Indian J.L.Sci. 4 (1) : 13-16, 2014

ISSN : 2277-1743 (Print)
ISSN : 2278-7879 (Online)

# MICROFLORA DEGRADING THE MUNICIPAL WASTES BY FUNGI

**SHILPA LOKHANDE[a1] AND M. MUSADDIQ[b]**

[a]Shri D.M.Burungale College of Arts and Science, Shegaon, India
[b]P. G. Department of Microbiology, Shri Shivaji College of Arts, Commerce and Science, Akola, M.S., India

## ABSTRACT

**Cellulases are synthesized in nature by a number of fungi and bacteria. The cellulolytic microbes occupy a broad range of habitats. These microbes play a major role in converting the complex polysaccharides into simple sugars, which they assimilate. The cellulolytic microorganisms are ubiquitous in nature and they include protozoa, fungi and bacteria. Microbial cellulases find applications in various industries and constitute a major group of industrial enzymes. This study was aimed to screen the cellulolytic ability of fungi from native environmental source. Out of 114 fungal cultures isolated from saline belt of Akola and Buldhana District 80(70%) were found to posses cellulose degrading ability. Cellulolytic fungi belonged to *Aspergillus* spp., *Trichoderma* spp., *Fusarium* spp., *Penicillium* spp., *Rhizopus* spp., and *Cladosporium* spp. *Trichoderma* viride showed high cellulase activity followed by *Cladosporium* spp. *A. niger*, *Penicillium* spp. and *Fusarium* spp. showed moderate while *Rhizopus oryzae*, *Rhizopus* spp., showed low cellulase activity.**

**KEYWORDS :** Cellulases, Municipal Solid Waste, Saline Belt, Cellulose Degrading Fungi

The ability to secrete large amount of extracellular protein is a characteristics of certain fungi and such a strains are most suited for production of higher level of extracellular cellulases. One of the most extensively studied fungi is Trichoderma reesei,which convert native as well as derived cellulose to glucose.Most commonly studied cellulolytic organism include: Fungal species- *Trichoderma, Humicola, Aspergillus, Penicillium*.

Bacteria and fungi are frequent microbes in soil, manure and decaying plant tissues that are able to degrade domestic wastes and their distribution patterns are correlated with the substrate organic matter (Alexander M.1961). Fungi use wastes for their metabolism and produce some simple and useful compounds that are important for soil health, plant growth and overall to keep a natural ecosystem well balanced. In biological processes, aerobic microorganisms biodegrade or mineralize solid waste completely into C, H compounds and mineral salts (ADB 2000).

Among microorganisms, fungi are of great interest for enzyme production because they excrete their enzymes extracellularly (Damisa et al., 2011) Micro-organisms from relevant environments previously exposed to hydrocarbons possess greater degradation capabilities on related wastes in the biodegradation process (Book of standards 1986). Fungi play an important role in bioconversion/ composting of organic waste and can be an important contributor to optimal agricultural waste bioconversion (Bari et al., 2007)

According to geological survey of India it was reported that the saline belt of Purna river basin is a part of Payanghat plains where to its north is Melghat and Ajanta mountain ranges to the south. Due to volcanic eruption on the nearby Satpuda ranges this land becomes arid as a result of deposition of alluvial. Hydro geologically, the Purna river basin is the worst alluvial tract of India though its water holding capacity is good. Secondly Purna River remains dry throughout the year except for the rainy season. The Purna river basin lies between latitude 20-40 to 21-45 and east longitude 76- 20 to 77-45. Purna River originates from Gawilgarh hills of Satpuda near Bhaisdehi in Baitul district of M.P. The Purna River travels through Akola, Amravati, and Buldana districts of Vidarbha region and finally meets Tapi River that eventually meets the Arabian Sea. Purna river basin extends east-west for a stretch of 170 kms and width of 55 kms. Total area covered is 6200 sq km out of which 3000 sq km comprising 547 villages is characterized as saline belt. Soil of saline belt of Vidarbha region is highly alkaline possessing pH ranging between 7.9 to 9.1. (Deshmukh and Vidhale, 2014)

Implementation of composting technology has great potential for mitigating several problems related to an ecological imbalance due to loss of nutrients from ecosystems and the disposal of organic wastes that cause water, soil and air pollution and corresponding health hazards.(Gautam et al.,2011) Therefore, the present investigation was carried out to isolate effective fungal strains from municipal solid waste from saline belt of Akola

[1]**Corresponding author**

and Buldhana District in order to identify and optimize their culture conditions. Further, these fungal strains were applied to decompose municipal solid waste (MSW) to determine their potential as bioconversion agents.

## MATERIALS AND METHODS

### Collection of Samples

For isolation of effective fungal strains, different types of samples, such as garbage and MSW were collected from different Villages of Saline belt of Akola and Buldhana District. These samples were obtained by digging to 15 cm depth with sterile spoons and were collected in sterile plastic pots. The samples were transported to the laboratory and stored at 4°C until use.

### Isolation, Identification and Maintenance of Microbial Strains

Soil dilution plate method (Waksman 1927) was employed in the present work to isolate di erent fungi. The 100µL portions (10−4 and 10−6) of the suspensions were inoculated onto plates containing potato dextrose agar (PDA) the plates were incubated at 30± 2°C for 48 days.

All the fungal isolates obtained from MSW, and composts and soils were identified according to cultural and morphological basis (Raper 1949). The identified strains were maintained on PDA and NAM slants at low temperature (4 ±1◦C).

### Screening for Cellulolytic Activity

The isolated Fungi were grown on basal salt media supplemented with 1% carboxymethylcellulose. The pure cultures were inoculated in the centre with almost equal amounts and incubated at 30 ± 2◦C until substantial growth was recorded. The Petri plates were flooded with Congo red solution, and after 5min the Congo red solution was discarded, and the plates were washed with 1M NaCl solution allowed to stand for 15 20 minutes. The clear zone was observed around the colony when the enzyme had utilized the cellulose. (Gautam et al., 2012).

## RESULTS AND DISCUSSION

A total 114 isolates were isolated of these 80 were belonged to cellulose degrading fungi. These were *Aspergillus* spp., *Trichoderma* spp., *Fusarium* spp., *Penicillium* spp., *Rhizopus* spp., *Cladosporium* spp. and *Trichoderma viride*.

**Table 1 : Details of Sample Collection from Varanasi Location**

| Taluka | Name of Village | No. of Sample | Types of Material and no. of Sample | | | |
|---|---|---|---|---|---|---|
| | | | soil | Plant residue | Compost | Mixed MSW |
| Akola | Kati | 01 | 01 | | | |
| Akola | Pati | 01 | | | | 01 |
| Akot | Khanapur Bk | 01 | | | 01 | |
| Akot | Rel | 01 | | 01 | | |
| Balapur | Zural kh. | 01 | | | | 01 |
| Murtizapur | Mana | 01 | | | | 01 |
| Telhara | Sirsoli | 01 | | | | 01 |
| Jalgaon Jamod | Iiora | 01 | | | 01 | |
| Jalgaon Jamod | Asalgaon | 01 | 01 | | | |
| Nandura | Isarkhed | 01 | | | 01 | |
| Nandura | Isabpur | 01 | | | | 01 |
| Malkapur | Harsoda | 01 | | | | 01 |
| Malkapur | Chincholi | 01 | 01 | | | |
| Sangrampur | Itkhed | 01 | | 01 | 01 | |
| Shegaon | Adsul | 01 | | | | 01 |

**Table 2 : Zone of Cellulose Degradation By Organism From Different Sources**

| Sr.No. | Culture | Source | | | Zone of clearance(mm) |
|---|---|---|---|---|---|
| | | Soil | MSW | Compost | |
| 1 | *Aspergillus niger* | + | + | + | 3.6 |
| 2 | *Aspergillus spp* | + | - | - | 2.7 |
| 3 | *Cladosporium spp.* | + | + | - | 3.4 |
| 4 | *Fusarium spp.* | + | + | + | 1.5 |
| 5 | *Penicillium digitatum* | - | - | + | 2.7 |
| 6 | *Penicillium spp.* | - | + | - | 1.9 |
| 7 | *Rhizopus oryzae* | + | + | + | 2.3 |
| 8 | *Rhizopus spp.* | + | + | + | 1.3 |
| 9 | *Trichoderma viride* | - | + | + | 4.4 |

The numbers of microbes isolated and details of samples collection from various location are shown in table 1.It was found that fungi isolated from15 different villages of saline belt of Akola and Buldhana district were potential cellulose degrader.

The results of screening showed that degradation of cellulose by tested isolates differ from organism to organism. Out of 114 isolates tested, cellulolytic activity was detected in 80 different isolates after 4 days of incubation indicating to be cellulose degraders. The cellulase activity of fungal cultures was confirmed by congo red dye decoloration The diameter of yellow halo varied from organism to organism. The results thus obtained by the above methods were very much the same and matched with earlier reports of Gautam et al., (2012) Similarly reports were made by authors Gautam et al.,(2010) reported that cellulose activity of *Aspergiluus fumigatus* and *Trichoderma* sp.1 were found relatively higher side.Sri Laksmi and Narsimha (2012) were isolated the four fungal cultures three belonged to *Aspergillus* and one belonged to the genus *penicillium* for cellulose degradation. Table 2 shows zone of cellulose degradation by organism isolated from different sources.

## CONCLUSION

From the results,it may be concluded that the Trichoderma viride will be high cellulose degrader and will be the potential strain for biodegration of Municipal Solid Waste within a short period to protect our environment.

## REFERENCES

Alexander M. 1961. Microbiology of cellulose. In: Introduction to Soil Microbiology (2nd Ed.). Johnwiley and Son, Inc. New York and London.

Asian Development Bank and ADB Institute Partnerships for Better Municipal Management., 2000. Manila: ADB, Philippines.

Book of Standards, 1986. American Wood-Preservers Association, Stevensville, Maryland.

Bari M. A., Begum M. F., Sarker K. K., Rahma M. A., Kabir A. H., Alam M. F., 2007. " Mode of action of *Trichoderma* spp. on organic solid waste for bioconversion." Plant Environ. Develop., 1: 61-66.

Damisa D., J.B.Amen and N.E.L. Edge., 2011. " Cellulase Production by native Aspergillus niger obtained from soil environments" Journal of fermentation technology and bioengineering 1:62-70

Deshmukh A. A. and N. N.Vidhale, 2014. "Screening the antibacterial Actinomycetes from saline soil of Vidarbha Region". Indian Journal of Applied Research, 4 (**3**) : 20-21

Gautam S. P., P. S. Bundela, A. K. Pandey, Jamaluddin, M. K. Awasthi, and S. Sarsaiya, 2012. "Diversity of Cellulolytic Microbes and the Biodegradation of Municipal Solid Waste by a Potential Strain" Hindawi Publishing Corporation International Journal of Microbiology Volume , Article ID 325907, 12 pages.

Gautam S.P., P. S. Bundela, A. K. Pandey, M. K. Awasthi, and S. Sarsaiya, 2010. "Screening of cellulolytic fungi for management of Municipal Solid Waste" Journal of Applied Sciences in Environmental Sanitation, 5(**4**):391-395

Raper K.B.and C. Thom, 1949. A Manual of the Penicillia, Williams & Wilkins, Baltimore, Md, USA,

Sukumaran R. K., R. R. Singhania and A. Pandey, 2005. "Microbial Cellulases production applications and challenges,"Journal of Scientific and industrial Research, 64: 832-844

Sri Lakshmi A. and G. Narasimha, 2012. "Production of Cellulases by fungal cultures isolated from forest litter soil".Ann.For.Res. 55(**1**):85-92

Waksman S.A., 1927. "Principles of Soil Microbiology", Williams & Wilkins, Baltimore, Md, USA.