers and enable in equal measure. Our Hon. Vice Chancellor, Dr. M. N. Patel is supporting this cause by starting a Gujarat University Staff and an Entrepreneurship Programme (GUSEC). This is the first support system for non-tech innovations in different subjects such as Science, Arts, Commerce, Law, Medical etc.

I hope that readers will get benefit from the information provided in the current edition. I welcome inputs and suggestions in making this effort better.

With Best Wishes.

Prof. (Dr.) Meenu Saraf

When learning is purposeful
Creativity Blossoms
When Creativity Blossoms
Thinking Emanates
When Thinking Emanates
Knowledge is Fully Lit
When Knowledges is Fully Lit
Economy Flourishes

- A.P.J. Abdulkalam
Abstract
This study is an attempt to understand the effect of music on plant growth and behavior. Eight medicinal and ornamental plants were subjected to two different types of music rhythmic and soft-melodious music. The control set of plants were not exposed to any particular music. The music was played using normal speakers for three hours, each day. The parameters such as difference in height of the plant, number of leaves, flowering time, number of flowers, estimation of metabolites (protein, starch, phenols, reducing and non-reducing sugars and chlorophyll) were all monitored. The results showed that when plants were exposed to music, their growth speeded up and also there was increase in concentration of metabolites as compared to control plants.

Keywords: Plant growth, Soft-melodious music, plant height, metabolites

Introduction
Music is an art form that not only is a powerful medium of communication but also has a positive impact on living beings well being. The researches in this area are underway to assess the influence of music on growth, development and metabolic processes in plants. Music is of four types-Positive music can be relaxing, calming, and mentally invigorating. Positive music is not about lyrics, but about the music itself. On the other hand, Negative music is a music that expresses or stimulates negative emotions like anger, frustration, depression, hatred and fear. Rhythmic music is a kind of music which has the rhythms like classical, violin, instrumental etc. Non-rhythmic music does not have the rhythms like rock music, pop, country, jazz etc.

Music is a vibratory phenomenon. Air particles are set in motion and these air particles in
turn set matter that is within hearing distance into motion. This is called vibration sympathy: When the vibrations of sound affect the airwaves, the airwaves affect other matter that they come into contact with in a manner that is in sympathy with the originating source. There are two main properties of a regular vibration - the amplitude and the frequency - which affect the way it sounds. Amplitude is the size of the vibration, and this determines how loud the sound is. Frequency is the speed of the vibration, and this determines the pitch of the sound. It is only useful or meaningful for musical sounds, where there is a strongly regular waveform (Tompkins and Bird, 1989).

A property of living things is that they respond to stimuli. Music effects human behavior in many ways and can summon emotions. It reduces fatigue, increases muscular endurance, speeds up voluntary activities, and it can manipulate the electrical conductivity in the human body.

Plants are complex multicellular organisms considered as sensitive as humans for initial assaying of effects and testing new therapies. Sound is known to affect the growth of plants and plants respond to music the same as humans do (Benford, 2002; Dossey, 2001; Kristen, 1997).

Music actually consists of sound waves that travel through the air at varying frequencies and finally reaching our ear drums to be recognized as sound and music. When the plant is exposed to the same music, it also receives the same sound waves and could in fact be receiving some form of stimuli.

Music causes drastic changes in plants metabolism. Plants enjoy music, and they respond to the different types of music and its wave-length. Music containing hardcore vibrations could be devastating to plants (Weinberger and Graefe, 1973).

Little work has been done in this field wherein the plants have been subjected to different types of sound and the effects being monitored and analyzed. On the basis of literature review the present study was an attempt to test the effect of music on plants in terms of plant growth, development and metabolism. Eight medicinal and ornamental plants selected for the experiments are as follows:

1. Tagetes erecta L.
2. Catharanthus roseus L.
3. Trachyspermum ammi L.
4. Duranta repens L.
5. Hibiscus rosa-sinensis L.
6. Epipremnum aureum L.
7. Dendranthema grandiflorm L.
8. Ocimum sanctum L.

**Materials and Methods**

Selected Plants and Experimental Design

Eight plants were selected and collected from the ‘Van Chetna Kendra’ Nursery, Gandhinagar. These plants were grown in the pots in Botanical garden of Department of Botany, Gujarat University, Ahmedabad. To investigate the effect of music on plants, two sets were prepared for the experiment. One set of selected eight plants was exposed to the music and other set of same eight plants was kept as control which was not exposed to any music.
Music Type and Frequency
The music which was selected for the treatment of plants was a kind of soft music. There were twelve soft songs selected with the average frequency of 100Hz.

Source Of Music
Music was applied by the normal speakers which were attached to the mobile phone. Distance between the speakers and the pots were about 35cm.

Duration Of Music
Plants are treated with music for the 1 month of duration, in which music was applied for 3 hours daily to the plants.

Environmental Conditions
Equal amount of water was poured in each set of pots with an interval of every two days. The plants were placed in a botanical cage under normal environmental conditions like light, temperature and humidity.

Date And Season Of Grown Plant
Plants were grown in pots in December 2013 and the music treatment was given from for about two months.

Collection Of Data
Data was collected on the first day, and then at an interval of 15 days for two months. Basically the whole experiment was divided into three main parts:
1. Effect of music on growth parameters of plants.
2. Phytochemical screening.
3. Estimation of various metabolites.

Parameters Studied
To study the effect of music on plant growth, several parameters studied are:
1. Height of the plant
2. Number of leaves
3. Flowering time
4. Number of flowers
5. Phytochemical screening
6. Estimation of metabolites (Protein, Phenols, Starch, Total sugar and reducing sugar, Chlorophyll)

Phytochemical Analysis
Preparation of Extract:
The fresh plants were collected and washed separately under running tab water for removing soil and dust particles. Plant material was air dried for two days and then powdered in a mixer grinder. Then this powder was soaked in (10gm/100ml) of solvent (methanol) overnight. The material was filtered and the extracts were pooled and evaporated to get the concentrated extract.
The qualitative preliminary phytochemical analysis of the extracts of all plant part isolated from methanol solvent was performed by following standard methods given by Harborne.

**Estimation Of Metabolites**

Standard methods were followed for estimation of metabolites

(a) Total Sugars and reducing sugar by Nelson, 1944
(b) Starch by Chinoy, 1939
(c) Total proteins by Bradford, 1976
(d) Total phenols by Bray et al., 1954
(e) Total Chlorophyll by Arnon, 1973

**Result and Discussion**

The result of this experiment is divided into three parts:

1. Effects of Music on plant growth
2. Phytochemical Screening
3. Biochemical analysis

**Effect Of Music On Plant Growth**

Sound is known to affect the growth of plants. Here the height increased (Fig. 1), the number of leaves also increased (Fig. 2), the number of flowers also increased (Fig. 3). The flowering time was advanced so the plants showed early flowering (Table 1).

![Plant height](image)

Fig. 1: Showing the height of Treated and Control plants
Fig. 2: Showing the Number of leaves of Treated and Control plants

Table 1. Showing Flowering time of Treated and Control plants

<table>
<thead>
<tr>
<th>S.NO</th>
<th>SET NAME</th>
<th>PLANTS NAME</th>
<th>DAY OF OCCURRENCE OF BUD</th>
<th>DAY OF OCCURRENCE OF FLOWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TREATED (With music)</td>
<td>Tagetes erecta L.</td>
<td>19th day</td>
<td>25th day</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Catharanthus roseus L.</td>
<td>25th day</td>
<td>28th day</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Dendranthema grandiflorm</td>
<td>21st day</td>
<td>29th day</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Hibiscus rosa-sinensis L.</td>
<td>No bud</td>
<td>No flower</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>S.NO</th>
<th>SET NAME</th>
<th>PLANTS NAME</th>
<th>DAY OF OCCURRENCE OF BUD</th>
<th>DAY OF OCCURRENCE OF FLOWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CONTROL (Without music)</td>
<td>Tagetes erecta L.</td>
<td>21st day</td>
<td>29th day</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Catharanthus roseus L.</td>
<td>26th day</td>
<td>30th day</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Dendranthema grandiflorm</td>
<td>30th day</td>
<td>No flower</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Hibiscus rosa-sinensis L.</td>
<td>No bud</td>
<td>No flower</td>
</tr>
</tbody>
</table>
Phytochemical Screening

The extracts were subjected to preliminary phytochemical qualitative screening for the presence or absence of various primary or secondary metabolites.

Hence, several metabolites like Total sugar (Fig 4), Reducing sugar (Fig 5), Phenols (Fig 6), Starch (Fig 7), Protein (Fig 8), Chlorophyll (Fig 9) were found to be more in plants treated with music as against the control plants that were not exposed to music.
Fig 5: Comparison of reducing sugar between Treated and Control.

Fig 6: Comparison of Phenols between Treated and Control

Fig 7: Comparison of starch between Treated and Control
Discussion

Music, more than entertainment, has played an instrumental role in healing and harmonizing the mind, body and spirit. For thousands of years, the Vedic, China, India, Turkey and Greece culture has used sound and music for body and mind balancing, health enhancement, and encouragement of heightened awareness (Bailey-Lloyd, 2003-2004). According to Burbank, 1868; and Creath and Schwartz, 2004, Science is now showing that these sounds actually do influence the growth of plants. This experiment also shows that plants respond to sounds in profound ways which not only influence their overall health but also increase the speed of growth and the size of the plants.

According to Chatterjee et al, 2013, if plants are exposed to the music, then the height of the plant would increase and they become more and much healthier. In this experiment the height of the plants increased in treated plants. Music therapy also increases the number of leaves and the number of flowers as compared to the plants which are not treated with music. Singh, 1962 showed that the flowers appeared one week earlier in treated set than the control one and that holds true for this experiment also.
Plants actually pick up the sound vibrations which have the different frequency and generally plants respond best to frequency of 100Hz. As the basic science says that sound needs a medium to travel so in this case air is the medium for travel of musical sounds from source to the plants. In a similar manner, the pressure from a sound wave creates vibration that is picked by plants. Plant does not hear the music but feels the vibrations. According to Dan Carlson, if the frequency of the sound is between 100Hz to 500Hz, then it causes stomata of the plants to open and absorbs nutrients more efficiently.

The protoplasm—the living matter is in the form of translucent substance, is always in a state of perpetual movement. The vibration picked up by the plant will speed up this protoplasmic movement in the cells. This stimulation will then affect the system and may improve on its performance such as the manufacture of the more nutrients that will give a stronger and better plant. Music is actually influencing the plant growth and in a similar manner, it affecting the plants biochemically also. In this experiment, phytochemical screening shows the increase of various metabolites like sugars, Phenols, starch, amino acids, protein and carbohydrates. According to Mynn et al, 2009 chlorophyll is the most important green pigment of the plants. Music increases the amount of chlorophyll and starch content in the plants. Hence, the photosynthetic rate also increases which help the plants to grow better, on the other hand, starch is the product of the photosynthesis so if rate of photosynthesis increases then amount of starch also increases. This will result in an increase in the amount of energy which is used by the plants cell for various functions. Due to this plant height and number of leaves increases.

Music therapy also helps in increasing the amount of total sugar and reducing sugars in the plants. This will maintain the growth of the plant and thus control the plant metabolism. On playing music to the plants also increases the amount of concentration of protein and phenols. Proteins are the basic instruments for expression of the genetic information as it controls the genetic expressions. Even phenols have been found to be stimulatory for flowering, bud formation and nitrate assimilation.

So, if music really affecting the plant growth then this concept can be very beneficial for the future aspects. Farmers can utilize the concept of music therapy to yield a higher and better quality of crops. In nursery also, music can be applied to speed up the seed germination and make the plants healthier. Even in home also music helps in indoor plants growth.

**Conclusions**

When melodious music therapy is applied to the plants, then plants shows positive results. There was a positive change in the plant growth. Plants grow faster when exposed to the music. Our preliminary studies clearly indicate that the plant is able to differentiate between “some sound” and “no sound”. For plants, melodious music was proving to be beneficial. Music also greatly influences the concentration of various metabolites. Hence this concept can be very useful in the field of Biochemistry, Horticulture, Physiology and ecology. Music can be used in plant nurseries to speed-up seed germination and help us grow healthier plants.

It can be concluded that plants grow faster with exposure to melodious music. This knowledge can be applied in agriculture to increase the yield and may help to solve the problem of starvation and world hunger in the future.
References
WEBLINKSwww.staurtxchange.com (retrieved on 21st April, 2014)
Abstract
Microbial communities play an essential role in the functioning of plants by influencing their physiology and development. While many members of the rhizosphere microbiome are beneficial to plant growth, also plant pathogenic microorganisms colonize the rhizosphere striving to break through the protective microbial shield and to overcome the innate plant defence mechanisms in order to cause disease. Although the importance of the microbial community associated with rhizosphere has been widely recognized to enhance plant growth including soil structure formation; decomposition of organic matter; toxin removal; and the cycling of carbon, nitrogen, phosphorus, potassium, ion chelation and sulphur. Thus these rhizospheric microbial community can be exploited for commercial application as Biofertilizer and Biocontrol agents.

Introduction
Microorganisms may comprise of mixed populations of naturally occurring microbes in soil that can be applied as inoculants to increase soil microbial diversity. Investigations have shown that the inoculation of efficient microbial community to the soil ecosystem improves soil quality, soil health, growth, yield and quality of crops. These microbial populations may consist of selected species of microorganisms including plant growth promoting rhizobacteria, cyanobacteria, plant disease suppressive bacteria and fungi, soil toxicant degrading microbes, actinomycetes and other useful microbes (Kavino et al. 2007) Efficient and potential soil microbial biota is required for sustainable agriculture practices and some of them have other potential applications. It is an added dimension to optimizing soil and crop management practices such as crop rotation, organic
amendments, conservation tillage, crop residue recycling, soil fertility restoration, maintenance of soil quality and the biocontrol of plant diseases. If used adequately, microbial communities can significantly benefit the agriculture practices. In this review Microbial diversity with relation to plant and its role in agro ecosystem would be discussed (Pandey et al. 2012).

A fundamental shift is taking place worldwide in agricultural practices and food production. Today, the drive for productivity is increasingly combined with the desire and even the demand for sustainability. Sustainable agriculture involves successful management of agricultural resources to satisfy human needs while maintaining environmental quality and also conserving natural resources for future. Improvement in agricultural sustainability requires the optimal use and management of soil fertility and its physico-chemical properties. Both rely on soil biological process and soil biodiversity. This implies management practices that enhance soil biological activity and thereby buildup long term soil productivity and crop health. Such practices are of major concern in almost all lands to avoid degradation and in restoration of degraded lands and in regions where high external input agriculture is not feasible (Lavania, et al. 2006).

Plants are always in immediate contact with microorganisms including different tissues of leaves and roots and also as endophytes presents within plant tissues. These microorganisms are actively associated with plant in their development, nutrient supply, plant growth promotion and protection against pathogens. There exist multiple diversity of microorganisms including bacteria, fungi, mycorrhiza, symbiotic and non-symbiotic nitrogen fixers. Here we have described some of the microbial diversity based on their significant role in plant growth (Goh et al. 2013).

Role Of Microbes In Soil

Microorganisms in soil are critical to the maintenance of soil function in both natural and managed agricultural soils because of their involvement in such key processes as soil structure formation; decomposition of organic matter; toxin removal; and the cycling of carbon, nitrogen, phosphorus, potassium, ion chelation and sulphur (Massol et al. 1995). In addition, microorganisms play key roles in suppressing soil borne plant diseases and in promoting plant growth (Doran et al. 1996). Soil microbial communities are often difficult to fully characterize because of their immense phenotypic and genotypic diversity, heterogeneity, and crypt city. With respect to the latter, bacterial populations in soil top layers can go up to more than 109 cells/g of soil (Cockell et al. 2009), and most of these cells are generally unculturable. The fraction of the cells making up the soil microbial biomass that have been cultured and studied in any detail are often less than 5% (Borneman and Triplett. 1997). As direct DNA-based methods offer the possibility to assess the total microbial diversity present, thus bypassing the limitations of cultivation-based studies, recent years have seen the rapid development of such cultivation-independent methods for analyzing the microbial communities in soil (Massol et al. 1995). The direct methods have become indispensable in such studies; however, one needs to be caution about what information they are giving (VonWintzingerode et al. 1997). Functional diversity is an aspect of the overall microbial diversity in soil, and encompasses a range of activities. The relationship between microbial diversity and function in soil is largely unknown, but biodiversity has been assumed to influence ecosystem stability, productivity and resilience towards stress and disturbance in plant.
Bacterial Diversity

Bacteria are an important portion of the microbial diversity, representing one of the three domains in the phylogenetic tree (Archaea, Bacteria and Eukarya) (Olsen et al. 1994). Though bacteria are found almost everywhere, the rhizosphere is a region of soil that is in immediate contact with plants, portioned directly influenced by root exudates and considered as the most active region of soil where maximum microbial community resides. The rhizospheric region of soil plays a very important role in growth and development of plants. Bacteria are the major portion of biomass in the soil and are responsible for some essential nutrient cycling processes of carbon, nitrogen, and sulfur. In addition to the bacterial diversity, intra-specific diversity also persists. The bacterial diversity is not static, due to the high reproduction capacity associated with the short life cycle and high cell multiplication rates, which leads to the high adaptation value, and fast responses to environmental change (Konstantinidis et al. 2006).

A broad diversity of bacteria can interact with plants, composing bacterial communities with important roles in plant growth and development (Hallmann et al. 1997). There are various interactions associated with bacteria and plant which can vary according to the host plant in a process (Salvaudon et al. 2008). Bacterial populations are distributed in the rhizosphere, within epiphytic and endophytic communities.

Classification of bacteria as Epiphytic and endophytic depends on their colonization on plant surface and inner tissues of plants, respectively. Endophytes are those microbes which are isolated from the internal tissues of the plant after disinfecting the outer surface (Hallmann et al. 1997). However, in addition to these definitions according to their essentiality in niche endophytes can be characterized into types: one “passenger” endophytes, bacteria that are eventually invade internal plant tissues by stochastic events and second “true” endophytes, those with adaptive traits enabling them to strictly live in association with the plants (Hardoim et al. 2008). The microbial cells in the rhizosphere, plant-surface or endophyte communities are variable. The analysis of these communities could lead to the conclusion that there is a strict specificity for their habitation and niche colonization. However, a more realistic situation is represented by the gradient of bacterial population distribution along and within the plants. If a didactic approach is applied to explain bacterial communities associated with plants and plant tissues, it would divide these bacteria into distinct communities, with separation between epiphytic and endophytic communities in accordance with plant organs, such as roots, stems, and leaves.

All these bacterial diversities present in soil have distinct roles, such as supplying nutrient to the plant, enhancing plant growth by producing plant growth hormones, inhibition of plant pathogens, and all such bacteria are referred as plant growth-promoting bacteria which can have symbiotic association or non-symbiotic association with plant. Some examples are listed in Table 1.

Plant growth-promoting rhizobacteria (PGPR) enhancing growth and development of crop/fruit plants (Singh et al. 2011)
**Fungal Diversity**

Fungi are an important component of the soil microbiota typically constituting more of the soil biomass than bacteria, depending on soil depth and nutrient conditions (Ainsworth and Bisby, 1995). Many important plant pathogens (e.g. smuts and rusts) and plant growth promoting microorganisms (e.g., ecto- and endo-mycorrhizae) are fungi. The saprobic fungi represent the largest proportion of fungal species in soil and they perform a crucial role in the decomposition of plant structural polymers, such as, cellulose, hemicellulose, and lignin, thus contributing to the maintenance of the global carbon cycle. In addition, these catabolic activities enable fungi to grow on inexpensive substrates.

Fungal diversity in soil plays a significant role such as water dynamics, nutrient cycling, disease...
suppression and decomposition. Fungi usually have a symbiotic mutualistic association they are
mainly member of Zygomycota, Ascomycota or Basidomycota in these symbioses, the host plant
receives mineral nutrients, while the fungus obtains photosynthetically derived carbon compounds
(Fortin et al. 2002). At least seven different fungi – plants associations have been recognized, with
distinct morphological patterns, involving different groups of organisms (Brundrett et al. 1996). The
most common ones are: i) vesicular arbuscular mycorrhizas (VAM), in which Zygomycetes fungi
produce arbuscules, hyphae and vesicles among root cortex cells, between cell wall and plasmatic
membrane; ii) ectomycorrhizas (ECM), where Basidiomycetes and other fungi form a mantle
around roots and a so called Hartig net among root cells; iii) orchid mycorrhizas, where fungi
produce coils of hyphae within roots (or stems) of orchidaceous plants; (iv) ericoid mycorrhizas,
developing hyphal coils in outer cells of Ericales hair roots (Stone et al. 2000). Factors that can
influence the establishment and persistence of mycorrhizal associations are various, besides
symbiont compatibility: external factors edaphic or microclimatic conditions, presence of further
soil organisms, nutrient competition; and internal factors organism phenology. Infective propagules
must be present when root growth activity occurs, since roots have a limited period of susceptibility.

Fungi and other microbes in the soil and are critical to decomposing organic residues and
recycling soil nutrients. Most soil fungi decompose recalcitrant organic residues high in cellulose
and lignin. Carbon use efficiency of fungi is about 40–55% so they store and recycle more C (10:1
C: N ratio) and less N (10%) in their cells than bacteria. Fungi are more specialized but need
a constant food source and grow better under no-till conditions. Arbuscular Mycorrhizal (AM) fungi
produce an amino polysaccharide called glomalin. Glomalin surrounds the soil particles and glues
macroaggregate soil particles together and gives soil its structure. AM fungus store and recycle
N and P in the soil and have a symbiotic relationship with most plants, greatly increasing the N
and P extraction efficiency and improving soil structure and water retention (Fortin et al. 2002).

Mycorrhizal Diversity

Glomus forms largest genus of arbuscular mycorrhizal fungi (AMF). All species present in
the species shows symbiotic relationships with plant roots. The establishment entire mechanism
of symbiosis involves a sequence of recognition mechanism, following to the morphological and
physiological integration of the two organisms (Logi et al. 1998). The life cycle of an AMF begins
with spore germination, and follows with a pre-symbiotic mycelia growth phase, hyphal branching,
appresorium formation, root colonisation, and finally arbuscule formation takes place (Giovannetti
et al. 1994).

There are mainly of two types of mycorrhiza ecto- and endomycorrhizas. The ectomycorrhizas
are characterized by an extracellular fungal growth associated with the root cortex and are more
common in temperate and boreal forest trees, also found to be over 5000 species mainly within
the Basidiomycetes (Covacevich et al. 2007). The tropical trees such as pine and eucalyptus plants,
however, have also been found to appear ectomycorrhizal associations. The endomycorrhizas are
characterized by inter-and intracellular fungal growth in root cortex, forming specific fungal growth,
referred to as vesicles and arbuscles. This characteristic growth gives the endomycorrhiza the
alternate name, vesicular arbuscular mycorrhiza. Mycorrhizal association in plants is widely
distributed. About 80% of all terrestrial plant species form this type of symbiosis association and
95% of the world’s present species of vascular plants belong to families that are characteristically
mycorrhizal (Quilambo et al. 2000). The arbuscular mycorrhizal fungi (AMF) belong to taxonomic order called Glomales.

Mycorrhiza shows symbiotic association between fungi and plant roots and is unlike either fungi or roots alone. Most trees and agricultural crops depend on or benefit substantially from mycorrhizae. The exceptions are many members of the Cruciferae family (e.g., broccoli, mustard), and the Chenopodiaceae family (e.g. lambquarters, spinach, beets), which do not form mycorrhizal associations. The level of dependency on mycorrhizae varies greatly among varieties of some crops, including wheat and corn.

Land management practices affect the formation of mycorrhizae. The number of mycorrhizal fungi in soil will decline in fallowed fields or in those planted to crops that do not form mycorrhizae. Frequent tillage may reduce mycorrhizal associations, and broad spectrum fungicides are toxic to mycorrhizal fungi. Very high levels of nitrogen or phosphorus fertilizer may reduce inoculation of roots. Some inoculums of mycorrhizal fungi are commercially available and can be added to the soil at planting time (Banerjee et al. 2006). VAM fungi play crucial roles in both natural and agricultural situations, including Native ecosystems such as forests where fertilization of extensive land areas with large quantities of P is not practical, agricultural systems in which the high P-fixing capacities of soils and the unavailability or high cost of P fertilizer limits crop production, situations in which it is essential to reduce soil fertilizer application rates significantly because of environmental concerns, situations in which phosphate rock is readily available and used instead of superphosphate (Habte et al. 2000).

Beneficial Role Of Soil Microbes

Biological nitrogen fixation is considered as one of the major mechanisms by which plants get benefited from soil microorganisms. According to an estimate, global contribution of biological nitrogen fixation is $180 \times 10^6$ metric tons per year. Of this contribution, 83% comes from symbiotic associations of microbes, while the rest part of it is provided by free living or associative systems (Ashraf et al. 2013). Archaea and bacteria are the only living forms that are capable of fixing the atmospheric nitrogen and enrich the soil with this form of nitrogen (Robertson et al. 2009). These include symbiotic nitrogen fixers (Rhizobium in legumes, Frankia in non-leguminous trees) and non-symbiotic nitrogen fixers such as Azoarcus, Acetobacter diazotrophicus, Azotobacter, Azospirillum, cyanobacteria etc. Plants require an adequate supply of nutrients for their proper growth and development. Plants growing on the soils enriched with nutrients may still exhibit nutrient deficiencies due to unavailability of these mineral nutrients. However, plant growth promoting rhizobacteria are actively involved in the solubilization of important minerals such as phosphorous, iron, thereby enhancing the availability of these essential nutrients to plants (Glick et al. 1995). The positive role of PGPR in stimulating the plant growth by improving solubilization (releasing siderophores or organic acid) and nutrient uptake by the plants has been well documented in the literature(Glick et al. 1995).

Based on their activities Ahemad (2014) classified PGPR as biofertilizers (increasing the availability of nutrients to plant), phytostimulators (plant growthpromoting, usually by the production of phytohormones), rhizoremediators (degrading organic pollutants) and biopesticides (controlling diseases, mainly by the production of antibiotics and antifungal metabolites). Bashan and Holguin (1998) proposed the division of PGPR into two classes: biocontrol-PGPB (plant-growth-promoting-
bacteria) and PGPB. This classification may include beneficial bacteria that are not rhizosphere bacteria but it does not seem to have been widely accepted. When studying beneficial rhizobacteria, the original definition of PGPR is generally used: it refers to the subset of soil and rhizosphere bacteria colonizing roots in a competitive environment, e.g. in non-sterilized or non-autoclaved field soils (García et al. 2003). Furthermore, in most studied cases, a single PGPR will often reveal multiple modes of action including biological control (Garcia et al. 2003). Microorganisms like bacteria, fungi, actinomycetes, algae and protozoa exhibit various properties which are helpful in nutrient cycling.

Nitrogen Cycling.

Among various important gases of Earth’s atmosphere, N2 is the most abundant gas which possesses the property of non-reactivity. Nitrogen (N2) is one of the basic necessities of living world. It comprises the formation of amino acids and proteins. Various organic compounds are derived from nitrogen fixation process. Biological nitrogen fixation is an important part of the wide range of protective responses aimed at deterring microbial processes.

The conversion of molecular nitrogen to ammonia is an enzyme catalyzed reaction which is the base of nitrogen fixation process. This enzyme is nitrogenase, an oxygen labile enzyme complex and found produced by free living and symbiotic diazotrophs (Rubio and Ludden 2005). Diazotrophs are ubiquitous in earth’s soils and waters and exhibit a range of metabolic life styles (Masepohl and Klipp 1996).

Non-Symbiotic Nitrogen Fixation

Free-living bacteria are found in soils that are free from the direct influence of plant roots and thus do not associate with plants. The amount of Nitrogen which is fixed by these microbe depends on their potential for accessibility to energy sources, i.e., substrates to generate adenosine triphosphate (ATP) and micronutrients required for the synthesis and functioning of nitrogenase (Reed et al. 2011). BNF by free-living diazotrophs is also limited by the severe oxygen sensitivity of nitrogenase (Postgate et al. 1998).
Due to their ability to fix N\textsubscript{2}, diazotrophs can have a competitive advantage over non-N\textsubscript{2} fixing bacteria in the rhizosphere and prevail in it particularly when soil N is limited (Dobereiner and Pedrosa, 1987). In addition to enhancing their own growth, rhizosphere diazotrophs like Acetobacter, Azospirillum, Azotobacter, Beijerinckia, Burkholderia, Enterobacter, Herbaspirillum, Klebsiella, Paenibacillus and Pseudomonas) have been shown to enhance the growth of the plants. These include agriculturally-important species such as plants like rice, wheat, barley, potato and several vegetable crops (Chanway et al. 2014).

**Symbiotic Nitrogen Fixation**

The term symbiosis generally denotes the mutual beneficial partnership between two organisms. Bacteria known collectively as Rhizobia are famous for their abilities to induce nodules on the roots of legume plants. In legume root nodule symbiosis, the legume is the bigger partner while the rhizobium is the smaller partner, often referred as microsymbiont. Within these nodules, the differentiated “bacteroid” forms fix atmospheric nitrogen and the resultant ammonia being used as the source of fixed nitrogen (Kanthe et al. 2012). The genus rhizobium has been placed in bergey’s manual of determinative bacteriology in such diverse families as azotobacteriaceae, mycobacteriaceae, myxobacteriaceae and pseudomonadaceae.

**Phosphorus Cycling**

Phosphorus (P), being the second most important plant growth-limiting nutrient following nitrogen, is copiously available in both forms in soils, viz. organic and inorganic (Khan et al. 2009). Regardless of the large reservoir of P, the actual availability of its forms to the plant, is usually low. Richardson (2000) reported that most soils are poor in accessible phosphorus and phosphate compost signifies a high cost to the farmer; subsequently, it is intriguing to exploit soil microorganisms utilized as inoculum for the mobilization of phosphorus in poor soils. This low accessibility of phosphorous to plants is on the grounds that the dominant part of soil P is found in insoluble structures, while the plants assimilate it just in two solvent structures, the monobasic and the diabasic ions (Bhattacharyya and Jha 2012).

Use of phosphate solubilizing microorganisms assume imperative part in solubilizing the insoluble forms of phosphorus. Strains from genera Pseudomonas, Bacillus Rhizobium, Aspergillus and Cephalosporium are among the phosphate solubilizers.
Sulphur Cycling

Microorganisms assume an essential part in the worldwide cycle of different components, for example, sulfur, nitrogen, carbon and iron. Sulfur happens in mixed bag of oxidation states with three oxidation conditions of -2 (sulfide and decreased natural sulfur), 0 (essential sulfur) and +6 (sulfate) being the hugest in nature. Compound or natural operators help change of sulfur starting with one state then onto the next. A biogeochemical cycle which portrays these changes contains numerous oxidation-reduction responses. Hydrogen sulphide, a reduced type of sulfur, can be oxidized to sulfur or sulfate by a mixed population of microorganisms. Sulfate, can be again converted to sulfide by sulfate reducing microorganism (Ishimoto et al. 1954).

Sulphate reducing bacteria fall into three major branches: (i) the subclass of proteobacteria (more than 25 genera), (ii) the Gram positive bacteria (Desulfotomaculum, Desulfosporosinus), (iii) branches formed by Thermodesulfobacterium and Thermodesulfovibrio.

Potassium Solubilization

Potassium uptake of plants can be increased by using potassium solubilizers as bio-inoculants further increasing the crop production. Also co inoculation with other bio inoculants like Phosphate solublizers has also shown positive co-relation with yields of crops. Muentz showed the first evidence of microbial involvement in solubilization of rock potassium (Muentz et al. 1890). Microorganisms like Aspergillus niger, Bacillus extroquens and Clostridium pasteurianum were found to grow on muscovite, biotite, orthoclase microclase and mica in vitro (Archana et al. 2013). Different bacterial species like silicate bacteria were found to dissolve potassium, silicates and aluminium from insoluble minerals produces acids like citric acid, formic acid, malic acid, oxalic acid. These organic acids produced, enhance the dissolution of potassium compounds by supplying protons and by complexing Ca2+ ions. Previous work has shown organic compounds produced by micro-organisms such as acetate, citrate and oxalate can increase mineral dissolution in soil (Sheng, 2003). Solubilization of potassium occurs by complex formation between organic acids and
metal ions such as Fe$^{2+}$, Al$^{3+}$ and Ca$^{2+}$ (Styriakova et al. 2003).

**Iron chelation**

Certain microbes oxidize ferrous iron to ferric state which hasten as ferric hydroxide around cells. These microorganisms usually known as iron microbes are typically non filamentous and round or bar molded like Galionella, Siderophacus, Siderocapsa, Ferribacterium, Sideromonas and so forth filamentous structures taking after green growth are likewise experienced like Leptothrix (Pringsheim et al. 1949), toxothrix etc. These microorganisms assume to play no critical part in cultivable soil.

Iron is an essential growth element for all living organisms. The scarcity of bioavailable iron in soil habitats and on plantsurfaces foments a furious competition (Loper and Henkels 1997). Under iron limiting conditions PGPB produce low molecular weight compounds called siderophores to competitively acquire ferric iron (Whipps et al. 2001). Siderophores (Greek: "iron carrier") are small, high affinity iron chelating compounds secreted by microorganisms such as bacteria, fungi and grasses. Microbes release siderophores to scavenge iron from these mineral phases by formation of soluble Fe$^{3+}$ complexes that can be taken up by active transport mechanisms. Many siderophores are non-ribosomal peptides, although several are biosynthesised independently (Challis et al. 2005). Siderophores are also important for some pathogenic bacteria for their acquisition of iron (Miethke and Marahiel 2007). Siderophores are amongst the strongest binders to Fe$^{3+}$ known, with enterobactin being one of the strongest of these (Raymond, Dertz and Kim 2003). Distribution of siderophore producing isolates according to amplified ribosomal DNA restriction analysis (ARDRA) groups, reveals that most of the isolates belong to Gram negative bacteria corresponding to the Pseudomonas and Enterobacter genera, and Bacillus and Rhodococcus genera are the Gram positive bacteria found to produce siderophores.

**Other Trace Nutrients**

Plants require trace nutrients like, iron, manganese, copper, zinc etc. Non availability of these trace metals in soil may result in the manifestation of specific symptoms on plant parts.

Manganese is obligated to oxidation in soil relying upon pH, oxygen supply and natural matter substance of soil. In acidic soils it is available in a bivalent state in which state it is effortlessly accessible for assimilation by plants. In unbiased and alkaline soils, manganese occurs in trivalent or tetravalent state when the component is not effortlessly accessible for retention by plants. The change of manganous to manganic particles may be a microbiological methodology including microscopic organisms, for example, azotobacter, chroococcum, pseudomonas flavescens, P. trifolii, leptothrix sp., aerobacter sp., proteus sp., corynebacterium sp., flavobacterium sp., chromobacterium sp., metallogenium sp., and a few other unidentified ones (Ghiorse et al. 1984).

**Harmful Role Of Soil Microorganisms**

Some soils are inhospitable to plant pathogens, by limiting either the survival or the growth of the pathogens. Such soils are known as pathogen- or disease-suppressiveland are found throughout the world. Suppressiveness has been defined as either "general" or "specific," indicating either the absence or presence of information about the mechanisms involved. General suppression often reduces fungal and nematode attacks, whereas specific suppression is often effective against only one or a few pathogens.
Suppressive soils are further differentiated in accordance with their longevity in “long-standing suppression” and “induced suppression” (Chabrol et al. 1988). Long-standing suppression is a biological condition naturally associated with the soil, its origin is not known, and it appears to survive in the absence of plants. Induced suppression is initiated and sustained by crop monoculture or by the addition of inoculum of target pathogen.

**Commercial Applications Of Plant Growth Promoting Rhizobacteria**

**Microbes as Biofertilizer**

Plant growth promoting rhizobacteria as natural manures, a gathering of biofertilizers comprising helpful rhizobacteria recognized as PGPR, are strains from genera of Pseudomonas, Azospirillum, Azotobacter, Bacillus, Burkholderia, Enterobacter, Rhizobium, Erwinia and Flavobacterium (Rodriguez and Fraga, 1999). Free-living PGPR guarantee to act as biofertilizers (Podile and Kishore 2007). Secondary metabolites from PGPR upgrade root development, prompting a root framework with vast surface region and expanded number of root hairs (Mantelin and Touraine 2004). Numerous studies and overviews reported plant development advancement, expanded yield, uptake of N and some different components through PGPR immunizations (Glick et al. 2007).

**Microbes as Biocontrol Agents**

The PGPR is a gathering of rhizosphere colonizing microbes that creates substances to expand the development of plants and/or secure them against illnesses (Harish et al., 2009). PGPR may ensure plant safety against pathogens. These incorporate, the capacity to deliver siderophores to chelate iron, to combat against contagious metabolites, for example, anti-microbials, parasitic cell divider lysing proteins, or hydrogen cyanide that stifle the development of contagious pathogens (Persello Cartieaux et al., 2003).

**References**


plant-associated microbes on plant phenotypic plasticity. *Journal of chemical ecology, 39*(7), 826-839.


nitrogenase and the alternative nitrogenase in Rhodobacter capsulatus. Archives of microbiology, 165(2), 80-90.


Food Preservation Through Dehydration

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Abstract

Food preservation involves all those processes that can be used singly or in combination for optimum utilization and value addition. Theoretically all agricultural produce can be preserved but practically there are limitations. The products that get naturally dried are easily preserved while others need special treatment. Dehydration is one of the easiest methods to preserve agricultural produce. Experiments were designed to standardize methods for optimum value of selected fruits through dehydration.

Keywords: Dehydration, Fruits, value addition

Introduction

Dehydration is one of most important complementary treatment and food preservation technique in the processing of dehydrated foods, since it presents some benefits such as reducing the damage of heat to the flavor, color, inhibiting the browning of enzymes and decrease the energy costs. Dehydration results in increased shelf-life, little bit loss of aroma in dried and semidried food stuffs, lessening the load of freezing and to freeze the food without causing unnecessary changes in texture. It has been reported that dehydration reduced up to 50% weight of fresh vegetables and fruits.

Dehydration involves the immersion of foods in osmotic solution such as salts, and concentrated sugars. which some extent to dehydrates the food. Osmotic dehydration which improves the sensorial and nutritional properties, preserve and improve the organoleptic properties of foods. Osmotic dehydration is used with other drying methods such as freezing and deep microwave drying.
to make available better quality final product. However, higher temperature has the significant effect on the structure of tissues and cause flavor deterioration and enzymatic browning at temperature above 45oC.

**Material and Methods**

Fresh fruits LIKE Apples, Bananas, Mangoes, Papayas, Chickoos and Pineapples were purchased from the market. They were cut into uniform pieces and then they were blanched. For this first they were dipped into hot water then immediately they rinsed with cold water. Then they were strained well. The fruits were then cut into small biting sized chunks. Three sets of fruit chunks are made. The chunks were transferred to air tight containers and were subjected to dehydration in the following sets. One set was untreated so was called as control. The second set of the same was dried with salt i.e., salt was used as a preservative. The third set of the same fruit was dried with sugar i.e., sugar was used as a preservative. Then these sets were kept for dehydration by different methods like dehydration with sun method, dehydration with microwave method and dehydration using freeze drying as a method. The sets were observed after one and then again after two months. The aspects identified were time taken for dehydration, change in texture, colour, aroma, aesthetic value and taste.

**Results and Discussion**

The fruits chunks which are dehydrated with different dehydration methods show significantly different texture, colour, odour and taste. The same fruit chunk takes different time to dehydrate in different dehydration methods e.g, Orange took 1 day in microwave for drying while it took 4 days when it was sun dried, and the same fruit took 5 weeks to become freeze dried. The results of all selected fruits chunks are given below in tabulated form which gives the information about the texture, colour, taste, odour.

Table: 1 Showing the texture of dehydrated apple chunks

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Salt</th>
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<tbody>
<tr>
<td>Sun dried</td>
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<td>Excellent</td>
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<tr>
<td>Microwave</td>
<td>Average</td>
<td>Good</td>
<td>Excellent</td>
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<tr>
<td>Freeze dried</td>
<td>Excellent</td>
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Table: 2 Showing the of colour of dehydrated apple chunks

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<tbody>
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<td>Sun dried</td>
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<td>Excellent</td>
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<td>Microwave</td>
<td>Average</td>
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<tr>
<td>Freeze dried</td>
<td>Excellent</td>
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Table: 3 Showing the taste of dehydrated apple chunks

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<tbody>
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<td>Microwave</td>
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<td>Freeze dried</td>
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<td>Excellent</td>
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Table: 4 Showing the Odour of dehydrated apple chunks

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<td>Microwave</td>
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<td>Freeze dried</td>
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Table: 5 Showing the time taken by dehydrated apple chunks

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<tr>
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<th>Salt</th>
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<tbody>
<tr>
<td>Sun dried</td>
<td>2 Days</td>
<td>2 Days</td>
<td>2 Days</td>
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<tr>
<td>Microwave</td>
<td>1 Day</td>
<td>1 Day</td>
<td>1 Day</td>
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<tr>
<td>Freeze dried</td>
<td>3 Week</td>
<td>3 Week</td>
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Table: 6 Showing the texture of dehydrated banana chunks

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<th>Salt</th>
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<tbody>
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<td>Good</td>
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<tr>
<td>Microwave</td>
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<td>Freeze dried</td>
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Table: 7 Showing the colour of dehydrated banana chunks

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<th>Salt</th>
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<tbody>
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<td>Average</td>
<td>Good</td>
<td>Average</td>
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<td>Microwave</td>
<td>Average</td>
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<td>Freeze dried</td>
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Table: 8 Showing the taste of dehydrated banana chunks

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<tr>
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<td>Average</td>
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<td>Excellent</td>
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<tr>
<td>Microwave</td>
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<tr>
<td>Freeze dried</td>
<td>Average</td>
<td>Average</td>
<td>Good</td>
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Table: 9 Showing the Odour of dehydrated banana chunks

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<td>Excellent</td>
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<td>Microwave</td>
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<td>Excellent</td>
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<tr>
<td>Freeze dried</td>
<td>Average</td>
<td>Average</td>
<td>Average</td>
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Table: 10 Showing the Time-taken by dehydrated banana chunks

<table>
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<th>Control</th>
<th>Salt</th>
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<tbody>
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<td>Sun dried</td>
<td>2 Days</td>
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<td>Microwave</td>
<td>1 Day</td>
<td>1 Day</td>
<td>1 Day</td>
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<tr>
<td>Freeze dried</td>
<td>4 Weeks</td>
<td>4 Weeks</td>
<td>4 Weeks</td>
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Table: 11 Showing the Texture of dehydrated orange chunks

<table>
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<td>Microwave</td>
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<tr>
<td>Freeze dried</td>
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<td>Excellent</td>
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Table: 12 Showing the Colour of dehydrated orange chunks

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<th></th>
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<tr>
<td>Freeze dried</td>
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Table: 13 Showing the Taste of dehydrated orange chunks

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<tr>
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<td>Good</td>
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Table: 14 Showing the Odour of dehydrated orange chunks

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<td>Microwave</td>
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<tr>
<td>Freeze dried</td>
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Table: 15 Showing the Time-taken by dehydrated orange chunks

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<td>1 Day</td>
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<tr>
<td>Freeze dried</td>
<td>5 Weeks</td>
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<td>5 Weeks</td>
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Table: 16 Showing the Texture of dehydrated papaya chunks

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<td>Microwave</td>
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</tr>
<tr>
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Table: 17 Showing the Colour of dehydrated papaya chunks

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<th>Sugar</th>
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<tr>
<td>Freeze dried</td>
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Table: 18 Showing the Taste of dehydrated papaya chunks

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Table: 19 Showing the Odour of dehydrated papaya chunks

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<td>Microwave</td>
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<td>Excellent</td>
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<tr>
<td>Freeze dried</td>
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Table: 20 Showing the Time-taken of dehydrated papaya chunks

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<td>2 Days</td>
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<td>Microwave</td>
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<td>1 Day</td>
</tr>
<tr>
<td>Freeze dried</td>
<td>3 Weeks</td>
<td>3 Weeks</td>
<td>3 Weeks</td>
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Table: 21 Showing the Texture of dehydrated pineapple chunks

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<tr>
<td>Microwave</td>
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</tbody>
</table>
Table: 22 Showing the Colour of dehydrated pineapple chunks

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Salt</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun dried</td>
<td>Average</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td>Microwave</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Freeze dried</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Table: 23 Showing the Taste of dehydrated pineapple chunks

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Salt</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun dried</td>
<td>Average</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Microwave</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Freeze dried</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Table: 24 Showing the Odour of dehydrated pineapple chunks

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Salt</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun dried</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Microwave</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Freeze dried</td>
<td>Average</td>
<td>Average</td>
<td>Average</td>
</tr>
</tbody>
</table>

Table: 25 Showing the Timetaken of dehydrated pineapple chunks

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Salt</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun dried</td>
<td>1 Day</td>
<td>1 Day</td>
<td>1 Day</td>
</tr>
<tr>
<td>Microwave</td>
<td>1 Day</td>
<td>1 Day</td>
<td>1 Day</td>
</tr>
<tr>
<td>Freeze dried</td>
<td>3 Weeks</td>
<td>3 Weeks</td>
<td>3 Weeks</td>
</tr>
</tbody>
</table>

Significance Of Value Addition

Dehydration is very significant method of food preservation. Standardisation of methods help in the preservation of extra agricultural produce for future use. These fruit chunks can be utilized in many ways. They can be used them as a mouth freshner, in mocktails, juices, with corn flakes, ice cream, puddings, desserts, cookies etc.

References


Isolation Of Tannase Producing Fungi And Optimization Of Culture Conditions For Tannase Production By Fungus tws-3

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Abstract

The tannase also known as tannin acyl hydrolase (TAH, E.C 3.1.1.20)), is a hydrolytic enzyme that acts on tannins. Primary screening for tannase was carried out from different soil samples. Six fungal isolates were obtained on the basis of zone of clearance produced on plates containing tannic acid. Among the isolates, fungus TWS-3 produced the highest 0.96 U/ml of tannase in submerged condition at 30°C, 150 rpm on a rotary shaker after 48 h. As inoculum 2×10^7 numbers of spores were found optimum for enzyme production. 1.0 gm% tannic acid showed the maximum tannase production. Among the other supplementary carbon sources tested, glucose was found as the best and it produced 2.51 U/ml of tannase with amla juice as a source of tannins. Ammonium chloride at 0.3 gm% showed the highest 3.45 U/ml of enzyme production among the organic and inorganic nitrogen sources tested. The tannase produced was partially purified by ammonium sulphate precipitation and 20-70% fraction gave 43.53 U/mg specific activity with 6.8 fold purification.

Keywords: Screening, tannase, tannic acid, amla juice, ammonium sulphate precipitation
Introduction

The enzyme tannase (E.C 3.1.1.20) also known as tannin acyl hydrolase (TAH), is a hydrolytic enzyme that acts on tannin such as tannic acid, methyl gallate, ethyl gallate, n- propylgallate, and isoamyl gallate. Tannase is responsible for the hydrolysis of ester and depside linkages in tannins to liberate gallic acid and glucose (Belur and Mugeraya, 2011). Such enzymes are naturally produced by ruminant animals, plants and microorganisms such as filamentous fungi belonging to the genera Aspergillus and Penicillium. The genus Aspergillus is considered as the best producer, followed by Penicillium, both standing out as great decomposers of tannins and have better thermal and pH stability (Lekha and Lonsane, 1994, Sabu et al., 2005).

Tannins are naturally-occurring plant polyphenols with proteins and other polymers such as cellulose, hemicellulose and pectin to form stable complexes. Tannins are found in leaves, bark, galls and wood. Tannins have important role in plant immunity and protect them from microbial attacks (Aguilar et al., 2001). Plants are rich sources of gallic acid either in free form or as a part of tannin molecule. Industrial production of gallic acid (3,4,5-trihydroxybenzoic acid) is generally accomplished by the bioconversion of tannic acid by tannase. Gallic acid is mostly used in the pharmaceutical industry for production of antibacterial drug trimethoprim. It is also used in the manufacturing of gallic acid esters such as propyl gallate, which is widely used as food antioxidant in the manufacture of pyrogallol, in leather industry and as a photosensitive resin in semiconductor production. Pyrogallol is used in staining fur, leather and hair, and also as a photographic developer (Kar et al., 1999).

Tannase has potential applications especially in the beverage industry and instant teas and coffees, as well as in the production of gallic acid and clarification of fruit juice rich in tannins, aiming to reduce the astringency of such products (Selwal and Selwal, 2012). Tannase is used in the treatment of tannery effluents and pretreatment of tannin rich of animal feed (Aguilar et al. 2007).

In the present study, isolation of tannase producing fungi, optimization of culture conditions and partial purification of enzyme is reported.

Materials and Methods

Tannic acid, rhodanine, Potato dextrose agar medium and agar powder were purchased from Hi-Media laboratories Pvt. Ltd. Gallic acid was bought from Sloca Research Laboratories Pvt. Ltd. Folin-phenol reagent and ammonium sulfate were purchased from SRL. All other chemicals used were of analytical grade.

Isolation Of Tannase Producing Microorganisms

The tannase producing microorganisms were isolated from different soil samples like fertile soil, amla litter soil, jamun leaves litter soil, tea waste dump soil etc. Ten different soil samples collected from various places of Anand district, Gujarat were screened for tannase producing microorganisms. For primary screening of tannase producers, medium containing (% w/v) tannic acid-1.0, NaNO₃-0.3, KH₂PO₄-0.1, MgSO₄•7H₂O-0.05, KCl-0.05, FeSO₄•7H₂O-0.001, Agar- 3.0, pH- 4.5 was used. Approximately 1.0 g of soil sample was added in sterile distilled water and shaken vigorously. Then, the suspended soil particles were allowed to settle down and supernatant was used as suspension. It was diluted appropriately and 0.1 ml was spreaded on the tannic acid
agar plates and incubated at 30°C for 48 h. Growth of colonies and zone of clearance produced upon tannic acid hydrolysis was checked for isolation of tannase producing microorganisms.

### Tannase Assay

Tannase activity was measured by chromogen formation between gallic acid and rhodanine (Sharma et al., 2000). The reaction mixture containing 0.25 ml of 0.01 M, methyl gallate in 0.05 M citrate buffer, (pH 5.0) and 0.25 ml of appropriately diluted enzyme was incubated at 50 °C in waterbath for 10 min. After that 0.2 ml of 0.5 M potassium hydroxide (KOH) was added to stop the reaction. Then, 0.3 ml of methanolic rhodanine 0.667% (w/v) was added. In a control tube, KOH was added first with the substrate methyl gallate and after that enzyme was added. The reaction mixture was diluted by adding 4.0 ml distilled water and absorbance was measured at 520 nm. The amount of gallic acid produced was estimated from a standard calibration curve of 0 – 200 μg. One unit was defined as the amount of enzyme that produced one μmol of gallic acid per min under assay conditions.

Protein concentration was determined by Folin phenol reagent method (Lowry et al, 1951) with bovine serum albumin as a standard (0-100 μg/ml).

### Tannic Acid Estimation

Tannic acid compounds were estimated using the Folin and Ciocalteu reagent. To 100 μl of appropriately diluted sample, 1.5 ml of 20% (w/v) sodium carbonate and 0.5 ml of Folin-phenol reagent were added. The mixture was kept at room temperature for 1 h and absorbance was measured at 725 nm. The amount of tannic acid was determined from a standard calibration curve of 0 – 100 μg.

### Preparation Of Spore Suspension

For fungal tannase production, young spore suspension was prepared and directly used as inoculum. To prepare spore suspension, isolated fungal cultures were grown on potato dextrose agar slant at 30°C upto 4 days for sporulation. 10 ml sterile distilled water containing 0.1 (v/v %) Tween 80 was added to harvest the spores from slant. The slant cultures were vortexed properly to obtain spore suspension. Spore count was carried out using Neuber’s Chamber after appropriate dilution of the prepared spore suspension. The prepared spore suspension was directly used as inoculum for submerged tannase production.

### Screening Of Tannase Producing Isolates

Five fungal isolates were isolated on the basis of zone of clearance on the tannic acid agar plates and they were further screened for tannase production in shake flask cultures. Five fungal isolates viz. ALS-1, ALS-2, ALS-3, TWS-1 and TWS-3 were inoculated in sterile 50 ml tannic acid medium as mentioned above except ager in 250 ml Erlenmeyer flask and incubated at 30°C, 150 rpm on a rotary shaker. Extracellular tannase production was checked after 24 h up 96 h. To estimate tannase from the samples, fungal biomass was separated using Whatman No.1 filter paper and filtrate was analyzed. The isolated fungal cultures were maintained on potato dextrose agar slants at 4°C by periodic transfer.

### Optimization Of Inoculum Size

Fungus TWS-3 showed the highest tannase production among the five isolates in shake flask
culture. Therefore, it was selected for further optimization studies. The inoculum size for TWS-3 was optimized for submerged tannase production. As the inoculum size 1×10⁷, 2×10⁷ and 1×10⁸ number of spores were inoculated in 50 ml tannic acid medium and incubated at 30°C, 150 rpm for 48 h on a rotary shaker. After incubation, tannase production was checked from the filtrate.

**Optimization Of Tannic Acid Concentration**

As tannase production was induced in presence of tannic acid, its different concentrations were tested for enzyme production. Tannic acid (w/v/%) was added at 0.3%, 0.6%, 1.0%, 1.5% concentrations keeping other components same as tannic acid medium. Prepared sterile media flasks were inoculated by fresh spore suspension with final count of 2×10⁷ spores/ml. The inoculated culture flasks were incubated at 30°C, 150 rpm on a rotary shaker for 48 h. After incubation, the fungal biomass was separated by the filtration and filtrate was analyzed for tannase production.

**Preparation Of Amla Juice**

100 gm of fresh amla (Indian gooseberry) was washed thoroughly and chopped with a clean knife to remove seeds. It was crushed in a jar of juicer-mixer. The crushed amla pulp was filtered through cheese cloth. The filtered amla juice obtained was stored at 0°C until further use.

**Effect Of Supplementary Carbon Sources On Tannase Production**

To check the effect of various carbon sources on tannase production, tannic acid medium was supplemented with carbon source. Fungus TWS-3 was tested for tannase production using different carbon sources viz. glucose, fructose, sucrose and starch at 0.3 gm%. In a separate experiment, 1 gm% tannic acid was replaced by amla juice (12.5 ml) supplemented with 0.3 gm% glucose in the production medium. Each 250 ml flask containing 50 ml media were inoculated by fresh spore suspension. The inoculated culture flasks were incubated at 30°C, 150 rpm on a rotary shaker for 48 h. After incubation, the fungal biomass was separated by the filtration and filtrate was analyzed for tannase production.

**Effect of Nitrogen Sources On Tannase Production**

Effect of different organic and inorganic nitrogen sources was tested on tannase production. In this set of experiments 1 gm% tannic acid was replaced by amla juice (12.5 ml) in the tannic acid medium. To check the effect of nitrogen sources, 0.2 gm% NaNO₃ was replaced by ammonium chloride, ammonium sulfate, ammonium nitrate as inorganic nitrogen sources and peptone and yeast extract as organic nitrogen sources. Prepared sterile media flasks were inoculated by fresh spore suspension. The inoculated culture flasks were incubated at 30°C, 150 rpm on a rotary shaker for 48 h. After incubation, the fungal biomass was separated by the filtration and analyzed for tannase production.

For tannase production, ammonium chloride was found as the best among the nitrogen sources tested. In subsequent experiment, different concentrations of ammonium chloride (w/v %) i.e. 0.1%, 0.2%, 0.3%, 0.4% and 0.5% were tested.

**Enzyme Precipitation**

The optimized medium containing amla juice - 12.5 ml, glucose - 0.2 gm%, ammonium chloride - 0.2 gm%, KH₂PO₄ - 0.1 gm%, MgSO₄·7H₂O - 0.05 gm%, KCl - 0.05 gm%, pH 4.5 was inoculated with young spore suspension and incubated at 30°C, 150 rpm for 48 h for tannase production. After
incubation, the medium was filtered to remove the fungal biomass and filtrate obtained was subjected to ammonium sulphate precipitation. To 90 ml of crude enzyme 20 gm% ammonium sulphate was added slowly in an ice bath with gentle stirring and kept for 2 h. The precipitated proteins were separated at 8000rpm for 15 min in refrigerated centrifuge. The first protein pellet obtained was dissolved in 0.5 M acetate buffer, pH 5.0 and stored at 4°C until further use. The remaining supernatant was further precipitated to achieve 20-70 gm% ammonium sulphate saturation in an ice bath and kept overnight to facilitate protein precipitation. Then, it was centrifuged at 8000rpm for 15 min to separate the precipitated proteins. The second protein pellet was dissolved in 0.5 M acetate buffer, pH 5.0 and stored at 4°C. Both the precipitated protein fractions were carefully transferred to dialysis bags and dialyzed against acetate buffer, 0.5 M, pH-5 at 4°C. The buffer assembly with dialysis bags was stirred gently using a magnetic stirrer to enhance solute exchange. Dialysis was carried out overnight with three buffer changes.

Amount of enzyme tannase and protein was determined in crude as well as in both the fractions of ammonium sulphate precipitation. For concentrated tannase, specific activity and fold purification was calculated.

**Results and Discussion**

**Isolation Of Tannase Producing Organisms**

Screening is defined as the detection and isolation of desired microorganisms from a large microbial population by using highly selective methods. The plate screening method is a qualitative, simple and rapid screening procedure for tannase production. Fungi producing tannase showed zone of clearance surroundings the colonies (Fig. 1). These clear zones were formed due to the hydrolysis of tannic acid to gallic acid and glucose.

We got five fungal isolates producing clear zone on plate with tannic acid and named them according to their soil source like amla litter soil (ALS), tea waste dump soil (TWS). Among the isolates namely ALS-1, ALS-2, ALS-3, TWS-1 and TWS-3, zone of clearance produced by TWS-3 and ALS-2 is shown in Figure 1.

![Figure 1 - Zone of clearance produced by fungi TWS-3 and ALS-2](image_url)
Screening Of Tannase Producing Isolates

Five fungal cultures viz. TWS-1, TWS-3, ALS-1, ALS-2 and ALS-3 were selected for further tannase production on the basis of plate assay. All the cultures were inoculated with spore suspension \((1 \times 10^7\) spores/ml) in 250 ml flask containing 50 ml of tannic acid medium. The inoculated flasks were incubated at 30°C, 150 rpm for 96 h and were analysed for tannase production at 24 h time interval. Tannase production by these five isolates is shown in Table 1. Fungal culture TWS-3 produced the highest quantity of tannase (0.96 U/ml) after 48 h and hence it was selected for further studies.

<table>
<thead>
<tr>
<th>Incubation time (h)</th>
<th>ALS-1 (U/ml)</th>
<th>ALS-2 (U/ml)</th>
<th>ALS-3 (U/ml)</th>
<th>TWS-1 (U/ml)</th>
<th>TWS-3 (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>0.016</td>
<td>0.027</td>
<td>0.25</td>
<td>0.18</td>
<td>0.49</td>
</tr>
<tr>
<td>48</td>
<td>0.099</td>
<td>0.42</td>
<td>0.63</td>
<td>0.34</td>
<td>0.96</td>
</tr>
<tr>
<td>72</td>
<td>0.045</td>
<td>0.18</td>
<td>0.30</td>
<td>0.19</td>
<td>0.63</td>
</tr>
<tr>
<td>96</td>
<td>0.032</td>
<td>0.02</td>
<td>0.26</td>
<td>0.04</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Table 1: Tannase production from five fungal isolates

Optimization Of Different Inoculum Size

The effect of inoculum size was studied for optimal tannase production using TWS-3. The different inoculum size was tested as number of spores \(1 \times 10^7\), \(2 \times 10^7\) and \(1 \times 10^8\) inoculated for enzyme production in 250 ml flask containing 50 ml of tannic acid medium and incubated at 30°C, 150 rpm for 48 h on a rotary shaker. \(2 \times 10^7\) no. of spores as inoculum showed the maximum tannase production of 1.09 U/ml (Table 2). It may be because of formation of very good small pellets of fungus which is different in other two cases.

<table>
<thead>
<tr>
<th>Innoculam size</th>
<th>Tannase (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1 \times 10^7)</td>
<td>0.52</td>
</tr>
<tr>
<td>(2 \times 10^7)</td>
<td>1.09</td>
</tr>
<tr>
<td>(1 \times 10^8)</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Table 2: Tannase production with different inoculum size

Optimization Of Tannic Acid

As tannic acid is hydrolysable tannin and so it is the most suitable carbon source used for tannase production. The different concentrations of tannic acid were checked in the medium to get higher tannase production. The addition of 1gm% tannic acid was proved as the best for tannase production (Table 3) and the highest extracellular tannase of 1.07 U/ml was produced after 48 h.

<table>
<thead>
<tr>
<th>Tannic acid (gm %)</th>
<th>Tannase (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>0.40</td>
</tr>
<tr>
<td>0.6</td>
<td>0.85</td>
</tr>
<tr>
<td>1.0</td>
<td>1.07</td>
</tr>
<tr>
<td>1.5</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Table 3: Effect of Tannic Acid on enzyme production
Banerjee and Pati (2007) reported 1.0 gm% tannic acid as optimum for tannase produced by *Aureobasidium pullulans* DBS66. In other report, 2 gm% tannic acid showed maximum tannase production using *Asp. japonicus* in Czapeck’s Dox medium (Bradoo et al. 1997). Sharma et al. (2007) reported 5 gm% tannic acid for maximum tannase production using *Asp. niger*.

**Effect Of Supplementary Carbon Sources**

Various carbon sources were tested at 0.3 gm% in addition to tannic acid in the medium to maximize tannase production. TWS-3 produced considerable amount of tannase with all the tested supplement any carbon sources viz. glucose, fructose, sucrose and starch (Table 4). Addition of glucose produced 1.88 U/ml of tannase showed about 75% increase in enzyme production. When glucose and amla juice (in replacement of 1 gm% tannic acid) combination was checked for tannase production, 2.51 U/ml of tannase was produced indicating 134% increase in enzyme. As addition of glucose may be beneficial to the initial growth of fungi and natural tannins and growth factors present in amla juice might have enhanced the tannase production.

<table>
<thead>
<tr>
<th>Carbon sources</th>
<th>Tannase (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sucrose</td>
<td>0.47</td>
</tr>
<tr>
<td>Fructose</td>
<td>0.35</td>
</tr>
<tr>
<td>Starch</td>
<td>1.3</td>
</tr>
<tr>
<td>Glucose</td>
<td>1.88</td>
</tr>
<tr>
<td>Glucose with amla juice</td>
<td>2.51</td>
</tr>
</tbody>
</table>

Table 4: Effect of supplementary carbon sources on tannase production

Kar and Banerjee (2000) reported higher tannase production using *Caesalpina digyna* seed cover powder than that obtained with only tannic acid. Sabu et al. (2005) stated that glucose and other readily metabolized carbon source reduce the lag period required for tannase synthesis and production. Banerjee and Pati (2007) also reported stimulatory effect of glucose at 0.1 gm% glucose on tannase production. Aguilar et al. (2001) reported the increased tannase production at 0.06 to 0.25 gm% glucose but but observed strong catabolite repression at 0.5 gm% using *Aspergillus niger* Aa-20 in submerged fermentation.

**Effect Of Different Nitrogen Sources**

The effect of different nitrogen sources was tested in the medium to increase tannase production. TWS-3 produced tannase with all the tested inorganic nitrogen sources (ammonium chloride, ammonium sulphate, ammonium nitrate) and organic nitrogen sources (yeast extract and peptone) as shown in Table 5. The highest tannase production of 2.18 U/ml was observed with ammonium chloride.

<table>
<thead>
<tr>
<th>Nitrogen sources</th>
<th>Tannase (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium chloride</td>
<td>2.18</td>
</tr>
<tr>
<td>Ammonium sulphate</td>
<td>1.38</td>
</tr>
<tr>
<td>Yeast extract</td>
<td>1.20</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>0.58</td>
</tr>
<tr>
<td>Peptone</td>
<td>0.63</td>
</tr>
</tbody>
</table>

Table 5: Effect of inorganic and organic nitrogen sources on tannase production
In compare to organic nitrogen sources, inorganic nitrogen sources proved better for TWS-3. The effect of inorganic nitrogen source like NaNO₃ has been reported during the production of tannase by *Aspergillus japonicus* (Bradoo et al., 1997). Similarly, Paranthaman et al. (2009) reported tannase production by *Aspergillus flavus* in the medium containing NaNO₃. The *Aureobasidium pullulans* DBS66 showed maximum tannase production with (NH₄)2HPO₄ as nitrogen source (Banerjee and Pati, 2007).

In subsequent experiment tannase production was measured at different ammonium chloride concentrations (w/v %) like 0.1, 0.2, 0.3, 0.4, 0.5 and results are shown in Table 6. The ammonium chloride at 0.3 gm% concentration showed 3.45 U/ml tannase production indicated 222% increase.

<table>
<thead>
<tr>
<th>Ammonium chloride (gm%)</th>
<th>Tannase (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>2.65</td>
</tr>
<tr>
<td>0.20</td>
<td>3.18</td>
</tr>
<tr>
<td>0.30</td>
<td>3.45</td>
</tr>
<tr>
<td>0.40</td>
<td>3.4</td>
</tr>
<tr>
<td>0.50</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 6: The effect of ammonium chloride concentrations on tannase production

**Ammonium Sulphate Precipitation**

Crude tannase produced by TWS-3 fungal culture was concentrated and partially purified by ammonium sulphate precipitation. The tannase was partially purified in two fractions of 0-20% and 20-70% ammonium sulphate saturation. The result of specific activity and fold purification is shown in Table 7. The protein fraction of 20-70% ammonium sulphate saturation showed 43.53 U/mg of specific activity with 6.8 fold purification.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Activity (U/ml)</th>
<th>Protein (mg/ml)</th>
<th>Specific activity (U/mg)</th>
<th>Purification fold</th>
<th>Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude enzyme</td>
<td>5.97</td>
<td>2.83</td>
<td>2.10</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Ammonium sulphate: 0-20%</td>
<td>5.6</td>
<td>0.73</td>
<td>7.67</td>
<td>4.1</td>
<td>22.19</td>
</tr>
<tr>
<td>Ammonium sulphate: 20-70%</td>
<td>7.41</td>
<td>0.17</td>
<td>43.53</td>
<td>6.8</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: The partial purification of tannase by ammonium sulphate precipitation

The partial purification of tannase from *Aspergillus ficuum* Gim 3.6 was carried out by aqueous two-phase extraction (ATPE) and 2.74 fold tannase was obtained (Ma et al. 2015). The tannase from *Penicillium notatum* NCIM 923 was purified by precipitation with ammonium sulphate at the saturation level of 75% and it was purified 5.96-fold with the specific activity was 6.74 U/mg (Gayen and Ghosh, 2013). The tannase from *Aspergillus niger* MTCC 2425 was purified to 1.4-fold with a yield of about 72.5% and the specific activity was 40.5 U/mg by
ammonium sulphate precipitation (Nandi and Chaterjee, 2016).

References


Enhancement Of Actinobacterial Protease Production by Optimizing Fermentation Parameters

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Abstract

Actinomycetes were isolated from soil, compost pit and vermicompost samples. Protease producing actinomycetes were screened and out of twenty five cultures, ten were positive for protease production. Actinomycete isolate MG4 was selected for optimizing submerged fermentation technology. MG4 produced 264EU/ml of protease in submerged fermentation. The selected isolate grew on Bennett’s medium with typical powdery texture and ivory aerial spore mass. MG4 exhibited straight chain spore arrangement pattern on morphological analysis by slide culture technique. Optimization of protease production process was done and the maximum production was observed at 30°C and pH 7 in 72 hours. Medium containing soybean residue promoted the protease production to maximum (316 EU/ml).

Introduction

Actinobacteria are filamentous prokaryotes, rich in GC content. They are a peculiar group of bacteria predominantly present in soil. They are slow growers and play a very important role in mineralization. Actinobacteria can breakdown a wide variety of organic macromolecules which are difficult to degrade. The extensive range of enzymes produced by them allow these filamentous bacteria to survive in extreme climates also. Actinomycetes have been isolated from soil [Zhu et al. 2007, Atalan et al. 2000], water [Zaitlin et al. 2003], insects, salt lakes [Thumar and Singh 2007], hot springs [Song et al. 2009], marine environments etc [Tian et al. 2009]. Production of protease
[Subramaniet al. 2009], amylase, cellulase, glucose isomerase etc [Bhasin and Modi 2013, Bhasin and Modi 2012] have been reported by numerous researchers. They are also well known producers of antibiotics [Chater et al. 2006]. Majority of the antibiotics available in the market are produced by Actinomycetes, especially Streptomycetes. They have extraordinarily large genome size which accounts for their special capacity to produce a vast repertoire of metabolites and enzymes. Enormous capacity of extracellular enzyme production exhibited by Actinomycetes help in recycling of organic and inorganic matter in the ecosystem [Vonothini et al. 2008, Bascarn et al. 1990].

Present industrial global market for enzymes is more than $2 billion which is expected to rise even further [Thumar et al. 2007]. Proteases find huge application in industrial market and accounts for 25% of total enzyme sales.

Majority of the proteases produced industrially is of microbial origin [Mehta et al. 2006]. Proteases are the degradative enzymes, besides catalyzing the hydrolysis of proteins they are also involved in specific modifications of proteins such as activation of zymogens [Rao et al. 1998]. Variety of proteases are produced using Actinomycetes for industrial applications. Submerged as well as solid state fermentation process are employed for the production of protease using Streptomycetes [Yang and Wang 1999, De Azeredo et al. 2006]. Mitra and Chakraborty (2005) have reported the presence of multiple kinds of proteases in the fermented broth of actinomycetes. Proteases find application in laundry, food, medicine, cosmetic, pharmaceutical industry and other biotechnological purposes [Ellaiah et al. 2002]. Numerous studies are associated with halophilic and alkaliophlic proteases of bacterial origin [Thumar et al. 2007].

Plant and animal sources are also used for the production of proteases but microbial proteases are preferred because of low cost of production, wide pH and temperature range of enzyme activity and stability. They are also preferred for large scale production due to the ease of growth and production on economic grounds also. Microbial proteases are extracellular in majority of the cases making the production and recovery process convenient. Numerous bacteria such as B. cereus, B. lichenformis, B. mojavensis, B. megaterium and B. subtilis, Streptomyces clavuliyerus, Streptomyces nogalator, Streptomyces fungicidicus [Subramani et al. 2009, Mitra and Chakraborty 2005, Bascarn et al. 1990] and fungi for example Aspergillus flavus, Aspergillus melleu, Aspergillus niger, Chrysosporium keratinophilum, Fusarium graminarum, Penicillium griseofulvis, Scedosporium apiospermum are known to produce proteases [Nijland and Kuipers 2008, Rao et al. 1998]. Microbial protease production technology can be further improved by developing recombinant enzymes [Jisha et al. 2013]. The influence of climate on plants and quality of food and their scarcity in case of animals is a major hurdle for these sources of proteases. Fermentation process parameter optimization and use of economic agricultural residues make the microbial production technology highly acceptable.

Current investigation deals with isolation and screening of protease producing actinomycetes. Screening was done at qualitative as well as quantitative level. High yielding isolate was studied for optimization of submerged fermentation technology wherein medium combination, fermentation period, optimum pH and temperature were determined.

Materials and Methods
Isolation Of Actinomycetes
Soil samples were collected from garden area, open fields, compost pits and vermicompost. The samples were treated with calcium carbonate and sundried. Suspension of samples were inoculated on plates and incubated at 30°C for 7 days. Actinomycetes were isolated and preserved on Actinomycete isolation agar and Bennett’s agar medium. Morphological analysis of the selected isolates was performed by slide culture technique.

**Screening For Protease Producers**

Primary screening for qualitative protease producers was done on Bennett’s agar medium containing milk (5%), casein(3%) and gelatin(1%) separately. All the isolates were spot inoculated on medium containing protein substrates and incubated at 30°C. Zone of hydrolysis was observed on milk Bennett’s agar plates by the difference in transparency developed in the medium. Casein Bennett’s agar was observed for visualization of hydrolysis by development of a clear area, a halo around the isolate’s growth. Commassie brilliant blue was used for visualization of the zone of hydrolysis on gelatin Bennett’s agar plates [Vermelho et al. 1996].

**Submerged Fermentative Production For Secondary Screening**

Secondary screening for selected isolates spotted by primary screening was performed by submerged fermentation process. Comparison of protease production was done performing submerged fermentation process in Bennett’s medium. The isolates were inoculated in 100ml conical flasks containing 20 ml of Bennett’s medium. The flasks were incubated at 30°C and 100 RPM in orbital shaker [Remi 24CL] for 96 hours [Mehta et al. 2006].

**Preparation Of Crude Protease Extract**

The fermentation process was terminated on fourth day of incubation and the fermented broth was harvested in sterile centrifuge tubes. Crude protease extract was prepared by centrifugation of fermented broth at 5000 RPM for 10 minutes.

**Determination Of Protease Activity**

Protease production by different actinomycete isolates was determined by Nagase’s method. Protease assay is a modification of two methods viz. Hagihara, 1953 and Anson, 1938. Casein was used as the substrate and protease activity was determined by estimating the soluble tyrosine released. Tyrosine was determined spectrophotametrically using Folin reagent. To 5ml of purified casein solution 1ml of crude enzyme extract (1:1 diluted with acetate buffer) was added. This was incubated for 10 minutes at 30°C. The reaction was terminated by adding 5ml of tri-chloro acetic acid. This was incubated at 30°C for 30 minutes for precipitating remaining total protein. The precipitates were separated by centrifugation. 2 ml of supernatant was mixed with 5 ml of sodium carbonate and 1ml of 1N Folin reagent. This was incubated for 30 minutes at 30°C. The absorbance for determination of tyrosine value was measured at 660 nm and expressed in Proteolytic Unit of Nagase (PUN). One PUN is defined as the amount enzyme which acts on casein for 10 minutes at 30°C and produces a quantity of Folin color-producing substances not precipitated by trichloroacetic acid that is equivalent to 1μg of tyrosine.

**Optimization Of Protease Production**

Demand of microbial enzymes is increasing tremendously because of varied applications [Jisha et al. 2013]. Continuous research is going on for establishing an effective production technology.
which is economically viable. Production of protease was optimized by determining the optimum temperature and pH, fermentation period and medium ingredients required for maximum production.

**Determination Of Optimum Temperature For Protease Production**

All the microbes require specific temperature for the production of enzymes and metabolites. The actinomycete isolate MG4 was subjected to submerged fermentation process in Bennett’s broth. Protease production was studied at 15°C, 20°C, 25°C, 30°C, 35°C, 45°C & 50°C. Protease produced at different incubation temperatures was estimated by Nagase’s method.

**Optimum pH For Protease Production**

Effect of pH on production of protease was studied by growing the isolate in Bennett’s broth. Submerged fermentation was carried out for the actinomycete isolate MG4 with initial pH adjusted to 5, 6, 7, 8, 9, 10 and 11. Optimum pH was determined by estimating the enzyme produced using Nagase’s method.

**Determination Of Optimum Fermentation Period For Protease Production**

Optimum fermentation period was determined by performing submerged fermentation process for the actinomycete isolate MG4 for different time intervals. Seven flasks containing Bennett’s medium were inoculated with actinomycete isolate MG4 and incubated for protease production at 30°C and 100 RPM. Fermentation process was terminated in one conical flask after a fixed interval of 24 hours for continuously seven days. The extent of protease produced was determined by preparation of crude enzyme extract and determining the activity by Nagase’s method.

**Selection Of Suitable Production Medium For Protease Production**

Production of enzymes significantly depends on the medium composition and different organisms are influenced by different medium components. The selected isolate was subjected to submerged fermentation in six different media to obtain maximum protease production. Media used by various researchers were inoculated with the selected actinomycete isolate such as Medium I consisting of Casein, 2%; Glucose, 0.1%; KH₂PO₄, 0.15%; proposed by Chahal et.al. (1976). Kathiresan (2007) reported the production of protease in a medium containing Casein, 5%; Glucose, 5%; Peptone, 5%; Yeast Extract 5%; MgSO₄, 0.1%, K₂HPO₄, 0.25%, FeSO₄, 0.1%, was used as Medium No. II. Media No. III was proposed by Shirato (1965) which contains Glucose, 3.5gm%; Defatted soybean, 2.5%; Dried beer yeast, 0.3%; Ammonium sulphate, 0.2%; Calcium carbonate, 0.2%; Sodium chloride, 0.2%; Soybean oil, 0.24%.

Media No. IV contains Starch, 1.5%; Milk, 1.5%; K₂HPO₄, 0.3%; Yeast extract, 0.1%; MgSO₄, 0.05%; NaHCO₃, 1% and Medium No. V contains Gelatin, 1%; Peptone, 0.5%; Yeast extract, 0.5%, NaCl, 5%; proposed by Thumar et. al. (2007). Bennett’s broth medium was also used for reference and named as Medium No. VI. The actinomycete isolate MG4 was inoculated in 20ml of above media in 100ml conical flasks and fermentation process was carried out for 96 hours at 30°C and 100 RPM. Crude enzyme extract was prepared by centrifuging the fermented broth at 5000 RPM for 10 minutes at 4°C. The comparison of protease production was done by determining enzyme activity by Nagase’s method.

**Results and Discussion**

**Microorganism**
Actinomycetes were isolated and screened for protease production. Culturally and morphologically diverse twenty five actinomycete cultures were isolated from compost and soil samples. The samples were rich in actinomycetal cultures. They grew on Bennett’s agar and Actinomycete isolation agar medium with their typical earthy smell of geosmin. Geosmin is an organic compound which has the specific earthy flavor and is produced by actinobacteria and some other soil dwelling microorganisms [Juttner and Watson, 2007]. Actinobacteria possess tremendous adaptability to diverse environmental conditions. They have been isolated from extremely cold and hot environments [Cotarlet 2009, Song et. al. 2009]. Our collection of isolates consisted of 40% grey aerial spore mass bearing cultures and another 48% white, rest of them exhibited ivory and green aerial spore mass (fig.1). Pigmentation which is a common feature with actinomycetes was observed in 40% of our isolates. Slide culture technique revealed the spiral spore arrangement pattern of grey aerial spore mass bearing isolates. Straight chain spore patterns were observed with white and ivory colour spore mass bearing isolates. The isolate selected for this study exhibited ivory spore mass colour and straight chain spore pattern arrangement, according to Bergey’s Manual of Systemic Bacteriology Volume 4 *Kitasatosporia* exhibits such features.

Fig 1. Distribution of Spore Mass Colour among Isolates

**Qualitative And Quantitative Screening For Protease Producing Actinomycete**

Ten isolates were found to be positive for protease production out of which five were high yielding. The isolates were analyzed for degradation of casein and gelatin along with hydrolysis on milk agar plates. Large hydrolysis zones ranging between 24 to 44mm were produced by promising isolates (fig.2). Actinomycete isolate MG4 was selected for further studies as it exhibited highest productivity of 264 EU/ml of the fermented broth in submerged fermentation (Fig.3). Protease production strategy was optimized using the selected isolate MG4.

Protease production has been reported by numerous strains of actinomycetes [Subramani et al. 2009, Thumar 2007, Rifat 2006] and Bacillus [Darani 2008]. They are also employed at industrial scale for large scale production. Actinomycetes produce large number of extracellular enzymes in order to survive in different type of environmental conditions with varying organic and inorganic content. They degrade the polymeric macromolecules for their nutritional purpose along with maintenance of ecological balance [Mitra and Chakraborty 2005, Bascarn et al. 1990].
Optimization Of Submerged Fermentation Process For Protease Production By Actinomycete Isolate MG4

Influential parameters for protease production were studied in order to meet high yield demands for commercialization of production technology.

Influence Of Temperature On Protease Production

Growth and production of protease was maximum at mesophilic range of temperature. Highest protease production was observed at 30°C (Fig.4). Proteases working at mesophilic temperature find applications in degradation of environmental wastes as compared to thermophilic proteases for industrial applications [Sepahy and Jabalameli 2011, De Azeredo 2006]. Kathiresan and Manivannan 2007 also found high protease activity at 30°C. Numerous bacterial proteases produced from Bacillus species have mesophilic and others have thermophilic optimum temperature such as Sepahy (2011) reported 60°C as optimum.
Profound effect of pH on protease production and growth of the isolate was observed. The isolate MG4 exhibited very scanty growth and protease production at pH 5 and 6 (Fig. 5). Growth and production was also less above pH 9. Highest protease production was observed at pH 7. Components of the medium also alters the pH which in turn influences the protease production. When ammonium salts are used as nitrogen source in the medium, the pH tends to become acidic on its degradation whereas organic nitrogen sources such as amino acids and peptides when utilized by microbes in the production medium leads to alkaline conditions [Ellaiah et al. 2002]. Majority of the reports focus on alkalophilic proteases because of industrial applications [Mehta et al.
Certain applications such as preparation of soluble flavoured protein hydrolysates at industrial level requires proteases with neutral optimum pH range [Rao et al. 1998]. Many proteases for example keratinases are required for degradation of feather wastes at neutral pH.

**Determination Of Optimum Fermentation Period**

Our study revealed that maximum protease production can be obtained after 72 hours of fermentation process (Fig.6). It is economically favorable that production reaches to its highest in 72 hours, which means that the fermentation process need not to be carried out long to get higher yields as in case of other actinomycete fermentation processes. In some cases Streptomyces are reported to produce protease in 144 hours [Subramani et al. 2009, Kathiresan and Manivannan2007]. Fungal proteases also require longer incubation period such as seven days for high yield [Muthulakshmi et al. 2011]. Protease is required by the organism for growth starting from the initial stages where the proteinases digests the complex protein macromolecules into peptides. These peptides are further degraded by peptidases to release amino acids for vital activities of the cell. As the growth proceeds, proteases degrade majority of the proteins in the medium including other enzymes.

This leads to high titre of proteases and lesser amount of other enzymes and metabolites in the medium towards stationary phase in some cases. However addition of complex organic protein substrates induces protease production in early stages of growth also.

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**Selection Of Suitable Production Medium**

All the organisms vary in their growth pattern and production of metabolites, therefore there is no perfectly defined medium available so far which can be used for any organism in consideration [Jisha et, al. 2013]. Production of extracellular protease is highly influenced by medium components [Mehta et al. 2006]. Protease is reported to be inducible in some cases, therefore a variety of medium combinations were studied for protease production. Extent of protease production by high yielding isolate MG4 was compared in presence of casein, gelatin as pure protein containing medium and defatted soybean and milk as crude protein source. A highly encouraging result was obtained, protease was produced in very high amount 316 EU/ml in the medium (Medium No. III) containing
crude protein source (defatted soybean) (Fig.7). Second highest productivity was observed in Bennett’s broth (Medium No. VI). Medium containing casein along with yeast extract was next to Medium No. III and VI. Protease production seems to be enhanced in presence of yeast extract which is a common factor in all the three media showing high yield. Although specific organisms require specific nitrogen and carbon sources for optimum production, Ellaiah, et al. (2002) reported a positive impact in most of the cases where complex organic nitrogen sources were used in the medium instead of simpler inorganic sources. However gelatin was not found to be suitable component for protease production in our study.

Conclusion

Our study reveals the presence of diversity in actinomycetes present in soil and their extensive capacity to produce proteases. Actinomycetes are already explored for the production of numerous bioactive compounds but still there is tremendous scope available for searching industrially and environmentally useful cultures. The selected isolate exhibited ivory aerial spore mass colour with straight chains of spore pattern arrangement. The isolated culture demonstrated high protease production capacity in Bennett’s broth. Growth and production of protease in case of our isolate exhibited synchronous trend, the suitable temperature and pH coincided for both. The optimum pH and temperature for production was found to be 7 and 30°C respectively. Requirement of moderate temperature and neutral pH for growth and production process are definitely advantageous results which opens a way for the application of the enzyme in food industry and environmental purposes. Early production of enzyme, i.e. 72 hours of optimum fermentation period also favors commercialization of the technology. Another encouraging result was the increased protease production in presence of crude nutritive sources. The productivity can further be increased by understanding and modulating the protease synthesis at genetic level.

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Use Of Fourier Transform In The Theory Of Finance

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Abstract

In the financial world, option is one of the definite types of contracts. Basically there are two types of option, Call and Put option. The important part is the valuation of this option and it is represented by a well-known Black-Scholes-Merton (BSM) Partial Differential Equation. It is of second order parabolic type Partial Differential Equation. The solution of this equation gives the theoretical value of an option (Call/Put). Here in the present paper we have solved BSM equation with the help of Fourier Transform. In fact we have solved BSM equation for two different Payoff functions: Standard Power option and Powered option as boundary conditions.

Keywords: Black-Scholes-Merton Model; Partial Differential Equation; Fourier Transform Method; Call/Put option.

Introduction

The pricing of option is a very important problem in financial market. In option pricing theory, the Black-Scholes-Merton equation is one of the most effective models for pricing options. If we consider the European call option, which gives the right to buy an asset on a specific future date, at a specific price, which depends on S-Spot price, X-Exercises Prices, t-Expiration date, r-risk free interest rate, and $\sigma$-Volatility. This model is very useful, since this requires five variables only in which four are easily available, those are and for the volatility we have to use historical data to estimate it. The formula developed by three economists- Fisher Black, Myron Scholes and Robert Merton. They were awarded the 1997 Nobel Prize in economics for their work [1].

Theoretical Analysis

In Mathematical Finance, the Black-Scholes-Merton equation is a Partial Differential Equation
to evaluate the value of European Call/put option. Suppose \( C(S,t) \) is the call premium then the equation [3], [5], [7],

\[
\frac{\partial C}{\partial t} + \frac{1}{2} \sigma^2 S^2 \frac{\partial^2 C}{\partial S^2} + rS \frac{\partial C}{\partial S} - rC = 0
\]

is a Black-Scholes-Merton Partial Differential Equation.

Where,

\[
t \in [0,T] \text{ and } C(0,t) = 0 \text{ for all } t \text{ and } C(S,t) \rightarrow S \text{ as } S \rightarrow \infty
\]

Consider the European call option whose final payoff at the expiry time \( T \) is given by a function \( f \) of the final spot price \( S \). \( \lim_{t \rightarrow T} C(S,t) = f(S) \) which is a continuous function that need not be differentiable everywhere.

The common assumptions of the BSM are [7]:

1. The options are European type
2. No dividends are paid
3. Movement of the market cannot be predicted
4. No Commission and no transaction cost
5. Interest rates are risk free and it is constant
6. Volatility is constant
7. Returns are normally distributed.

To solve the above mathematical model various approaches and methods are proposed by researcher like the Method of Separation of Variable, Method of Laplace Transform [2]. Some of them having limitations and some having advantages over them. In this paper we have applied Fourier Transform Method to solve the problem. Our goal is to find the function \( C(S,t):(0,\infty) \times [0,T] \rightarrow [0,\infty) \), which satisfy the given Partial Differential Equation. This equation has many solutions corresponding to all the different functions that can be defined with the underlying variable. The particular value that is obtained when the equation is solved depends on the Payoff functions. These specify the values of the call option at the boundaries of possible values of and . Here we will discuss two different Payoff functions: Standard Power option and Powered option. First, we will convert the Black-Scholes-Merton Partial Differential Equation to the heat equation by the following substitutions:

\[
y = T - t,
\]

\[
x = \ln\left(\frac{S}{X}\right) + \left(r - \frac{\sigma^2}{2}\right)(T-t)\text{ and}
\]

\[
D(x,y) = e^{r(T-t)} C(S,t).
\]
These substitutions also convert the above mentioned boundary condition,

$$\lim_{t \to 0^+} C(S, t) = f(S)$$

into the initial condition,

$$\lim_{y \to 0^+} D(x, y) = f(Xe^x)$$

Thus the Black-Scholes-Merton equation gets converted into the following Heat Equation with the stated initial condition:

$$\frac{\partial D}{\partial y} = \frac{\sigma^2}{2} \frac{\partial^2 D}{\partial x^2} \quad \text{with} \quad \lim_{y \to 0^+} D(x, y) = f(Xe^x) \quad (1)$$

Applying Fourier transform on both the sides of the equation (1) we get,

$$\frac{\partial}{\partial y} F(D) + \frac{\lambda^2 \sigma^2}{2} F(D) = 0$$

∴ $$F(D) = C_1 e^{-\frac{\sigma^2 \lambda^2}{2} y}$$

Now we get,

$$F(D(x,0)) = G(\lambda) \quad \text{because} \quad D(x,0) = f(Xe^x)$$

Here, is the Fourier transform of , so that is determined and we now have:

$$F(D) = G(\lambda) e^{-\frac{\sigma^2 \lambda^2}{2} y}$$

Taking inverse Fourier transform on both the sides we get,

$$D(x, y) = F^{-1}\left(G(\lambda) e^{-\frac{\sigma^2 \lambda^2}{2} y}\right)$$

Now, using convolution theorem and from the facts,

$$F^{-1}(G(\lambda)) = f(Xe^x) \quad \text{and} \quad F^{-1}\left(e^{-\frac{\sigma^2 \lambda^2}{2} y}\right) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2 y}}$$

we get:
\[ D(x, y) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(v) \frac{1}{\sigma \sqrt{y}} e^{-\frac{(x-v)^2}{2\sigma^2 y}} \, dv \]

\[ \therefore D(x, y) = \frac{1}{\sigma \sqrt{2\pi}} \int_{-\infty}^{\infty} f(v) e^{-\frac{(x-v)^2}{2\sigma^2 y}} \, dv \]

This is the required solution of the Heat equation [6].

**Solution Of The Problem Using Different Payoff Functions**

Many people have solved BSM equation for Standard Power Payoff function and Powered Payoff function using the Method of Separation of Variable [4].

**Standard Power Payoff Function**

Consider the Payoff function, which is known as Standard Power Payoff function:

\[ f(S) = \max\{S^2 - X, 0\} \]

\[ \therefore f(Xe^y) = \max\{X(Xe^{2y} - 1), 0\} \]

\[ \therefore D(x, y) = \frac{1}{\sigma \sqrt{2\pi}} \int_{0}^{\infty} X(Xe^{2y} - 1)e^{-\frac{(x-v)^2}{2\sigma^2 y}} \, dv \]

\[ = \frac{X^2}{\sigma \sqrt{2\pi}} \int_{0}^{\infty} e^{2y} e^{-\frac{(x-v)^2}{2\sigma^2 y}} \, dv - \frac{X}{\sigma \sqrt{2\pi}} \int_{0}^{\infty} e^{-\frac{(x-v)^2}{2\sigma^2 y}} \, dv \]

Taking,

\[ Z = \frac{v-x}{\sigma \sqrt{y}} \]

We get,

\[ \therefore D(x, y) = \frac{X^2}{\sqrt{2\pi}} e^{2(x+\sigma^2 y)} \int_{x}^{\infty} e^{-\frac{(Z-2\sigma \sqrt{y})^2}{2\sigma^2 y}} \, dZ - \frac{X}{\sqrt{2\pi}} \int_{x}^{\infty} e^{\frac{-Z^2}{2\sigma^2 y}} \, dZ \]

\[ = \frac{X^2}{\sqrt{2\pi}} e^{2(x+\sigma^2 y)} \int_{x}^{\infty} e^{-\frac{(Z-2\sigma \sqrt{y})^2}{2\sigma^2 y}} \, dZ - \frac{X}{\sqrt{2\pi}} \int_{x}^{\infty} e^{\frac{-Z^2}{2\sigma^2 y}} \, dZ \]
\[ \begin{align*}
&= \frac{X^2}{\sqrt{2\pi}} e^{2(x+\sigma^2y)} \int_{-\infty}^{\frac{-t^2}{2\sigma^2y}} e^\frac{t^2}{2\sigma^2y} dt - \frac{X}{\sqrt{2\pi}} \int_{-\infty}^{x} e^\frac{t^2}{2} dt + \frac{X^2}{\sqrt{2\pi}} \int_{-\infty}^{\frac{-Z^2}{2\sigma^2y}} e^\frac{Z^2}{2\sigma^2y} dZ \\
&= \frac{X^2}{\sqrt{2\pi}} e^{2(x+\sigma^2y)} \int_{-\infty}^{\frac{x+2\sigma^2y}{\sigma \sqrt{y}}} e^\frac{-t^2}{2\sigma^2y} dt - \frac{X}{\sqrt{2\pi}} \int_{-\infty}^{x} e^\frac{t^2}{2} dt \\
&= X^2 e^{2(x+\sigma^2y)} N(d_1) - XN(d_2)
\end{align*} \]

Where,
\[ d_1 = \frac{x + 2\sigma^2y}{\sigma \sqrt{y}}, \quad d_2 = \frac{x}{\sigma \sqrt{y}} \text{ and } N(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^\frac{-t^2}{2} dt \]

\[ \therefore C(S,t) = S^2 e^{(r+\sigma^2)(T-t)} N(d_1) - Xe^{-r(T-t)} N(d_2) \]

Where,
\[ d_1 = \frac{\ln\left(\frac{S}{X}\right) + \left(\frac{r + 3\sigma^2}{2}\right)(T-t)}{\sigma \sqrt{T-t}} \text{ and } d_2 = d_1 - 2\sigma \sqrt{T-t} \]

**Powered Payoff Function**

Now, we consider the Payoff function, which is known as Powered Payoff function:

\[ f(S) = \max\{(S - X)^2, 0\} \]

\[ \Rightarrow f(Xe^y) = \max\{X^2(e^y - 1)^2, 0\} \]

\[ \therefore D(x,y) = \frac{1}{\sigma \sqrt{y}} \int_{0}^{\infty} X^2 (e^y - 1)^2 e^{-\frac{(x-y)^2}{2\sigma^2y}} dv \]

\[ = \frac{X^2}{\sigma \sqrt{y}} \left[ \int_{0}^{\infty} e^{2y} e^{-\frac{(x-y)^2}{2\sigma^2y}} dv - 2 \int_{0}^{\infty} e^{y} e^{-\frac{(x-y)^2}{2\sigma^2y}} dv + \int_{0}^{\infty} e^{-\frac{(x-y)^2}{2\sigma^2y}} dv \right] \]
Taking,

\[ Z = \frac{V - X}{\sigma \sqrt{y}} \]

We get,

\[
D(x, y) = X^2 e^{2(x+\sigma^2 y)} \int \frac{e^{-\frac{(Z^2 - 2\sigma \sqrt{y} Z + 4\sigma^2 y)}{2}}}{\sigma \sqrt{y}} dZ - 2X^2 e^{\frac{x+\sigma^2 y}{2}} \int \frac{e^{-\frac{(Z-\sigma \sqrt{y})^2}{2}}}{\sigma \sqrt{y}} dZ + X^2 \int \frac{e^{-Z^2}}{\sigma \sqrt{y}} dZ
\]

\[
= \frac{X^2}{\sqrt{2\pi}} e^{2(x+\sigma^2 y)} \int \frac{e^{-\frac{t^2}{2}}}{x+2\sigma^2 y} \frac{x^2}{\sigma \sqrt{y}} dt - 2 \frac{X^2}{\sqrt{2\pi}} e^{\frac{x+\sigma^2 y}{2}} \int \frac{e^{-\frac{t^2}{2}}}{x+2\sigma^2 y} \frac{x^2}{\sigma \sqrt{y}} dt + \frac{X^2}{\sqrt{2\pi}} \int \frac{e^{-Z^2}}{x} \frac{x}{\sigma \sqrt{y}} dt
\]

\[
= \frac{X^2}{\sqrt{2\pi}} e^{2(x+\sigma^2 y)} \int \frac{e^{-\frac{t^2}{2}}}{x} \frac{x}{\sigma \sqrt{y}} dZ - 2 \frac{X^2}{\sqrt{2\pi}} e^{\frac{x+\sigma^2 y}{2}} \int \frac{e^{-\frac{t^2}{2}}}{x} \frac{x}{\sigma \sqrt{y}} dZ + \frac{X^2}{\sqrt{2\pi}} \int \frac{e^{-Z^2}}{x} \frac{x}{\sigma \sqrt{y}} dZ
\]

\[
= X^2 e^{2(x+\sigma^2 y)} N(d_1) - 2X^2 e^{\frac{x+\sigma^2 y}{2}} N(d_2) + X^2 N(d_3)
\]

where,

\[ d_1 = \frac{x + 2\sigma^2 y}{\sigma \sqrt{y}} \quad d_2 = \frac{x + \sigma^2 y}{\sigma \sqrt{y}} \quad d_3 = \frac{x}{\sigma \sqrt{y}} \quad and \quad N(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{t^2}{2}} dt \]

where,

\[ C(S, t) = S^2 e^{(r+\sigma^2)(T-t)} N(d_1) - 2SXN(d_2) + X^2 e^{-r(T-t)} N(d_3) \]

\[
\ln \left( \frac{S}{X} \right) + \left( r + \frac{3\sigma^2}{2} \right)(T-t) \
\]

\[ d_1 = \frac{\ln \left( \frac{S}{X} \right) + \left( r + \frac{3\sigma^2}{2} \right)(T-t)}{\sigma \sqrt{T-t}} \quad d_2 = d_1 - \sigma \sqrt{T-t} \quad and \quad d_3 = d_1 - 2\sigma \sqrt{T-t} \]

**Conclusion**

The BSM equation is solved using Fourier Transform Method. This gives the value of an option
for the above mentioned two different Payoff functions. Using this solution the trader can find
the theoretical value of options (call/put) on a verity of assets including securities, commodities,
currencies etc. with stipulated Payoff functions. It is hoped that in certain situations solution found
will be useful. Also the method used here has scope of wider adoption.

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गुजरात के हिन्दी साहित्यकार

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समाजों, सबसे पहले तो मैं आप सभी का अभिवादन करती हूँ तथा राष्ट्रभाषा प्रचार समिति का हार्दिक आभार मानती हूँ कि मुझे आप सब के बीच अपनी वात रखने का अवसर दिया। मुझे गुजरात के हिन्दी साहित्यकारों पर वात करनी है। ग्लोबल विलेज (विश्ववाणी) तथा वसुदेव कुरुंकल के दीर्घ में ही हम हिन्दी रचनाधीनता की प्रांतीय अभिव्यक्ति के वात कर सकते हैं।

अन्य हिन्दीतर प्रदेशों की तुलना में गुजरात का हिन्दी के साथ एक अलग ही संबंध है। आगाम के साथ जैसे ऐसा। यह उसका हिस्सा भी है और उससे अलग भी। केवल अपबंध के कारण यानी मूल की समानता के कारण ही नहीं, भाषा की एक साती सांस्कृतिक प्रियासत भी होती है। गुजराती हिन्दी की यह सांस्कृतिक प्रियासत धर्म, आर्थिक तथा सामाजिक रहन सहन के रूप में समाज में भी मूल उजागर हुई है और साहित्य के माध्यम से यह सब अभिव्यक्ति भी होता रहा है। गुजरात के मध्यकाल में इस तथा राजस्थानी में बहुत कुछ लिखा गया, अतः इसके संदर्भ में जितना कहा जाए कम ही है। डॉ. अम्बाशंकर नागर, डॉ. गोविंद शर्मा, डॉ. रंजना अरगडे, डॉ. रामकुमार गुप्ता, डॉ. महावीरसिंह चौहान, आदि ने इस क्षेत्र में बहुत महत्वपूर्ण काम किए हैं। इस संदर्भ में एक संकेत अवस्था जरा चालू होने का मध्यकाल में प्रचलित इज़, पुरानी गुजराती तथा राजस्थानी एवं संसूचा की संबंधित कुछ इस तरह प्रकटमान थी कि जैसे एक ही व्यंग्य, विभिन्न समिलित स्वाद से चुक हो।
हम सीधे अपने विचार पर आते हैं। डॉ. अंबांकर नागर तथा डॉ. महावीर सिंह चौहान ने गुजरात के हिंदी रचनाकारों को मोटे तौर पर दो भागों में बीटा है। एक वें, जिनकी मातृभाषा हिंदी नहीं है और एक वें जिनकी मातृभाषा हिंदी है और जो उन्हें प्रदेश बिहार, राजस्थान, मध्यप्रदेश आदि हिंदी भाषा-भाषी राज्यों से हिंदीतर प्रदेशों में आकर बसे हैं। इसके 'गुजरात की समकालीन हिंदी कविता- युग संपूर्णित' में डॉ. महावीर सिंह चौहान ने एक बहुत मानक प्रमाण उदाहरण है कि वह गुजरात की समकालीन हिंदी कव्या परंपरा गुजरात की मध्यकालीन हिंदी रचनाशीलता का ही सहज परिभाषण है। इस प्रश्न में एक और नुकता जोड़ना अथवा पूर्ण होगा कि रचनाांकन के संदर्भ पर आज लिख्या जाने वाला हिंदी साहित्य अपनी स्वतंत्रता में मध्यकाल में लिखे जाने वाले हिंदी साहित्य के संबंध है। इस संदर्भ में हिंदी व्याकरण समुन का यह कथन अथवा पूर्ण है - हिंदी भाषा प्रांतों में रहने वाले हिंदी के कवि और लेखक इस तथा अनुमान भी नहीं कर सकते हैं कि हिंदीतर भाषाओं में रहने वाले कवियों और लेखकों के कथा अभाव वस्तुवाय हो सकते हैं। इसमें अनेक और सुनिश्चित दोनों साथ-साथ होती हैं। अद्वैत तो यह है कि देशदिन व्यवाय में न आने के कारण ऐसी रचनाओं में हिंदी मुहावरे की फ़कर प्रमाण साध में जाती है और सुविधा यह है कि अन्य प्रांतीय भाषाओं का भाषा सौकर्य और समुदाय उसे अनावश्यक हार प्राप्त हो जाती है जिससे हिंदी का मानस प्रसार और अधिक व्यापक तरीके द्वारा भारत की ध्वनिता साहित्याओं की समन्वय भूमि बनाने का प्रारंभ करता है। (समून) समुन जी जैसे रचनाकार हिंदीतर भाषी प्रांतों की रचनाओं को हिंदी के प्रसार में उपयोगी मानते हैं। ऐसे में नागरजी ने हिंदी रचनाकारों का जो विभाजन किया है, उस पर भी एक दृष्टि जानी जा सकती है और उसे वर्तमान समय में बोला इस तरह से विख्यात किया जा सकता है।

लेखक की व्याख्या की दृष्टि से अगर देखा जाए तो; 1-गुजरात में जमी हिंदीतर भाषी रचनाकार, 2-गुजरात में प्रांतीय की हैसियत से आए हिंदी भाषा-भाषी रचनाकार, 3-गुजरात में आकर और मध्यप्रदेश में वह जाने वाले प्रांतीय रचनाकार और 4- गुजरात में जमी हिंदी भाषी रचनाकार। व्यवसाय की दृष्टि से देखा तो ये रचनाकार अध्यात्मर, व्यवस्थापित, व्यापारी तथा मुक्त-लेखक (प्री-तांत्रि) हैं।

गुजरात में हिंदी रचनाशीलता के विषय में तथा शैक्षणिक अनुमान कई दस्तावेज़ी लेख एवं पुस्तक में भिन्नता है। हिंदी साहित्य परिसर के जो तीन महत्वपूर्ण प्रकाशन है- डॉ. अंबांकर नागर अभिनन्दन संग्रह, डॉ. रामकुमार गुप्त अभिनन्दन संग्रह तथा आयार्य रूपान्तर यह पुस्तक में उनमें गुजरात के हिंदी रचनाकारों की जो सूची दी गयी है यह एक हजार की संख्या के करीब होगी। असल में गुजरात की हिंदी रचनाशीलता के व्याख्या का अंदाजा लगाने के लिए ये तीन संघ तथा डॉ. राम पांडेय की 'गुजरात में लिखा हिंदी साहित्य का इतिहास' बहुत ही महत्वपूर्ण शों है। पांडेय की लिखा इतिहास अब अपार है। इसका पुनःप्रकाशन जरूरी है। इनमें हम डॉ. रामचंद्र चौधरी के, 'गुजरात का व्यास्तंगोत्तर हिंदी साहित्य' को भी अधिकार्य कर सकते हैं। 2003 तक के आंकड़े इन व्याख्या में हमें मिलते हैं। उसके बाद हिंदी रचनाकारों की सूची और भी बढ़ी है।

गुजरात में हिंदी लेखन के आरंभिक रचनाकार चौक व्यवसाय से अन्यप्रकार भी रहे हैं जो हिंदीतर प्रांतों में उनकी आवाजाही रही। डॉ. अंबांकर नागर के साथ जिन रचनाकारों ने लिखा आरंभ किया था उनमें से अधिकांश रचनाकार हिंदी भाषी प्रांतों से यहीं आ कर बसे थे। अतः उनके लेखण में हिंदी के यही प्रचलित व्यवहार और रचनाविधान था जो उनकी स्मृति में रचा बसा था।। कविताएँ, खंड कायाँ,
गजलें और सरसों। फिर क्रमशः रचनात्मक गध लेखन भी सामने आया और कहाँ अपना उपयोग तथा निरंतर लेखन को गला मिली। नाटक लिखने वाले रचनाकार तुलसी में कम आए।

गुजरात में लिखे जाने वाले हिंदी साहित्यकारों का एक विभाजन हम इस प्रकार भी कर सकते हैं। भारतीय मध्यकाल में लिखे वाले दयानंद आदि को गुजरात की हिंदी रचनात्मकता के भूमिका काल में समाप्त कर सकते हैं। इसके बाद जो रचनात्मकता का पहला स्तर बनता है उसमें रोमन जंगली नाम, रामदर्श मिश्र, भगवत शरण आसवाल, किशोर काव्यर, रामकुमार गुप्त, अभिनाथ श्रीवास्तव, सुधा श्रीवास्तव, मयावनसास जैन, चंद्रकान्त मेहता, रघुनाथ भूम, शिवकुमार मिश्र, बसन्तकुमार परिहार, भावप्रवास नियाज आदि को शामिल कर सकते हैं। इनमें अधिकतम कारणों से दों अंबाशंकर नागर की तथा रचनात्मक कारणों से किशोर काव्यर एवं बसन्तकुमार परिहार की पहचान बनी। पर सबसे अधिक कोई नाम पुरुष गुजरात के बाद जाना गया तो वह अपने समय में दों। अंबाशंकर नागर तथा यापक रूप से शिवकुमार मिश्रजी का ही है।

दूसरे स्तर पर गुलाम अहसंद, श्रीराम विपुल, फूलचंद गुरु, अजिता संगी, धारिका त्रासिंद संपीडकर, शेखी पंजाबी, सुभाष भद्दरिया, सुरक्षी बाबा आदि को शामिल कर सकते हैं। यह कहना चाहिए कि गुलाम अहसंद, श्रीराम विपुल तथा अजिता संगी जैसे रचनाकारों ने पुरुष के बारे में हिंदी ज्ञान में अपनी पहचान बनाई है।

तीसरे स्तर पर विविध आधारित साहित्य संगठनों से जुड़े रचनाकारों को शामिल किया जा सकता है जो एक तरह से एक उम्मीद विषय है। उसमें रोमन जंगली साहित्य की रचनात्मक की तथा रचनाशीलता की उनकी विशेष भूमिका को शामिल किया जा सकता है। बड़ी तथा अहसंदलादृढ़ की महिला रचनाकारों का यह संगठन है जो केवल हिंदी भाषा तक ही सीमित नहीं है। यह भारतीय भाषाओं में लिखे वाली महिलाओं का संगठन है। यह पिछले पच्चिस वर्ष से कार्यरत है। इसमें गृहणियों से ले कर अध्ययनांकों तथा अन्य व्यवसाय से संबंधित महिला रचनाकार शामिल हैं।

यहीं 'स्वर्णभव गुजरात' जैसे महत्त्वपूर्ण प्रकाशन का भी उल्लेख करना आवश्यक है जिसका संपादन अजिता संगी ने किया है। यह प्रकाशन इस्लाम महत्त्वपूर्ण है क्योंकि इसमें गुलाम अहसंद में लिखने वाली 100 से अधिक काव्यिकों को सम्मानित किया गया है। इनमें यह बहुत सरी, बांसू अधिकांश कवितालय के भाषा पहले की हैं, पर यह प्रकाशन-कम, यह पुस्तक उत्तर-आधुनिक गतिविधि का हिस्सा हो जाता है। महत्व इसी वाण है। ताकि इसी तरह का काम बिहार की श्रीमती मिशनदेस्कुमारी ने अपने प्रदेश की महिला रचनाकारों को एक साथ प्रकट कर दिया है。

रामकिशन मेहता जैसे रचनाकार तथा प्रभात मोदी जैसे विशेष उलेख इस्लाम द्वारा करना चाहिए कि उन्होंने विविध तरीकों तथा वैदिक संदर्भों को अपनी रचनात्मकता में शामिल किया है। यहाँ उन गुजराती रचनाकारों को याद करना चाहिए जिन्होंने गुजरात के बाहर अपनी रचनाओं के लिए हिंदी में लिखा। यह भी बहुत ही बात है। रक्त व्यापक रूप से चौंदी में से दो रचनाकार हैं। एक ने विचारधारा के कारण तो एक ने उत्तर-प्रदेश का कामना से हिंदी माध्यम में अपनी रचनाएं लिखी।

नारी विवरण की तरह दलित विवरण के संदर्भ में धीरे व्यक्त तथा धन्यवाद विषय जैसे रचनाकार भी शामिल किए जा सकते हैं जिन्होंने दलित संदर्भ को केंद्र में रखा। अपनी बात दूर तर दूर दूर के लिए गुजराती दलित कवि राजू सोंकी ने भी कुछ रचनाएं हिंदी में लिखी हैं। नारी विभाग और दलित
विमर्श जैसी साहित्यक्र प्रवृत्तियां भारतीय तथा शैक्षक संदर्भों की ओर संकेत तो करती हैं परन्तु यहाँ भी यह प्रणाली तो रहता ही है कि भारतीय अथवा राष्ट्रीय संदर्भ में पहचान किस रचनाकार की हो पाती है। इसमें भी हम प्रभाव मनमुदार अथवा निम्नलिखित रूप से या फिर रातु मुखर्जी जैसे कुछ नाम ही गिना सकते हैं। यहाँ मेरे कहने का तात्पर्य यह नहीं है कि जिनकी पहचान राष्ट्रीय स्तर पर नहीं हो सकती है वे कमजोर रचनाकार हैं। पर जब रचनाशीलता का माध्यम हिंदी चूना है तो मूल्यांकन का एक आधार तो यह रहेगा ही।

मैंने यह जो विभाजन आपके सामने रखा उससे सारे से मेरा आशय गूढ़ता नहीं अपनु विश्वासकर है। आप चाहें तो इसे पहली पीढ़ी, दूसरी पीढ़ी आदि नाम या स्थल के साथ है। साथ ही इसमें जिन रचनाकारों के नाम दिए हैं वह केवल संकेत मात्र है। गुजरात क्षेत्र का था जीवन तथा शैक्षिक विभाग की पीढ़ी के बाद भी रचनाकार की एक नयी पीढ़ी आ गयी है जिसमें कार्य धीर्षिंध सिकर, इंद्राशिंध चीराण, पूर्ण शाही आदि कुछ नाम नियम जा सकते हैं। आज गुजरात में बहुत बड़ी संख्या में हिंदी के रचनाकार उत्पन्न हैं और बहुत लिख रहे हैं। इस सभी के मूल्यांकन करने हुए दो-एक शोध प्रेम भी लिखे जा चुके हैं।

अपने मलबे के लिए जो टूट फूटा विभाजन मैंने आपके सामने रखा उसका आधार केवल इन्हीं ही है कि गुजरात में लिखी जाने वाली हिंदी रचनाशीलता के मात-माते दलालों को रेखांकित किया जा सके। डॉ.अंबासंधार नागरजी की रचनाकार पीढ़ी ने अब लिखा तब उनका आधार गुजरात प्रदेश में अपनी एक पहचान को यथार्थता करना था। फिर यह महामाया गांधी की भूमिम है। अतः हिंदी के साध का संबंध बहुत व्यापक था। यहीं गुजरात विशारदत भी थी। उन्होंने अपने मूल वन की भाषयी एवं साहित्यिक संस्कृति की स्मृति में हिंदी को गुजरात में वसाया। इसकी तुलना हम उन प्रवर्धनी,अध्याबें या भारतीय विभाग के साथ कर सकते हैं जो भारत छोड़ कर विश्व के विभिन्न देशों में बसे थे। यहाँ में एक बात जोड़ देना चाहती हूँ कि गुजरात में लिखे हिंदी साहित्य को प्रवासी दृष्टि से देख कर कोई शोध कार्य नहीं हुआ है। शोध के लिए यह एक अच्छा विश्व हो सकता है। खैर ; इस रचनाकारों की रचनाओं में संबंधित के साथ इन्होंने शोध की उसके अपने सामय की रचनाशीलता ही रहती। अंबासंधार नागर और विभाजन कार्य ने संभवतः इसीलिए प्रमुखता प्राप्त कर लेने भी लिखीं। इनके लिए गुजरात में रहते हुए अपनी मूल भाषा की रचनाशीलता को बनाए रखना महत्वपूर्ण था। इनकी यहाँ कापुड़े अध्याबें या पहले हिंदी की थी; राजस्थानी, अवधी अथवा उँची नहीं। गुजरात का अपना परिवेश हिंदी भाषी परिवेश से भिन्न था; अपनी हिंदी को परिशुद्ध रखने के लिए गुजराती के प्रभाव से बचाने का रचनाशील प्रभाव भी उनके लेखन में देखा जा सकता है। अतः इस रचनाओं में न ही गुजरात प्रदेश के जीवन राज का संचार हो सका न ही हिंदी प्रदेश की हवाओं ने उन्हें पुता।

इसके बाद की पीढ़ी के रचनाकारों ने इस बात की ओर अधिक ध्यान दिया कि उनकी रचनाओं में हिंदी प्रदेश की रचनाशीलता से आए इस साथ ही गुजरात के परिवेश को भी नजरबाज न किया जाए। भाषा की शुद्धता के प्रति राय का गठबंधन भी नहीं था। संबंधित; यह जागरूकता विधायक से कारण आयी। विद्याधिकार छोटी और घनीबी कीबाले आयी जिसमें शुरुआत परिवार जी से होती है। यूं यह दो पीढ़ियों के बीच के रचनाकार कहे जा सकते हैं।
विख्यात की संख्या थे भी बदल से कम और संगठनों से अधिक है। यहाँ तक आते आते हिंदीतर प्रांतों की रचनात्मकता को पहचान मिलना आरंभ हो गया था नतः यहाँ की हवाओं और गुजरात देश के परिवेश ने रचनात्मकों की रचनाशीलता को प्रभावित किया। मात्र महत्व रचनात्मक और अभिव्यक्ति संगठन असल में आता है। ऊपर तरह हिंदी में दिल्ली प्रेम का गुजरात में प्रवेश होता है।

गुजरात की हिंदी रचनाशीलता में केवल हिंदी मातृभाषी ही कार्यरत नहीं है अतः गुजरात में रहने वाले और हिंदी पढ़ने-पढ़ने वाले अथवा हिंदी का उपयोग करने वाले जिनमें गृहरोधों से लेकर व्यवसायी भी शामिल हैं। यह गुजरात की हिंदी रचनाशीलता के लिए अच्छा संकेत है।

लेखक मिश्र, गुजरात में लिखने वाले हिंदी साहित्यकर्मों की बात जब हम करते हैं तो सबसे उज्ज्वल है कि हम किस हिंदी के साहित्यकारों की बात कर रहे हैं? क्योंकि अन्य हिंदी की अभिव्यक्ति हो रही है; यह भी सींचे तीर पर अंग्रेज़ी के कारण नहीं। सुप्रीम पत्रिका का मानना है कि यह वास्तव में अंग्रेज़ी लोगों के ‘शास्त्रीकरण’ की ही प्रकृति है। एक विशाल भाषा को बोलियों में विधायत करने की प्रतिविद्या। हमने जिस भाषा को आज तक ‘हिंदी’ के रूप में पहचाना है वह तो कई समुद्र बोलियों से सजी विविध हिंदी हैं जिसमें तामाम बोलियों के रचनाकर्ताओं ने उनमें कोई काफी साहित्य रचा है। साथ ही तत्वांश हिंदीतर भाषी प्रांतों में रहने वाले हिंदी रचनात्मक है भी रचा है और हिंदी को समृद्ध किया है। हम जो हिंदीतर हैं, जिन्हें अर्थात्, ब्रज, भोजपुरी, राजस्थानी चाहे जिनकी भी दुनिया लोग हमारे सुधि समीक्षकों और संगठनों के सहारे मानक हिंदी के द्वारा हम तुलसी जायसी, सूर-केशव के मूर्ति तक बड़ी सरलता से पहुंच हो जाते हैं।

समाजों, यह प्रस्तुत इसलिए भी कि आज आजादी के सतर्क यथार्थ बाद भी हमारे देश में राजमार्ग, राष्ट्र भाषा को लेकर एकमत नहीं बन पाया है। हम लोग जो यहाँ हिंदीतर भाषी राज्यों से संबंधित हैं उनके लिए यह प्रस्तुत और भी जतल होता ही रहा है। इसे भोजपुरी-हिंदी पर जो घमासान मचा है यह कई सारे प्रस्तुत हमारे सामने खड़े करता है। भोजपुरी हिंदी का इमारत हिंदी प्रेमका का अन्वयी इमारत है यह कह कर हम उससे बिना कर सकते हैं। लेकिन इस इमारत के परिणामों तो हिंदीतर प्रेमका को भी मृत्यु नौ तो पड़े ही। हम लोग, जो हिंदी में इसने रचा - बसके हैं कि कई चर यह भी भूल जाते हैं कि हिंदी हमारी मातृभाषा नहीं है; लेकिन यह हम हिंदी से उतना ही करते हैं जितना हिंदी मातृभाषी अपनी भाषा से करते हैं। हमारे सामने बहुत ज्यदा ही यह निराशामय खिलखिल आ जाती वाली है कि हम अन्य अपने पात्रस्तरों में किस हिंदी को पढ़ें-पढ़ाएं? अतः अपने भोजपुरी, हिंदी से अलग अपनी अभिव्यक्ति के लिए लड़ेंगे तो कन्न व्याख्या, राजस्थानी, खड़ीबोली आदि अलग नहीं थायी? मिश्र यह न भूले कि भाषा बोलने वालों की संख्या के आधार पर राजभाषा तय होती है। बोलियों जब अपनी अभिव्यक्ति की पहचान के लिए अलग होंगी और आउटबर सूची में स्थान पाएँगी तो राजभाषा के रूप में हिंदी का स्थान प्रभावित हो जाएगा। जब यह भी भाषाएँ तथा समाज-शास्त्रकारों के विचित्र विषय संकेत के दौर से गुजर रहे हैं ऐसे में भाषा की यह अनलगवर्ती मानकता हिंदी के मामले में खतरे की पंखी ही समझनी चाहिए। आउटबर सूची में स्थानात्मक होने के विषय का बिना इसने कुल है कि अन्य भाषाओं की बोलियों भी इसके लिए तम तक होंगी। इसलिए चतुरस्र और तेलंगाना के बाद कलन में कौन- कौन होगा? यह भीगोलिक 'वाकनीकरण' है, जो भाषाओं के बाक्यनीकरण की दृष्टि से ले जाता है।


Argade

एसेम एवं हमारे सामने एक ही विकल्प रहेगा- केवल अपने ही विद्वान में लिखी जाने वाले दिनी शाहिद को अपने पाठ्यक्रम में पढ़ना। यानी हम अपने पाठ्यक्रम में केवल गुजरात में लिखा जाने वाले हिंदी साहित्य ही पढ़ेंगे। अधिक से अधिक हम हिंदीतर हेतु प्रदेशों का एक समूह बनाकर अपने हिंदी- पाठ्यक्रम को कृपया इस तरह गद्दे की हिंदीतर भाषा प्रदेशों का हिंदी शाहिद हो। इसमें अलग अलग हिंदीतर भाषी प्रदेशों में लिखी जाने वाले हिंदी साहित्य का ‘अध्ययन एवं अनुसंधान’ होगा। तो स्वाल यह है कि क्या हम इस प्रकार का पाठ्यक्रम पढ़ा चाहेंगे? आज जब जने के सबसे विशेष अर्थ के तराई से तोले जा रहे हैं और ये जो हिंदी है, वैसी अपने अतिसंपत्त के लिए संयंत्र कर रही है इसे ये नयी परिस्थितियाँ कैसे समझेंगी?

इस पाठ बना ध्यान देना ज़रूरी है कि गुजरात के कई महापूर्वों ने हिंदी के माध्यम से राष्ट्रीय एवं भारतीय हिंदी को सिद्ध किया। मध्यकाल में मीराबाई एक ऐसा नाम है जो हिंदी तथा गुजराती दोनों ही साहित्य के इतिहास में गौरवपूर्वक स्थान को प्राप्त कर प्रतिष्ठित है। पूर्णामी संग्रहालय के अभ्यासक निर्देशी, स्वामी प्राणनाथ ने हिंदी को राष्ट्रभाषा के रूप में पहली बार पहचाना था। वे भी गुजराती थे। हिंदी गाथे उपन्यासों में से एक तलवूलाल, गुजराती थे। स्वामी दयानंद सरस्वती, महामाय गांधी- वे सभी गुजराती थे, हिंदी की राष्ट्रीय अंतत्त्व तथा विकास के लिए प्रतिष्ठित थे। आज गुजरात में रहने वाले और हिंदी में लिखने वाले, हिंदी के लिए काम करने वाले लोगों की राष्ट्रीय पहचान क्या है मीरा की पहचान कृपणभण्डारी थी, भाषा माध्यम थी,प्राणनाथ की पहचान उनकी अपनी धार्मिक के सांस्कृतिक भूमि थी, भाषा माध्यम थी। पॉर्ट विलियम कॉन्स्ट्रक्शन ने तलवूलाल को पहचान दी, राजनीति ने गांधीजी को पहचान दी तथा स्वामी दयानंद सरस्वती को राष्ट्रीय नवजागरण ने पहचान दी।

अब स्वाल यह है कि गुजरात की आधुनिक तथा समकालीन हिंदी रचनाशीलता देश अथवा प्रदेश की किस व्यापक अंतत्त्व के लिए रचनाशील है? आज गुजरात में लिखी जाने वाले समकालीन हिंदी साहित्य के पास ऐसी तथा अर्थात भूमि है, जो उसे राष्ट्रीय मंच पर पहचान दे सकती है आज राष्ट्रीय स्तर पर लिखी जाने वाले मुख्यालय के हिंदी साहित्य में गुजरात का प्रतिनिधित्व क्या है गुजरात में हिंदी जाने वाली कविताएं, कहावतें तथा उपन्यास, समीका, आदि क्या हिंदी प्रदेशों में लिखी जाने वाले साहित्य की मुख्यालय का एक हिस्सा बन सके हैं नायगों प्रशिक्षण के एक अंक में राजनीतिक जांची जी ने यह प्रश्न उठाया था कि क्या गुजरात के हिंदी साहित्य को मुख्य धारा में पहचान नहीं मिलती। स्वतंत्रता के पूर्व गुजरात में जो कुछ भी हिंदी संस्थित हुआ वह मुख्यालय के समानांतर था। आजादी के बाद भारत में विभिन्न प्रदेश बने अत: एक विभाजन तो अपने आप हो गया। विश्वविद्यालयों में हिंदी अवधारणा का आरंभ हुआ अत: हिंदी-संस्कृत की संस्था में गुप्त हो गयी। हिंदी में पढ़ा लाभदायी है- तो हिंदी में और हिंदी का अवधारण किया गया। स्वतंत्रता मिल गई अत: राष्ट्रभक्त मसला नहीं रहा, आधुनिकता के कारण भिन्न मसला नहीं रहा। फिर हिंदीतर प्रदेशों में विभिन्न प्रकार के अनुवाद एवं हिंदीतर होने की संस्था ने हिंदी के विकास में बाधा पहुंचायी। इसमें कोई संदेह नहीं कि आज हिंदी के साथ किसी-न किसी रूप से संबंधित लोगों
का संख्या पढ़ने की अपेक्षा बहुत अधिक है, परन्तु इन सभी में हिंदी भाषा की अभिव्यक्ति के लिए समर्पित लोगों की संख्या कितनी हमारे पास एक अवसर आया था जब हम हिंदी के प्रति अपनी प्रतिकूलता अभिव्यक्त कर सकते थे। मेरा संकेत है राज्य की उस शिक्षा नीति की ओर जहाँ हिंदी को वैकल्पिक भाषा बनाया गया। लेकिन हम में से लगभग सभी वह अवसर चूक गए। पूरी ज़िंदगी हिंदी का लाभ और हिंदी से रोटी खाने वाले हिंदी के लोग अपनी मातृभाषा संवर्धन में लगे रहे, अवसर मिलने पर अंग्रेजी के समर्थक भी हो गए। जो हिंदी से वे रूप में अपनी पहचान बनाए हुए वे वे न जाने किन संभवतः राजनीतिक लाभों के लिए चुप रहे। पर इन सब में हिंदी की स्थिति तो रचनातील सहाय व शहदों में 'दुहाजू की बीमारी' ही बनी रही है।

अगर आपने नहीं शिक्षा नीति का मसीदा पढ़ा हो तो आपने देखा होगा कि उसमें हिंदी के लिए कोई जगह नहीं है। अंग्रेजी, संस्कृत तथा श्रीमती भाषाएं, विशेषकर दक्षिण की, उसमें परिलक्षित होती हैं, हिंदी नहीं। यथा इसलिए उसकी विशेषगत विशेष विशेषकर भाषा नहीं है? वैश्विक हिंदी सम्मान इसके लिए अंतर्राष्ट्रीय के तरह काम कर रहा है। गुरुस्वामी में रहने वाले हिंदी लेखकों तथा हिंदी का प्रयोग करने वाले अन्य लोगों के पास अभी भी यह एक अवसर है कि वह हिंदी रचनाशीलता के माध्यम से हिंदी को रक्षा करें।

जय हिंदी!! जय भारत!!

-Argade
નિસાગ્રાહય

ઉ. સ. કે. ખાખર

મહાદ્વીના નિયમશાળા, પુદ્ધ્ર ક્યાલાષ વિભાગ ભૂજનત યુનિવર્સિટી, અમદાવાદ

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પ્રિષ્ઠાવાની :

નિસાગ્રાહય અંગ જવનના સ્ત્રી છે. સાથે સાથે ઉતામ વિકશેન પ્રદૂતિ છે. અને વચ્ચાનની સમાનશીલ અને નિર્ભેદ બનાવે છે. નિસાગ્રાહય સમાન જવન વાળભાદ રહે છે અને જવનની વાળભાદના પરમ શારીરિક અને જનરલ માધ્યમના ભાવના ફેલાવના રેજ બાપ છે. સૂર્યના પરમ વિકશેન હોય છે. પાયું પોતાનું કારચ નિર્દિષ્ટ રહે છે. આ ભી કરા પાયું વાળભાદ તાવા આધાર લાવે છે. પસુ, પન્નું કરા સેલની જવન મહાશીલાના ઉતામ વાળભાદ છે. ઉપરે આક્ષણસાર છે કે ઉપરે ભલિબદ્ધ જવન જેવે છે? ડિલોક કરતી આપણી માધ્યમ પર છે. આપણે જવને લીધે આણુષના પરમ હૃદય કરીને તે પહોંચા તે તેમના કારચની સારાં વિષયે ખાતરિત કરી મુક્દે છે. વધુલી સાધારણ માર અને બોલવાને ઉપગૃહ સામાન્ય હોય, પુદ્ધ્રતઃ અને જવન ક્રશીનું મીઠુ મુશૂ સંગીત આપણા કામે પશુ હોય લાંબાલોડો કુંચર સામાન્યો હોય તો આપણે પરા આનંદ-વિભોર પ્રતયેક લીધે છીએ.

પલીઓના મહુર અખભાજ્ય, ગામ મહિમા પ્રભાવનું, ધોરાણી હળાકશાળી, ધેરાણી ધીરજદારી અને સિંહ, ધા ગળીનો આમ નૈસર્ગિક જવન મહાશીલાની પ્રજ કરેલ સવાધનની જ પીઘલ છે.

નિસાગ્રાહયના વિષંદૃષ્ટા અને નિર્માણ ચેર અને કરા છે. અને વચ્ચાનની સમાનશીલ અને નિર્ભેદ બનાવી છે અને તે રોગની મોટરસાર પ્રજા ઉપસ્થિત કરીને તેથી. રોગો અનેક સપુષ્પે લેવે છે. પછુ તેનું કાય અનેક જે કસ્તરીય વિજ્ઞાન વિવિધ આગર જેનો બધાં.

આ વિજ્જતમી દબો પોરાક તથા દવા દાખલી વિશેષતા પહેરાતી બધી વિક્રમ અને લોલીના પુંભારશીલ શરીરમાં અહીં પોરાક જોડાની કરણા કરવા લાગું છે. પોરાક ફરું તેમજ દવા ફરું જેમાં રાસ્તે છે.

િપથવસ્તુ:

િસતાઓના અંતર વિસ્તારમાં વિશેષ પહેરાતી બધી લોલીના અભિવ્યક્તિ પહેરાતી હોવા છે. પોરાક વિચારો લેવા શકાય છે. લાખેલાનોં પ્રશાંક ધારા છે અને તેની માં ઉપર પણ મોટો કારણ વધુને જય છે. આ કારણો સર્દિઓને અંગ અને વિશેષ વાતો ધારા છે તેની નીચે મળાવાન ભૂમિષ્ઠતા, સુધા, કેસસુ અને તેના દ્વારા સર્જી કરે છે. અને વાસના અંદર ફેલા માનો નિવારણ કરવામાં અસંજ્ઞાન અને તેની કરના શરીરમાં રહેલી વૈજ્ઞાનિક શાંત તાવ, જા, ગાંધમાર અને ટીવી દ્વારા તેની કલ્પના કરે છે અને આ તાવ, જાઝ બોકલા તે રેમા વાતી ફરું શું અને તે દાખલવા કરા દાખલો ઉપયોગ કરીને ફીને, દવા દાખલ ઉપયોગી વૈજ્ઞાનિક શાંત અને વસ્તુદેવી વાતી ધારા છે. શરીરમાં રહેલી વૈજ્ઞાનિક શાંત શરીરને નેત્રની સમાધાનની તાવા પર વે તે સારાંશ સરી આપવાના માગની નિસતાઓની નક્કરા દેકાવા છે. તેમાં...

- ઉપયોગ (ભૂમિરો નિબી)
- પહેરાતી બધી અલાશ
- સુધા જય તથા જય અનગો
- સમગ્ર સુરીદાકલ
- સુધા હાસ
- મુક્કિબદી તામ વધારી માટી
- આશા માટામાં અને હાસયો યુયમાં
- મૂનનયુ
- આશા અને વિશે અને મુખ્ય દાખલાની સમાપ.

િસતાઓના વિસ્તાર અને તેને ઉપયોગ કરતા માગની આગળ વિચાર કરીને તે ફરું નિસતાઓના ઇલેનો શરીરમાં વિક્તેરો શું વાગ વધ્યે છે તે પદ ખાલી કરીને.

િવિષયપ્રદાનની વિભાગત અને તેને ઉપયોગ કરતા માગની આગળ વિચાર કરીને તે ફરું નિસતાઓના વિક્તેરો શું વાગ વધ્યે છે તે પદ ખાલી કરીને. વિક્તેરી-સુધા જઠુમો દેખાશા વધ્યે છે અને આધા તે હામણા છે અંગે માગના અનિદી છે. પરંતુ નિસતાઓના અંગ માટામાં નાલ. તે માન છે કે આપણું સર્જી સાધા સુધા જઠુમોથી બદલી રહે છે અને આ બધા શરીરસાંચર અંગ ફેલા માણના તથા વિચારો દૂર કરવામાં કારણ કરે છે. શરીરો અંદરજત વધેલી માન જેટલી આ જનસુ દૂર કરી તમે આપણે આપણે જશું પણ આલખો વધુ વર્ણ જશે. જ વસ્તીનો સર્જી અંદરજત સુધા છે તેના ઉપર જશું કરી સર્જી અંગ વધેલી કરી દાખલા નથી. જેમાં યથા અને વાત આસાંકો અંદરજત છે તેના જેમમાં શરીરના ઉલાગણ માટેના અલાશ અને પ્રકારના મળશી બદામ જશે, તેની અંદરજત વસ્તીનો જશું ગુમાવી હોય છે અને તેની ના તખી જશું પોરાક ધારા છે અને શરીરની સાથી કરવા માટે હાસ છે, જેમાં આપણે રેમા વધુ આને શરીરની છીએઓ.

Chavda

Vidya

Chavda

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शक्ति अनेक सूचनात्मक शक्ति. वातावरण में शक्ति की गोलापियाँ गोप-गोपीयों साथ नैसर्गिक ज्वलन शक्ति. इन परिस्थितियों
जेंद्रने प्रेम अनेक शारीरिक सरिता प्रदर्शन. धर्ममण अनेक नैसर्गिक ज्वलन व्यवस्थापन वीरि ज निर्भयताबी सिंहनु भी कारणे तेस दंत गणी शक्ति. अनेक तापुसंतो निर्माणनां सतत शंकर में रही तानानां तापमयी तापमयी जनी आयुष्मां राही जनी आयुष्मां सारी अन्य व्यक्ति करी रही है. नैसर्गिक ज्वलन ज व्यक्तियों ज्वलन मुक्त करे जने अनेक आयुष्मां रह्यां गाँवी है.

संदर्भ:
मुकुटार, १८८५, वृ. जयंति हाकिर शक्तिक शिक्षारी, अम्बावाड.
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Positive Goal Setting

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Abstract
Many people begin their career in management with high hopes of making an impression on their bosses by developing the business or by implementing new and better ways of doing things. Unfortunately, most of them find that they are so busy handling day-to-day issues that there never seems to be time for anything else.

Furthermore, comparatively few people have tangible goals; most have the awareness that things could be improved but only vague ideas about how to achieve these improvements.

All tasks are either reactive or proactive. Reactive tasks are when you react to situations that occur, and are driven by events and the actions of other people. Conversely, proactive tasks are when you seek opportunities to make a positive impact in the workplace and are driven by you.

This Article will throw some light on management students / employees to be proactive in positive Goal Setting. Behaving proactively revolves around anticipating events and using initiative to predict the likely outcome, whilst being in a position to respond and take the appropriate action when needed.

Those who gain recognition and promotion in organizations are usually those who are proactive;
they are those who use their initiative to make things happen. In order to truly be proactive, however, there are two things that need to be addressed.

The first is that a certain amount of time needs to be freed up from handling routine tasks, resolving crises, and handling interruptions.

The second thing that you need to do is to be able to set positive goals that will inspire you and your team to make things happen. Setting goals that motivate people is not easy and requires effort and good judgment.

This article will also provide new direction for other research to the scholars.

Keywords : Goal, Goal Setting, Positive Goal Setting, Motivation.

Introduction

Goal: A goal is a desired result a person or a system envisions plans and commits to achieve a personal or organizational desired end-point in some sort of assumed development. Many people endeavor to reach goals within a finite time by setting deadlines.

Goal Setting: Goal-setting ideally involves establishing specific, measurable, attainable, realistic and time-bounded (S.M.A.R.T.) objectives. On a personal level, the process of setting goals allows people to specify and then work towards their own objectives most commonly, financial or career-based goals. Goal-setting comprises a major component of personal development.

The Positive Psychology of Goal Setting

Having goals can help you live the life you want. It can give you a focus and some direction. This article outlines why setting goals can be beneficial for your wellbeing. It also discusses how your character strengths can be used to assist you in setting and achieving goals.

The benefits of goal setting:

Hope and optimism

Goals give you a focus and something to look forward to. They give your life a purpose and increase your feelings of hope and optimism. Whether your goals are long term or short term, you are giving yourself a reason to get up in the morning. The link between hope and goal setting goes both ways. Thinking about and planning your goals can increase a feeling of hope and optimism. This optimism can then boost your ability to achieve your goals. It will also assist you in planning more goals in the future. A person with hope is able to define their goals, know how they are going to get there and are motivated to achieve them. Furthermore, hope will help a person work through any complications and so not give up when things get difficult.

Taking control

If you set and achieve daily goals, these will add up to some major goal accomplishments at the end of the year. And it’s all your own work. Happy people take control of their lives, rather than just drifting or let others make the decisions. Recognize the feeling of control and empowerment as you establish and then accomplish your goals. Imagine you have a deadline at work (something you cannot control). However, how would it be if you made the decision to meet that deadline ahead of time? Or if you are the sort of person that tends to go over deadlines, making excuses
all the way, turn this around and work hard to meet that deadline.

Recognize how much you can do. Even a shift in attitude can give a feeling of mastery. Being able to overcome hurdles and developing a more constructive attitude to the things you cannot control is a great confidence booster.

**Flow experience**

By setting yourself regular, meaningful goals you position yourself to encounter more flow experiences. A flow experience is one where your whole consciousness is absorbed with a particular activity. Thoughts of time and other needs (such as hunger) are forgotten. Positive psychologists generally agree that the more flow experiences a person has, the happier they are. Goals give us something we can actively get involved with, which is an essential ingredient to a flow experience.

To achieve this state it is important to have a clear purpose. So clearly defining your goals is a good start. Also, you will want to choose a goal that is challenging for you, but is not out of your depth. If it is not challenging enough, you will almost certainly become bored. It is worth reviewing your goals on a regular basis to help keep you motivated. Furthermore, try to obtain regular feedback so you are aware of how you are doing. Support from others can be a good idea, else make sure you track your progress in some way.

Goals and the flow experience have a good relationship. By setting goals we enhance our chances of experiencing flow. By experiencing flow, we are more likely to achieve our goals.

**General wellbeing**

Having goals in our life is good for our wellbeing. It provides us with an opportunity to go on a journey which we can learn from and enjoy. It helps a person appreciate their capabilities, gives life a purpose and increases optimism. As such, it can reduce stress and help reduce the chances of developing depression.

Carrying out goal-related tasks gives a person focus and increases happiness.

**Goal setting and your strengths**

When setting and working on your goals, consider how you might use your personal strengths to help you achieve your objectives. It is worth knowing what your top strengths are as these are the ones that are most effortless to use and so drawing on them should be a great motivator.

**Consider how the following strengths may assist you when setting up your goals:**

Curiosity, creativity and love of learning may assist you in your brainstorming. This may be useful when you are considering which goals to set, how you are going to achieve them and ways to overcome potential difficulties. Bravery can help you reach for those huge goals you’ve never quite got off the ground. This strength will enable you to act, in spite of your misgivings. If persistence is your strength, then you are sure to achieve the goals you set yourself. Having humor as your strength will enable you to laugh if things go wrong, as you see the lighter side of life. Prudence can help you set the right goals as you are able to consider whether the goal you think you want now is one you will want in the future. Being authentic means you will remain true to yourself when setting your goals. It ensures you are doing them for yourself and not other people.

Another way you can make use of personal strengths when setting goals, is to actually set
a goal dedicated to developing a particular strength. For instance, you might want to work on being kinder, so decide to volunteer at an organization that helps other people.

Alternatively, you could use goal setting as an opportunity to nurture a particular strength, although the strength is not a goal in itself. For instance your goal is to write a novel. However, along the way you decide to exercise your gratitude strength and so make a conscious effort to acknowledge those people who assisted you in working towards your goal.

Whatever goals you set yourself, enjoy the process and reflect on how they are benefiting you along the way.

**Observation**

Did you know that most people who try to attain their personal goals fail? This is especially true of behavior changing goals such as weight loss, smoking cessation, alcohol and drug abuse programs.

For example, the majority of people who start a weight control program and achieve their weight loss goal (so we exclude those who attempt, go part way, and then fail) will be at or in excess of their previous weight level one year later. There are similar failure rates for other programs designed to control smoking, drugs and alcohol.

As looked further into this, what was puzzling that most of these programs are technically correct. For example, if you follow what most weight control programs suggest you will lose weight. The addiction control programs methods are sound. So why do these goals setting programs fail so broadly? Certainly it is not due to lack of desire on the part of those Who try these programs to achieve their personal goals? If a person is involved in weight control, he / she will say “I want to lose weight”. If smoking is a problem, he will say “I want to quit smoking “. If drinking is problem, he will say “I want to stop drinking”. What are “lose,” “quit,” and “stop”? All negative goals. And that’s the problem.

We naturally move towards positive goals and intuitively away from negative goals. We are pleasure-seeking organisms who seek pleasure and avoid pain. Lose, quit, and stop are all negative goals. (The first three letters of a diet are “die.”)

So why do we ever get involved in these negative goal programs in the first place? Typically, it is a negative emotion such as fear or anger. We fear what is happening to our health or are angry with ourselves for what we have done and, based on that emotion, we now submit ourselves to do these negative things such as lose, quit, and stop, much like we would punish a child.

Then one of two things occurs. We fail and nothing more really matters. Or we succeed. As we succeed, we start to get confident and somewhat cocky.” He haven’t had a cigarette in three days!” As we gain that confidence, the negative emotions that brought us into the negative control program in the first place start to weaken. And when those negative emotions, the anger and the fear disappear, we go right back to our previous behavior.

**Conclusion**

To increase our chances for achieving any goal, we need to frame it as a positive goal with a positive outcome. Don’t tell yourself you are going to “lose” weight. Say, “I am going to get into a size 8 dress by next summer.” Instead of “quitting” smoking, how about, “I am going to
get fresh, pink new lungs and more money in my pocket.” Rather than “stop” drinking, instead see yourself waking up with a clear head, without a frequent hangover. We will move more naturally and comfortably toward the achievement of a POSITIVE goal.

The mind will more readily accept a positive goal and not automatically try to find ways and rationalizations to sabotage us as with a negative goal.

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