International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

E-ISSN 2347-2677
P-ISSN 2394-0522
https://www.faunajournal.com
IJFBS 2024; 11(2): 27-29
Received: 25-01-2024
Accepted: 27-02-2024

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Importance and profits of photo autotrophic microorganisms in composting techniques

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Abstract
Composting is a regulated microbial bio-oxidative process that breaks down biodegradable organic material under carefully monitored environmental conditions. The press-mud is allowed to mature while being kept at room temperature, creating compost that is stable, volume-reduced, hygienic, and yet contains mineral elements that are good for the soil and plants. The end result of regulated microbial decomposition of diverse organic materials into helpful and safe humus-like substance is compost. Composting is distinguished from "uncontrolled" decomposing or the straightforward putrefaction of biological waste by emphasizing a "controlled" process. Composting allows for the safe handling, storage, transportation, and application of organic material to the field, which turns it into a stable product. The Bio-compost was prepared in farm by sugarcane wastes such as bagasse 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. Microbiological results were performed once a week or as and when required. After proper degradation of the bagasse 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: Compost, organic fertilizer, bio-fertilizers, microbiological, pathogens, nitrogen, phosphorus, potash

1. Introduction
Composting is a well-known technique for hastening the stability & biofiltration of biological waste. Composting is distinguished from "uncontrolled" decomposing or the straightforward putrefaction of biological waste by emphasizing a "controlled" process. Composting is the traditional process for handling and reusing organic and hazardous waste (Taeporamaysamai & Ratanatamskul 2016) [23]. Composting is a biological process in which numerous indigenous microbe species work in compost mixtures to humify and degrade organic waste. Many species of widely distributed microscopic organisms with a wide range of morphological, physiological, and biochemical characteristics are classified as photoautotrophs (Kata *et al*., 2018) [24]. Cyanobacteria are one of these species that can survive a wide range of environmental challenges, such as cold, drought, salt, photo-oxidation, and UV radiation exposure. As a result, they can be found in various kinds of habitats (Samarkoon and Jeon, 2012; Moscoso *et al*., 2013) [25, 26]. In addition to being regarded as substantial primary producers, cyanobacteria are significant members of the aquatic food chain and play vital roles in the biochemical cycles of carbon, nitrogen, and oxygen (Moscoso *et al*., 2013) [26]. Particular significance has been placed on microalgae as a sustainable natural supply of biologically active chemicals that do not compete with the traditional food resources, given the growing need for food, nutrition, bioenergy, and medicinal compounds. Cyanobacteria in particular have drawn attention for their ability to produce third generation biofuels (Both biomass and H2 production) as well as for their value in a variety of industries, particularly agro-food, aquaculture, biotechnology, and pharmacy (Trabelsi *et al*., 2017) [27]. For instance, cyanobacterial protein has drawn interest from all over the world as a food supplement and a different type of food. According to M'baye *et al*. (2011) [28], the cyanobacterium Arthrospira platensis has a very high protein content (Up to 85.55 percent dry weight). Given their exceptionally healthy advantages, phycobiliproteins are also among the most valuable accessory pigments that can be isolated from cyanobacteria.

These fluorescent proteins that are water-soluble are widely regarded as powerful functional constituents with a variety of fascinating uses, particularly in the domains of biotechnology, medicine, and pharmacy (Jalal *et al*., 2013) [29].

2. Materials and Methods

2.1.1 Sample collection

In the present study, isolation of microorganisms was done from pond water namely, Cyanobacteria (Blue-Green Algae). Microbes were isolated in Buffered Peptone Water and BG11 broth. Serial dilution technique was performed from 10^{-1} – 10^{-7} dilution to isolate the micro-organisms. Pour plate Method was performed in Nutrient Agar to isolate the Cyanobacteria species and Cyano-Agar for isolation of Cyanobacteria. Microscopical observation was done for enumeration of morphology of the colonies. Isolated pure cultures were preserved on freshly prepared slant. Shredded sugarcane bagasse was collected from sugar manufacturing industry for the preparation of Bio-compost.

2.1.2 Sample preparation

The isolated microorganisms preserved in slant were further processed for Microbial Consortium in double stranded Soya bean Casein Digest Medium. The bagasse 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.

2.1.3 Methodology for Microbiological Analysis: - Enumeration of Total Bacterial Count

- Homogenized the sample manually then took 1 ml of the sample in 9 ml diluents (0.1% Buffered Peptone Water & BG11 broth) 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^{-7} dilution.
- Transferred 1 ml from each dilution to sterile Petri plate.
- Poured about 15-20 ml of melted Nutrient Agar media and Cyano-Agar into the Petri plates.
- Mixed the inoculums with media by gentle rotation and allowed to solidify.
- Incubated the plates in inverted position at 37 ºC for 24 - 48 hours for bacterial isolation.
- Recorded the observation of the appeared colonies in the petri plates.
- Counted the number of colonies in the range of 10-100 colony forming units by using Quebec Colony Counter and report in Cfu/g.
- Made smears for Gram staining to observe the characteristics of colonies.

3. Results and Discussion

The prepared bio-compost was analysed microbiologically to determine Total Viable Count, Cfu/g including TBC (Total Bacterial 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 quite productive.

3.1 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	Comments
01	*Escherichia coli*/25g	Absent	Absent	Absent	Absent	Absent	Complies
02	*Pseudomonas aeruginosa*/25g	Absent	Absent	Absent	Absent	Absent	Complies
03	*Staphylococcus aureus*/25g	Absent	Absent	Absent	Absent	Absent	Complies
04	*Salmonella*/25g	Absent	Absent	Absent	Absent	Absent	Complies
05	Isolation and Identification of Bacteria	Presence of Cyanobacteria species	-	-	-	-	Isolated the species of Cyanobacteria from the pond water sample and confirmation done by Gram staining & stick test

4. 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 $25x10^7$ to 80 $x10^7$ as given in Table A, which signifies the conversion of press-mud samples into organic matter.

5. Acknowledgement

I would like to acknowledge and give my warmest thanks to my supervisor (Dr. Dhanendra Kumar Rai) who made this work possible. His 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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