Production of Biocompost from Agrowaste and Identification of its Growth Promoting Ability

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Abstract **- Composting is one of the natural process of decomposition of any type of organic matter by microorganisms. It may done by two different methods one is controlled conditions and another one is uncontrolled condition. Mostly crop waste, animal waste, food waste, municipal and industrial waste are mixed with soil in various forms. These waste materials are naturally decomposed by soil microbes like *Pseudomonas sp.*, and *Phosphobacteria sp*., That decomposed materials are used as fertilizers and it enhance the soil fertility and yielding in our selected plant like tomato, brinjal and chilli. This type of organic materials may used as fertilizers it is alternative for chemical fertilizers. In this study, the compost material were produce better growth in the plants. It also induce the plant nutrient up taking, improves chemical and biological properties of the soil.**

Index Terms **- Composting, waste, fertilizer, *Pseudomonas sp., Phosphobacteria sp.***

INTRODUCTION

Bioconversion of agro raw materials to residues several benefits like develop the soil fertility, soil health, nutrient development in soil, microbial population develop, secondary metabolites formation and improve soil biodiversity. The bioconversion ecological risks in environment. In recent reports indicate that the large quantities of agrowastes are generated in the world. Sometimes it responsible for the environmental pollution and biological agents for diseases and improper bioremediation. The effective microorganisms were isolated from the soil and used to prepare high quality compost in shorter duration and new technologies applied for large scale production for composting process (1).

Agricultural beneficial microorganisms are used for plants growth and yield development and this type of bacteria or fungi called as biofertilizers. These microbes effectively involved in nitrogen fixation, phosphate solubilisation, seed enriching components etc. The live and specific cells of bacteria and fungi formulated in suitable carrier materials. These microbes are used for soil application in suitable conditions it consist of secrete metabolites and enzymes which makes simplify form of elements. It also increases the minerals, water uptake, development of root, vegetative growth and induce the yield with good quality. Biofertilizers are eco-friendly, easy to use, nontoxic, economically low and improve soil healthy and crop production (2).

The sustainable organic farming practices can reverse the tradition methods of agriculture process and increase the global productivity. Large quantities of agrowaste materials mixed with biofertilizers and reduce the days of degradation process. India nearly 70-million-ton organic waste is generated annually, it estimated in both cities and rural areas and these waste materials are which is either burned or land filled (3). This bioconversion method supports to avoid the environmental pollution.

MATERIAL METHODS

COLLECTION OF BIOWASTES

Biowastes were collected from a waste dispersal yard of vegetable market. Discarded vegetables, fruits were collected in sterile plastic bags.

COLLECTION OF SOIL SAMPLES

Soil samples were collected from organic agricultural farm and the area is which present in Dharmapuri district.

ISOLATION OF MICROORGANISM

The soil samples were serially diluted and pour plate technique was performed for isolation the microbial diversity of the soil sample.

Pour Plate Technique

The soil samples were serially diluted like 1:10, 1:100, 1:1000 etc., up to 7 tubes. The serially diluted samples (0.1ml) of the 4^{th}, 5^{th} and 6^{th} tubes were inoculated into the Petri plates and the Nutrient agar medium was poured onto the samples and allowed to solidify. The inoculated plates were incubated at 37° C for 24hrs to obtain bacterial culture. After incubation, colonies of differentiate by morphological observation and forward to staining process (4).

MICROSCOPIC OBSERVATION

Gram's Staining method were performed for identification of isolated bacterial cell wall structure is whether Gram positive or negative.

A thin smear of bacterial culture was prepared then stains were added and washed with water. Finally, the stained smear was blotted or air dried and observed under oil immersion objective lens.

BIOCHEMICAL TESTS

Biochemical analysis were performed for the identification of isolates. The IMVIC series consists of four definitive tests like Indole test, Methyl red test, Voges-Proskauer test and Citrate utilization test. The biochemical test was performed including oxidase, catalase and TSI test.

There are three different kinds of media namely Nutrient agar, Gelatine agar and Kings medium were used for the pure culture process and culture maintenance.

MASS CULTIVATION OF BACTERIAL CULTURE

Nutrient broth was used for the mass cultivation microbial culture. The Nutrient broth is prepared into plastic canes and autoclaved at 15 lbs pressure for 15 minutes. After the sterilization process, media cooled and inoculated with 10% of inoculums. This mass cultivation process done by fermentation method it may takes 3-4 days for development. Talc powder used for the dilution of the bacterial cultures, and it act as carrier material it support to better degradation without decay. These talc powder do not have any special characters in it (5).

40 ml of broth culture which mixed with 100 grams of talk powder component. These processes which used for long time storage of bacterial culture in preserve condition (6).

LAND FILL METHOD

Six pits were made of size 1.5 X1.5 feet respectively. Among them three pits were filled with vegetable waste along with the culture. The pits were dumped with three layers. The first layer was agro waste and the second being the culture and the top layer filled with agro waste finally again covered with culture. Pits one and two filled with culture A, three and four filled with culture B respectively. Two of the pits were left uninoculated and it conceder as control. These pits were closed and allowed for degradation with mixture of components.

APPLICATION OF BIOCOMPOST

The components were degraded during the landfill method and the Biocompost was obtained after 45 days. These were collected in sterile aluminium covers and stored. The obtained biocompost were used for plants as fertilizers.

In the field of application, I have chosen agricultural land. In the primary stages, I have collected 3 types of plant seeds and placed in the cultivation tray for development. The names are as follows 1. Tomato 2. Chilli 3. Brinjal. These plants were placed in agriculture land and tested. Once in 10 days Bio-Compost materials applied and five days once plants measured for growth analysis.

RESULTS

The pre-treated soil samples were serially diluted from 10^{-1} to 10^{-7} respectively. The dilutions 10^{-4} to 10^{-6} were plated onto the nutrient agar and incubated at 37°C for 24 hours. Different colours and colony morphology were observed on the plates like white coloured irregular colonies, pale, orange-coloured colonies, white coloured colonies, green coloured colonies and etc. White coloured and green coloured colonies were selected for the further investigations (1).

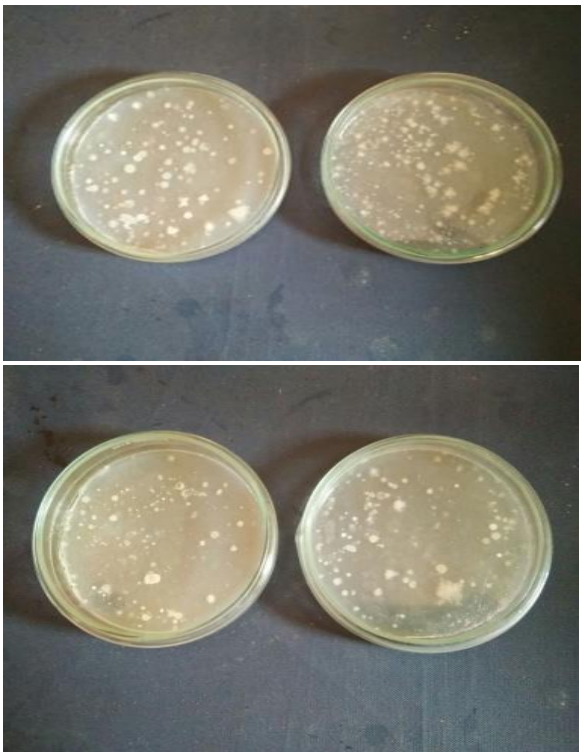

Fig 1: Isolation of bacteria by pour plate method

Few microbiological medias were used for the identification and purification of bacterial cultures. The green coloured and white coloured colonies were inoculated in Nutrient Agar, Kings medium and Gelatin Agar plates. After the proper incubation period colonies were formed well and the results were follows.

Sample A which produced Green coloured colonies on Nutrient agar and Kings medium. Few bacterial colonies only produce these colours of pigments like *Pseudomonas sp.*, Hayder *et al.*, reported that, Kings Media used for isolation of all *Pseudomonas spp.*, from the various samples, it developed well in that media with pigment production. Sample B which forms white coloured colonies on both Nutrient Agar and Gelatin Agar. Furnkranz *et al.,* and Hanif *et al.,* reported that, large number of plant-growth-promoting rhizobacteria are present in rhizosphere soil, specifically phosphate solubilizing bacteria involved in the plant growth and increase plant production and its yields (8,9). Biochemical and gram's staining results were interpreted in Table 1.

S.NO	CULTURE	Gram's Staining	I	MR	VP	C	TSI	O	CL	U
1	A	Gram –ve rods	-	-	-	+	AK	+	+	-
2	B	Gram +ve rods	-	+	-	+	A	-	-	-

Table 1: Biochemical characterization of pseudomonas and phosphobacterium

I-Indole, MR-Methyl Red, VP-Vogues Proskeur, C-Citrate, A-Acid Production, AK-Alkaline production, O-Oxidase, CL-Catalase, U-Urease.

The bacterial culture, vegetable waste was mixed and filled by land filling method. After the degradation of waste materials, it taken out and used for the plant's growth. It produces difference level of growth in the selected plants. *Pseudomonas sp.,* induce the nutrient cycling process, organic materials transformation one to another place, induce the plant productivity and it also supporting the soil-borne diseases (10). The presence of many phosphate solubilising bacteria in the soil is important factor for effective promotion of crop growth and agricultural development (11). Growth of plant is important for the calculation of compost activity in plant development, and it identified by measurement of plant height and number of branches in the plant. Growth level measured in centimetre and results are interpreted in table 2.

Fig 2: Biocompost preparation using Landfill method

TOMATO PLANTS						
Treat by	*Pseudomonas sp.,*		*Phosphobacteria sp.*		Control	
	Height	Branches	Height	Branches	Height	Branches
10 Days	05 cm	03	07 cm	04	04 cm	03
20 Days	11 cm	07	13 cm	07	08 cm	06
30 Days	19 cm	12	22 cm	13	16 cm	11
40 Days	30 cm	16	35 cm	17	25 cm	14
50 Days	55 cm	19	61 cm	21	41 cm	18
BRINJAL PLANTS						
10 Days	04 cm	01	05 cm	01	04 cm	01
20 Days	09 cm	03	10 cm	03	08 cm	03
30 Days	16 cm	08	19 cm	09	14 cm	07
40 Days	27 cm	12	32 cm	13	21 cm	11
50 Days	51 cm	16	57 cm	17	41 cm	15
CHILI PLANTS						
10 Days	05 cm	02	06 cm	02	04 cm	02
20 Days	10 cm	04	11 cm	05	09 cm	04
30 Days	19 cm	07	22 cm	07	15 cm	07
40 Days	28 cm	12	34 cm	11	23 cm	11
50 Days	45 cm	14	53 cm	14	40 cm	13

Table 2: plants growth chart

CONCLUSION

The *Pseudomonas sp.,* and *Phosphobacterium sp.,* used as starter culture for the fermentation process. After the composting process, that compost was applied to the plants. *Pseudomonas sp.*, which makes better results on tomato plants when it compared to *Phosphobacterium sp.,* and control plants. *Phosphobacterium sp.,* which makes better result on tomato and chilli plants when it compared to *Pseudomonas sp.,* and control plants. Agrowaste materials were largely available in the markets. This waste material will be used as biofertilizers for the development of plants. Further future studies which makes some innovative things to consume the waste materials in different manner.

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CONFLICT OF INTEREST

Agrowaste are left unused and wasted. To promote the sustainable utilization of agrowaste we prepared it as biocompost which is cost effective and eco-friendly.

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