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Enhancement of Composting of Kitchen Waste Using Effective Microorganism Concentrate

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Abstract *– Composting is considered one of the most effective methods for the treatment of organic kitchen waste. However, its application is often limited due to the long processing time involved. The use of microbial additives, such as Effective Microorganism (EM) concentrate, can significantly reduce the composting duration while improving the quality of the final product. Compost produced using EM concentrate exhibits higher nutrient content and better soil-conditioning properties. Additionally, the leachate generated can be utilized as a soil conditioner. This study evaluates the enhancement of the composting process using EM concentrate and compares it with conventional composting methods. The procedures for both methods, along with the preparation of EM concentrate, are presented. Various tests were conducted on compost samples, and the results indicate that compost produced using EM concentrate is superior in terms of nutrient value and processing time.*

Keywords*- Composting, micro-organism, kitchen waste*

1. INTRODUCTION

Composting is an exothermic biological process in which organic matter undergoes natural oxidation through the action of aerobic microorganisms. The transformation and mineralization of organic matter are carried out by diverse microbial communities such as bacteria, fungi, and actinomycetes.

These microbial activities are significantly influenced by factors such as temperature, moisture content, and the physical characteristics of the waste material. During composting of food waste, large quantities of leachate are generated due to rapid decomposition and formation of organic acids. Food waste decomposes quickly, whereas raw vegetable waste contains high moisture and organic content.

To improve composting efficiency, bulking agents such as sawdust, rice straw, dry leaves, and cattle manure are commonly added. These materials help maintain optimal moisture content, carbon-to-nitrogen (C/N) ratio, and pH, which are essential for microbial activity. However, these materials are rich in lignocellulosic content, which is relatively resistant to microbial degradation compared to easily biodegradable organic waste.

2. METHOLOGY

2.1 Role of Effective Microorganisms (EM)

The addition of EM concentrate introduces beneficial microorganisms at the early stages of composting. This reduces the lag phase required for microbial growth and accelerates the overall composting process.

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2.2 Preparation of Effective Microorganism Concentrate

Materials:

1. One cup uncooked rice
2. Two cups chlorine-free water
3. Four cups buttermilk
4. One chicken egg
5. Half cup jaggery
6. Fruit waste (pumpkin, banana, etc.)
7. Powdered dry herbal roots (3–5 types)

Procedure:

1. Mix one cup of uncooked rice with two cups of chlorine-free water.

2. Stir thoroughly for 1–2 minutes (similar to washing rice).
3. Drain the cloudy water and store it in a bottle for 7 days.
4. After one week, three layers form; the middle layer contains lactic acid bacteria.
5. Extract the middle layer into a separate container.
6. Add buttermilk and allow fermentation for 7 days.
7. Remove the top curd layer; the remaining liquid contains Lactobacillus culture.
8. Transfer this liquid to another container and add jaggery, egg, fruit pulp, and herbal root powder.
9. Add chlorine-free water if required and mix thoroughly.
10. Allow fermentation for 14 days. The EM concentrate is then ready for use.

2.3 Experimental Setup

A. Conventional Composting

Requirements: Bucket, stand, container, kitchen waste, dry leaves, soil, water

Procedure:

1. Make 2–3 holes at the bottom of a bucket for aeration and leachate collection.
2. Place the bucket on a stand with a container below to collect leachate.
3. Add layers of dry leaves and kitchen waste (vegetable peels, fruit waste, eggshells, coffee grounds, etc.).
4. Add soil and sprinkle water on alternate days to maintain moisture.
5. Cover the bucket with a lid.
6. Repeat layering until the bucket is full.
7. Compost is produced in 60–90 days.
8. Dry the compost in sunlight for one day and sieve before use.

Outputs: Compost and leachate (both used as bio fertilizers)

B. Composting with EM Concentrate

The same procedure as conventional composting is followed, with the addition of EM concentrate to each layer on alternate days.

Composting Time: ~30 days

2.4 Tests Conducted

The following parameters were analysed using a soil testing kit:

1. pH
2. Organic Carbon
3. Nitrogen
4. Phosphorus
5. Potassium

3. RESULTS AND DISCUSSION

Parameter	**Conventional Composting**	**EM Composting**
pH	8.0	7.5
Total Organic Carbon (% w/v)	<0.4	<0.4
Nitrogen (% by weight)	0.89	2.23
Potassium (% by weight)	11.23	12.9
Phosphorus (% by weight)	1.11–1.78	>1.78
C/N Ratio	22.47	8.96

Discussion

- **pH:** EM compost is closer to neutral and meets CPHEEO standards.
- **Organic Carbon:** Within permissible limits for both methods.
- **Nitrogen:** Significantly higher in EM compost, indicating better nutrient quality.
- **C/N Ratio:** Lower in EM compost (<20), indicating better maturity.
- **Phosphorus & Potassium:** Higher in EM compost, improving fertilizer quality.

CONCLUSIONS

- EM composting reduces composting time from 60–90 days to approximately 30 days.
- Nutrient content (Nitrogen, Phosphorus, Potassium) is higher in EM compost.
- The C/N ratio of EM compost falls within the acceptable range, indicating better stability.
- EM technology enhances compost quality and process efficiency.

Thus, the use of Effective Microorganism concentrate is an efficient, sustainable, and economically viable method for converting biodegradable waste into high-quality compost suitable for agricultural applications.

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