

STUDY OF MICROBIOLOGICAL ACTIVITY IN THE CONVERSION OF SUGARCANE PRESSMUD INTO BIO- ORGANIC MANURE

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ABSTRACT

Bio-compost is a material which contains live micro-organisms exhibiting beneficial characteristics towards the growth of plants and also in soil development making the soil more fertile. Bio-composting of sugar-cane press-mud is a composition of Organic fertilizer and Bio-fertilizers where a unprocessed biological nature. i.e., plant material and living micro organisms which are agriculturally useful in terms of nitrogen fixation, phosphorus solubilisation or nutrient mobilization have been altered together through mobilization have been altered together through microbiological decomposition processes increase the productivity of the soil or crop. Bio-Composting is the degradation of organic matter by various microbes in a moist, favourable environment. Composting takes place aerobically or an-aerobically in the environment. Five different varieties of plants were grown for enumeration of the quality of the bio-compost prepared in the trial windrow. The varieties of plants grown were namely Tomato, Chili, Cabbage, Brinjal. The Bio-compost was prepared in farm by sugarcane wastes such as baggase and the dried sludge from Sugar Effluent Treatment Plant was mixed with it. Aerobic condition was maintained by regular tumbling of the trial bio-compost windrow and continuous monitoring of Temperature, pH and Electrical conductivity was done. Physico-chemical and microbiological results were performed once a week or as and when required. After proper degradation of the baggase the bio-compost was used in the cultivation of the plants in selected plot. The essential factors such as N: P: K was maintained by the selected strains of micro-organisms and it was also checked that no pathogenic activity by any microbes occurred while preparation of the bio-compost.

Keywords: *Bio-compost, Physico-chemical, Organic fertilizer, Bio-ertilizers, Microbiological, Pathogens.*

1. INTRODUCTION

The bio-composting of sugar-cane press-mud with addition of effective microbial strains culture in bio-fertilizer enhances the growth factor of crops, makes the crop disease resistance and helps it tolerate the pollutant activity of soil which may have raised due to earlier use of agrochemicals. The application of bio-

compost is considered an important component of nutrient management and a eco-friendly alternative to chemical based farming with cost-effective input and a sustainable way of agriculture crop production. Waste and microbiology studies are becoming increasingly important for understanding the roles of micro-organisms that play in agricultural productivity. Microorganisms are playing an important role in the bio-composting process through the generation of enzymes, which help while the degradation of plant based organic waste materials like cellulose, lignin hemicelluloses, etc. (Vargas Garcia et al., 2010) The increase of pH in the initial period of composting might be due to the evolution of ammonia from the nitrogenous sources during composting (Rashad et al., 2010). The C:N ratio of different treatment reflects the organic waste mineralization and stabilization. The microbial population of soils is made up of five major groups including bacteria, actinomycetes, fungi, algae and protozoa, and among these groups, bacteria are the most abundant group and the most important microbe for degrading waste.

Composting can be aerobic and anaerobic. Different species of bacteria are responsible in each case, different chemical changes takes place and different temperatures are reached (Hussain and Naser, 2013). Microorganisms are increasingly becoming an important source in the search for industrially important molecules. In soil 80-90% of microorganisms remain unidentified whereas these biological communities are known to play a dominant role in maintaining a sustainable biosphere. Microorganisms are highly considered valuable as they are used in composting, fermentation processes, in brewing, baking and in production of various antibiotics and vaccines. The composting process always occurs in nature, however many artificial measures have been developed to improve composting efficiency. Over the past years, effective inoculation has been reported by several researchers. Various specialized inoculums have been applied in practice. Several authors have been reported composting using different bulking agents (Gautam et al., 2007; Rosazlin et al., 2011; Tripetchkul et al., 2012; Harrison et al., 2014). Recently addition of microorganisms to speed up composting and increase the nitrogen content in the waste to improve the microbiological degradation is actively investigated (Vargas-Garcia et al., 2007; He et al., 2008; Li et al., 2011).

2. MATERIALS AND METHODS

2.1.1 Sample Collection:

In the present study, isolation of microorganisms were done from soil/root sample, pond water and ETP sludge namely, Cyanobacteria (blue-green Algae), Rhizobium sp. and Aspergillus sp. The leguminous roots were dipped in Ethanol for few minutes and then wiped with tissue paper to remove any foreign particles. Microbes were isolated in Buffered Peptone Water and BG11 broth. Serial dilution technique was performed from 10^{-1} – 10^{-8} dilution to isolate the micro-organisms. Pour plate Method was done in Differential Media namely Nutrient Agar for Cyanobacteria sp. and Aspergillus sp. Sprinkle method and pour plate method was performed to isolate the Rhizobium sp. from roots and soil sample

respectively. Pure culture was isolated in Soyabean Casein Digest Agar/ Nutrient Agar for Rhizobium sp., CyanoAgar for isolation of Cyanobacteria and Sabouraud Dextrose Agar for Aspergillus sp. Further microscopically observation was done for enumeration of morphology of the colonies. Isolated pure cultures were preserved on freshly prepared slant. Shredded sugarcane baggase was collected from sugar manufacturing industry for the preparation of Bio-compost. Plant seeds were collected from vendor.

2.2.2 Sample Preparation:

The isolated microorganisms preserved in slant were further processed for Microbial Consortium in double stranded Soyabean Casein Digest Medium. The baggase was laid on the plot scale trial in Windrows. The Microbial Consortium was diluted with sugarcane treated effluent water to check controlled growth of Microbes and to prevent the growth of any pathogenic micro-organisms such as Escherichia coli sp., Salmonella sp., Pseudomonas sp., and Staphylococcus sp. Windrow was sprayed by the diluted Microbial Consortium and tumbling was done by Aero tiller. The windrow was turned on a regular basis to improve the oxygen content, distribute heat to regulate temperature and to distribute moisture equally in the windrow.

Methodology for Microbiological Analysis:-

- Enumeration of Total Bacterial Count and Total Fungal Count as per IS 5402:2012, RA 2018
 - Homogenized the sample manually then took 10g of the sample in 90 ml diluents (0.1 % Buffered Peptone Water) to make initial dilution (1: 10).
 - Transferred 1 ml of the above stock to 9 ml of the diluents making it to 10^{-2} dilution repeated same procedure up-to 10^{-8} dilution.
 - Transferred 1 ml from each dilution to sterile Petri plate.
 - Poured about 15-20 ml of melted Nutrient Agar media into the Petri plates.
 - Mixed the inoculums with media by gentle rotation and allowed to solidify.
 - Incubated the plates in inverted position at 37° C for 24 – 48 hours.
 - Count the number of colonies in the range of 10-100 colony forming units by using Quebec Colony Counter and report in Cfu/g.

3. Results and Discussions:

The prepared bio-compost was analysed microbiologically to determine Total Viable Count, cfu/g including TBC (Total Bacterial Count) & TYMC (Total Yeast and Mould Count) and Pathogens were also tested to determine the biological properties of the sugar-cane press-mud. The plants were observed to grow well and yield in the plants were also observed to be quiet productive.

A. Microbiological analysis results of Sugarcane press-mud:-

S. No.	Microbiological parameters	Obtained Values "0" day	"15" day	"30" day	"45" day	Specified/ Desired Limits (As per FCO)	Comments
01	Total Bacterial Count, cfu/g	25 x10 ⁷	45 x 10 ⁷	46 x 10 ⁷	80 x 10 ⁷	NLT 50 X 10 ⁷	Complies with the limits mentioned in FCO
02	Yeast & Mould Count, cfu/g	10 x 10 ⁷	70 x 10 ⁷	55 x 10 ⁷	60x 10 ⁷		
03	Escherichia coli/25g	Absent	Absent	Absent	Absent	Absent	Complies
04	Pseudomonas aeruginosa/25g	Absent	Absent	Absent	Absent	Absent	Complies
05	Staphylococcus aureus/25g	Absent	Absent	Absent	Absent	Absent	Complies
06	Salmonella/25g	Absent	Absent	Absent	Absent	Absent	Complies
07	Isolation and Identification of Bacteria	Cyanobacteria sp. and Rhizobacterium sp.	-	-	-	-	Isolated from the soil and pond water sample
08	Isolation and Identification of Fungus	Aspergillus sp.	-	-	-	-	Isolated from ETP waste sample

Conclusion:-

After completion of 45 days, Pathogenic parameters were found to be absent in the press-mud and complied within the specified and desired range, as prescribed in Fertilizer Control Order for Organic manure. After completion of the 45 days, it was observed that the Total Bacterial Count increased from 25x10⁷ to 80 x10⁷ and the Yeast and Mould count also increased from 10 x10⁷ to 60 x 10⁷ CFU/g as given in Table A. which signifies the conversion of press-mud samples into organic matter.

The Organic C: N ratio also reduced from 20.9 to 15.2 in 45 days due to action of microbes inoculated in the form of Consortia.

Acknowledgement:-

I would like to acknowledge and give my warmest thanks to my supervisor Dr. Dhanendra Kumar Rai, who made this work possible. His/her guidance and advice carried me through all the stages of writing my paper. I would also like to thank the HOD and all members of Shri Venkateshwara University. I would also like to thank my parents for their continuous support and understanding when undertaking my research and writing my project.

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