Comparitive Study of Muncipal Solid Waste Degradation Using Bacteria And Fungus

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Abstract- *Bacteria and fungus can form a range of physical associations that depend on various modes of molecular communication for their development and functioning. We used bacteria and fungal solution for converting solid waste into manure. In our project, initially waste was collected from Srivilliputhur municipality and waste has been separated according to the particle size. This waste decomposes into manure with the help of bacteria and fungus and to establish the efficiency between them. Among old techniques like vermicomposting, this type of waste culture concentrates more on obtaining manure in short time.Initially, waste was collected and separated using sieve analysis method. The sieve size includes 45 mm, 22.4mm, 13.5 mm and 9.5 mm and 4.65 respectively. Then the wastes are separated as suspended and retained particles accordingly. By solutioning (bio-inoculum solution) the waste on daily manner, we have identified which category tray waste is converted into manure as earlier.*

Keywords- Bacteria, fungi, municipal waste, sieving, bio-inoculum, degradation.

I. INTRODUCTION

In India, we are dealing with massive issues for managing the strong waste consists of plastic, polythene, meals waste etc. Since our united states of america having a populace of 136 million persons, and they produce lots and heaps of stable waste per day which are gathered and disposed in yards(Kunwar Paritosh.,2018).In Srivilliputhur town, about ninety tonnes of wastes have been amassed per month.As per latest survey 51% of MSW is natural or biodegradable, 32% is inert or inorganic and 17% is recyclable waste. 9% of waste solely handled scientifically earlier than disposal. Another hassle in stable waste is challenging to preserve unscientific disposal of stable waste(Kalaivani.S.,2011). Types of stable waste are municipal waste, industrial waste and bio scientific waste municipal waste incorporates of residence maintain waste, building waste, demolition waste and road waste. Industrial waste consists of hazard waste, poisonous waste and flammable waste. Bio clinical waste consists of waste from city hospitals and laboratories.

In India modern-day method over 91% of whole municipal waste is simply dumped in the open land and dump yards, amongst that 10% are burnt. (Kalaivani.S.,2011).These landfills are now not the solution, it simply pollutes the surroundings and degrades the great of soil. landfills additionally trade the nature of groundwater in the environment to contaminated water, which leads to many serious illnesses to the people.

It value round Rs.12.5 lakhs every yr for series and transportation of unsegregated waste generates by using a thousand households (Raju et al., 2018). If it executed in decentralized method, the fee can be saved about 50%. Additionally, the strength additionally generated and households waste administration can be made self-sustainable and absolutely free of cost. While these decentralized corporations are actively taking it upon themselves in every zone to clear up the developing trouble of waste management.(SP Gautam.,2012)

Initially separation of waste is extra challenging to the human beings working in the processing web sites of stable wastes are dealing with extra issues whilst setting apart the non-biodegradable waste from the whole waste due to the terrible odour releases from the whole waste. (Smitha Mathews.,2016).This leads to have an effect on their fitness and additionally their effectivity of day via day separation work. Municipal Solid Waste Management in India spends eighty proportion of finances for the transportation of waste from the town to the dump yards. In future 2030 the waste manufacturing will increase from forty million lots to 80-85 million ton per day.

In this project, initially waste was collected from Srivilliputhur municipality and waste has been separated according to the particle size(MansiRastogi., 2020) This waste decomposes into manure with the help of bacteria and fungus and to establish the efficiency between them..(Anastasi A.,2011). Among old techniques like vermicomposting, this type of waste culture concentrates more on obtaining manure in short time.

II. OBJECTIVES

- To test the time efficiency of solid waste degradation using separated bacterial and fungal consortiums.
- To produce organic manure in short period of time and cost efficient production.
- To test the efficiency of quality of manure generated from the bacterial and fungal consortiums.

Municipal waste quantity & Characteristics

There are different types of waste like municipal waste, industrial waste and Bio medical waste, but in this project only municipal waste was treated.We used nearly 10 kg of waste. Municipal waste contains household waste, construction waste, demolition waste and street waste.

III. METHODOLOGY

Methodology on process:

Already existing concept for Centralized method:

Vermicompost is the most predominant method being followed everywhere for degrading municipal solid waste. Usually, it takes about nearly 30 to 45 days for decomposition of waste.Then the following compost is converted to manure.

New concept frame work towards decentralized solid waste management:

In this method, initially waste was collected and separated using sieve analysis method. The sieve size includes 45 mm, 22.6 mm, 13.6 mm and 9.5 mm and 4.65 mm respectively. Then the wastes are separated as suspended and retained particles accordingly. Two tests namely, impact and specific gravity tests were performed. There are no health issues for the worker. Our process is new we are doing the method in which, the mixture of bacterial and fungal solutions were used for decomposing the waste for minimizing the time.

1. SIEVING:

Its is a process of separation the larger size particle to small size according to its sieve sizes.In this method, initially waste was collected and separated using sieve analysis method. The sieve size includes 45 mm, 22.6 mm, 13.6 mm and 9.5 mm and 4.65 mm respectively. Then the wastes are separated as suspended and retained particles accordingly.

2. SIZE ANALYSIS:

Size analysis is to be performed to analyze the characteristics of waste which is to be fastly degrade. To identify the dry characteristics of waste the specific gravity and impact test to be perfomed.

Sieve size(mm)	Retained(g)	Passed out(g)	Retained materials
45 mm	310	660	Stick, Fish, Banyan leaf, Saw dust, Hair, Balloon piece.
22.4 mm	90	480	Fish, Saw dust, Banana leaf, Palmyra sprout, Balloon piece.
13.5 mm	105	365	Balloon piece, Red chilli, Tamarind, Peas, Onion peel, Leaves.
9.5 mm	75	285	Ear bud, Flower, Neem seed, Tamarind seed, Leaves, Sticks, Orange peel.
4.75 mm	125	150	Ear bud,Stick, Peas, Paper.
Pan mm	150		

3. BIO-INOCULUM PREPARATION:

Isolation of bacteria

Nutrient agar (2.8g in 100ml) in 250ml conical flask was kept in autoclave for at 121 C for 15min. After completion the media was taken and poured in Petri plate and kept for solidification.

About 2 g of municipal waste was taken and dissolve in 100 ml distilled water. Now 100 ml of dissolved waste was take and spread over the petriplate using L rod. Then the plates are kept in incubator for overnight. Next day morphologically different bacteria strains were identified.

Isolation of fungus

Potato dextrose agar (8 g in 100 ml), Peptone (3 g on 100 ml) and agar (2 g in 100 ml) in 250ml conical flask was kept in autoclave for at 121 C for 15min. After completion the media was taken and poured in Petri plate and kept for solidification. About 2 g of municipal waste was taken and dissolve in 100 ml distilled water. Now 100 ml of dissolved waste was take and spread over the petri plate using L rod. Then the plates are kept in incubator for overnight. Next day morphologically different fungal strains were identified.

Nutrient broth preparation

Dissolve 6.5 g of nutrient broth in 100ml distilled water. Keep it in autoclave for at 121 C for 15min. After cooling add 100ml of bacterial consortia into broth and kept in shaker for overnight. This Overnight culture is further use as a bio-inoculum for decomposition process.

Bioinoculum

4 SEPARATION OF WASTE IN TRAYS:

We collected the sample of solid waste from Srivilliputhur town and started the composting process with 12 different trays and we also added control in trays. Each tray is filled with 750 grams of solid waste, based on the sizes.

Bacteria and fungus 1 (45mm)

Bacteria and fungus 2(22.6)

Bacteriaand fungus3(13.6mm)

Bacteria and fungus 4(9.5mm)

Bacteria and fungus 5(4.65mm)

PROCEDURE:

- Solid wastes were categorized into 4 different sieve sizes such as 45 mm,22.5 mm,13.6 mm and 9 mm respectively.
- After sieve analysis test, wastes have been separated as suspended and retained particles.
- The final retained particles were collected in the pan.
- Impact and specific gravity tests were performed for determining its quantity analysis.
- Bacterial culture is prepared by using nutrient broth and agar and Ph is noted.
- 500 ml of bacterial solution is prepared and poured into the waste categorized trays on daily basis.
- 500 ml of fungal solution is prepared and poured into the waste categorized trays on daily basis.

Detailed procedure of each trays:

B1 and F1 :This pair of trays consist of 750 grams each sieve size of about 45 mm, in which 100 ml of bacterial solution in B1 and fungal solution in F1 is added everyday.
B2 and F2 : This pair of trays consist of 750 grams each sieve size of about 22.4 mm, in which 100 ml of bacterial solution in B2 and fungal solution in F2 is added everyday.
B3 and F3 : This pair of trays consist of 750 grams each sieve size of about 13.5 mm, in which 100 ml of bacterial solution in B3 and fungal solution in F3 is added everyday.
B4 and F4: This pair of trays consist of 750 grams each sieve size of about 9.5 mm, in which 100 ml of bacterial solution in B4 and fungal solution in F4 is added everyday.
B5 and F5: This pair of trays consist of 750 grams each sieve size of about 4.65 mm, in which 100 ml of bacterial solution in B5 and fungal solution in F5 is added everyday.

IDENTIFICATION OF BACTERIA AND FUNGUS WHICH HELPED IN DECOMPOSITION:

Initially we taken 10g of waste from the muncipal solid waste we collected, and then pour into the 100 ml distilled water,then the ph of the sample is checked as 7 which is found to be suitable for the bacterial growth. Then the conical flask is kept in the shaker over night.Then it is plated for the petric plates and used as an bioinoculum preparation.

The remaining bacterial plates are kept in the incubator of 30 degree celsicus. Then with the help of loop rod we taken the growth bacteria and placed under the microscope.It shows the cluster of bacteria like Bacillus subtilis, Pseudomonas fluorescens etc.these bacteria is very helpful for the decomposition of the soil wastes.

The growth of fungus is suitable best under the temperature below 25 to 27 degree celsius .In the same method we kept the fungal growth plate and take the fungus in the glass slide and placed under the microscope.we identify the colonial growth of fungus named as Geotrichum candidum.

Then for the further confirmation we stained it in the lactophenol cotton blue and the we confirmed the species as Geotrichum candidum.

Lactophenol cotton blue stain on Geotrichumcandidum fungi species

Scientific classification

Kingdom :Fungi

Division :Ascomycota

Class :Saccharomycetes

Order: Saccharomycetales

Family: Dipodascaceae

Genus: Geotrichum

Species : G.candidum.

It is a fungus, which is a member of the human microbiome, notably associated with skin, sputum and feces where occurs in 25% to 30% of specimens.

It is common in soil and has been isolated from soil collected around the world.

It is a fast growing colony that can grow 5 to 6 cm diameter. Potato dextrose agar and peptone were the media used to grow fungus. The optimum temperature for growth of fungus was 20 degree celcius. pH range is 5 to 5.5.

IV. VISUAL OBSERAVATION OF TRAYS

Bacterial trays observation:

Week	Bacteria1	Bacteria 2	Bacteria 3	Bacteria 4	Bacteria 5
1st week	Dry waste	Dry Waste	Dry Waste	Dry waste	Moist Waste
2nd week	There is no change	There is no change	Slight shrinkage in leaves	Slight shrinkage in leaves	No change
3rd week	Little moist condition with slight decomposition is observed	Reduce in Smell with slight decomposition	Completely decomposed with reduction in weight	Completely decomposed	compost is obtained

Fungal trays observation:

Week	Fungus 1	Fungus 2	Fungus 3	Fungus 4	Fungus 5
1st week	Dry waste	Dry waste	Dry Waste	Dry waste	Moist waste
2nd week	Slightly moist condition and compost is almost ready	Moist condition	Well moisturized and fresh fungi are formed	Compost is obtained	compost is obtained

Manure

After the compost is obtained, it is set to dry for about 2 days to remove the moisture condition in waste. Then the sample is obtained as manure, which can be helpful in agriculture.

Quality of the manure:

In order to check the quality of the manure we check the pH and conductivity of the manure .

Types of composting	pH values
Bacterial waste sample	7.8
Fungal waste sample	5.4

The compost microorganisms operate best under neutral to acidic condition with pH in the range of 5.5 to 8.

Types of composting	Conductivity values
Bacterial waste sample	1.360
Fungal waste sample	1.5

Conductivity In ms/cm	Nature of manure
<0.8	Normal
0.8-1.6	Critical for salt sensitive crops
1.6-2.5	Critical for salt tolerant crops
>2.5	Injurious to all crops

V. RESULT AND CONCLUSION:

Almost about 20 days of treatment is needed to decompose the municipal solid waste using bacterial culture and about 12 days is required to decompose the waste using fungal solution.

It is observed that time efficiency of fungus is greater than the time efficiency of bacteria.

Obtained compost of each trays:

Bacteria and fungus 1(45mm)

Bacteria and fungus 2(22.6mm)

Bacteria and fungus 3(13.6mm)

Bacteria and fungus 4 (9.5mm)

Bacteria and fungus 5 (4.65mm)

Therefore, fungal solution mixed waste is having more efficiency than the bacterial mixed one. Thus, the obtained manure can be used for agricultural purpose. It saves the times than the older method like vermicomposting.We also suggest by mixing the both bacteria and fungus the efficiency of time can be shorter than the single stand using of the bacteria and fungus.

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