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Research Article

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Bioremediation of Various Agro Waste Using Microorganism in Hadoti region of Rajasthan

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ABSTRACT

Bioremediation is the use of microorganism metabolism to degrade or remove waste materials contaminants (sewage, domestic and industrial effluents) into non-toxic or less toxic materials by natural biological processes. For the degradation of waste material biomass various microorganisms was used. The best response was observed in Trichoderma viride. It gave good degradation effect in every type of waste like temple waste, vegetable waste, fruit waste and saw dust waste.

Key Words: *Bioremediation, contaminants, microorganism sewage, domestic and industrial effluents.*

INTRODUCTION

Waste is a necessary by-product of virtually any industry. The agricultural industry produces a large amount of waste every year. This includes animal waste as well as food residual waste. Animal wastes from farms may include bedding material and also wash down water. The food harvesting and production industry generates crop residuals, as well as pre- and post-consumer food wastes. There is a need to find ways to deal with these wastes other than by sending them to landfills.

Types of Bioremediation: Mycoremediation

This method makes use of fungi to remove chemical contaminants from the soil. It is one of the more modern methods. In this method, the fungus makes use of certain enzymes and acids that it naturally secretes to decompose the hazardous chemicals into less or non toxic compounds.[1]

This process utilizes very specific fungi for specific contaminant, therefore making it a difficult method to some extent. But it is a very environmentally friendly method. The use of mycoremediation in the removal of diesel, zinc and chemicals from contaminated soil has been reported.[2] The diesel is biodegraded to Carbon (IV) Oxide and water after the fungi has acted on it. The removal of zinc from soil polluted by effluents from textile industries was studied using two fungi strands *Ahspergillus Fumigatus* RH05 and *Aspergillus Flavus* RH07.[3]

The result indicates that by varying the conditions of pH and temperature, the two strands were very effective at removing zinc from the effluent.

Phytoremediation

This method uses plants to control and remove pollutants from the soil, air, and water. Organic and inorganic waste such as metals, sewage, sludge, salts, leachates, metalloids and xenobiotic contaminants can be removed by this method.[2] There are three ways by which plants can remove pollutants. They are through phytoextraction, phytostabilization and phytotransformation.

Bacteria Bioremediation

This method makes use of bacteria to clean up environmental contaminants such as oil spills, mine effluents and even human waste through its natural metabolic process.

Bacteria bioremediation may be achieved in any of the follow methods:

(A) Ex-Situ Methods

Bioreactor-A slurry or sludge of the contaminated soil is placed with microorganisms in a vessel. The bioreactor provides a controlled, optimal environment for metabolic activity and degradation of contaminants.

Land Farming-which involves spreading of contaminated soil over an area and either apply specialized bacteria or allowing indigenous bacteria to metabolize the contaminants.[4]

Biocell Treatment-which is similar to land farming except that the contaminated soil is placed in a pile with alternates vent layers to provide oxygen needed for bacteria growth.

(B) Insitu Methods

Biostimulation-involves the management of a naturally occurring microbial population to monitor or provide an environment that optimizes the growth and activity of microbes. Methods of biostmulation include biorenting, air sparging, nutrient addition and oxygenation.[5]

Present study was aimed to degrade various agro wastes using microorganism.

MATERIAL AND METHODS

There are two main methods of bioremediation of agro waste. Both methods rely on the degradation of organic matter by microorganisms to reduce volume, moisture, and odor from volatile organics. The first method is anaerobic digestion. Digester systems consist of a vessel in which the waste is heated to a certain temperature, to allow the microorganisms to consume at an efficient rate.

The other method is composting, an aerobic process where microorganisms break down the organic material in the waste when air and water are added to the waste product. The method in which this is done varies widely, from using simple composting piles to composting vessels. Yet another option is to combine one or more composting methods, incorporating the beneficial aspects of each, to produce the desired composition of compost.

Reasons for processing organic wastes

There are several reasons for processing these wastes through bioremediation. One of the biggest reasons is the reduction in waste volume that can be accomplished through this method. Since transportation and disposal costs are based either on weight or volume, there is a need to minimize these parameters, especially to eliminate weight due to water content. Processing these wastes can reduce unpleasant odors associated with these wastes. Bioremediation also kills pathogens and conserves valuable nutrients in the waste product. These nutrients can then be used as soil amendments, rather than wasting valuable nutrients by placing them in landfills.

Isolation of fungal culture

Fungal species was isolated from soil samples by using potato dextrose agar (PDA) medium. Samples were inoculated over plates by multiple tube dilution technique and the plates were incubated at 26°C for 4 days. The fungal colonies which were picked up and purified by streaking and incubated at 26°C for 7-8 days. The culture was maintained on PDA slants.

Maintenance of culture

A loopful of inoculum from sub cultured plates of Fungal species were transferred to Potato Dextrose Agar (PDA) slants and maintained as pure culture.

For laboratory studies, the fungus was cultured on PDA medium. The medium was sterilized at 15 psi for 30 min in autoclave, poured to sterilized plates, cooled and inoculated with pure culture of the fungus under aseptic conditions.

The plates were then incubated at room temperature (26±2°C) for ten days. After complete sporulation, conidia from the medium were harvested by washing them thoroughly with sterilized water containing Tween-20 (0.2%) for immediate use. Otherwise, spores were harvested with the help of a small sterile metal spatula. Harvested conidia were air dried under laminar air flow and stored in a small air tight screw cap vials (10 cm with 2.5 cm diameter) in refrigerator at 4°C before using for further studies. Colony forming units (cfu) were estimated by plating technique.

RESULTS AND DISCUSSION

In the present study, several naturally available substrates of both solid & liquid media were tested for mass multiplication of fungal culture. The success of bioremediation depends not only the isolation, characterization & pathogenicity, but also on the successful mass production of the fungal agent in laboratory. Current research

efforts were directed at selecting native fungi, characterizing them assessing their virulence and developing a formulation for them. The results obtained are discussed herein.

Table: 1

Microorganism: *Trichoderma viride* Incubation Period: 6 week Temperature: 25 ˚C					
Waste	Vol.(gm)	Moisture	Odor	Color	pH
Temple waste	10	15-18%	putrid	dark	7.3
Vegetable waste	20	30-35%	putrid	muddy	7.5
Fruit waste	30	40-45%	pungent	brown	6.5
Saw dust waste	35	50-60%	ethereal	golden	7.1

Table: 2

Microorganism: *Beauveria bassiana* Incubation Period: 6 week Temperature: 25 ˚C					
Waste	Volume	Moisture	Odor	Color	pH
Temple waste	15	20-25%	pungent	dark	6.2
Vegetable waste	20	15-20%	putrid	dark	7.1
Fruit waste	25	38-41%	pungent	brown	7.5
Saw dust waste	40	60-70%	ethereal	golden	7.8

Table: 3

Microorganism: *Verticillium lecanii* Incubation Period: 6 week Temperature: 25 ˚C					
Waste	Volume	Moisture	Odor	Color	pH
Temple waste	18	16-20%	putrid	dark	7.4
Vegetable waste	23	33-35%	putrid	dark	7.8
Fruit waste	30	32-35%	pungent	dark	6.5
Saw dust waste	38	58-64%	ethereal	golden	6.1

Table: 4

Microorganism: *Metarhizium anisopliae* Incubation Period: 6 week Temperature: 25 ˚C					
Waste	Volume	Moisture	Odor	Color	pH
Temple waste	20	20-22%	putrid	muddy	7.6
Vegetable waste	25	33-35%	putrid	Dark muddy	7.8
Fruit waste	30	45-50%	putrid	brown	7.5
Saw dust waste	38	60-70%	ethereal	golden	8.0

CONCLUSIONS

Bioremediation of agricultural wastes is growing rapidly, as demonstrated by the growing number of new facilities in use. Miceoorganisms are also used for remedation process. *Trichoderma viridie*, *Beauveria bassiana*, *Verticillium lecanii*, *Metarhizium anisopliae* were tested for remedation of waste materials like temple waste, vegetable waste, fruit waste and saw dust waste. Each microbe was incubated individually in waste for appropriate time period. *Trichoderma viridie* proved as a good remediasing agent. It gave best result comparatively other micro organisms. it degrade waste without polluting the environment.

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