www.irjhis.com ©2023 IRJHIS | Special Issue, March 2023 | ISSN 2582-8568 | Impact Factor 6.865
National Conference Organized by Seth Hirachand Mutha College of Arts, Commerce & Science, Kalyan (Maharashtra, India) "BIODIVERSITY AND SUSTAINABLE DEVELOPMENT" on 25th March 2023

INTERNATIONAL RESEARCH JOURNAL OF HUMANITIES AND INTERDISCIPLINARY STUDIES
(Peer-reviewed, Refereed, Indexed & Open Access Journal)
DOI : 03.2021-11278686 ISSN : 2582-8568 IMPACT FACTOR : 6.865 (SJIF 2023)

KITCHEN WASTE COMPOST DERIVED BY USING FUNGI AND ITS EFFECT ON PLANT GROWTH

Siddiqui Shireen[1], Shaikh Asfiya[1], Ansari Heena[1], Nirmalkar Vaishali[1]

[1]K.M.E Society's G. M. Momin Women's College, Bhiwandi (Maharashtra, India)
** Corresponding author: vaishu_p2025@gmmomincol.org*
DOI No. 03.2021-11278686 **DOI Link ::** https://doi-ds.org/doilink/01.2024-44962185/IRJHISNC2303001

ABSTRACT:

Over the past ten years, food waste has emerged as a significant global concern, with far-reaching implications for the environment and public health. In addition, the harmful substances that emerge from its breakdown can seep into agricultural areas and water systems, posing potential health risks. To address this issue and align with the objectives of global sustainable development goals (SDGs), the practice of composting has been adopted as an effective means to both manage and diminish food waste. This study compiles inputon decomposition of organic kitchen waste by microbial decomposers and its physico-chemical properties involved to promote seed germination and seedling growth.Four different fungal species were used for making compost from kitchen wastes. The fungal spore suspension was inoculated in flasks containing kitchen wastes and incubated for fifteen days. The flasks were harvested by adding Czapek salt after fifteen days of incubation. Protein estimation, Cellulase enzyme assay and plant growth promoting effect of compost extract were evaluated. The effect of compost extract was found to be positive on enhancing shoot length, root length and seedling length of Vigna radiataL. (Moong) plant. The compost extracts were found to promote growth of plant more than two folds as compared to control. Amongst all the compost extracts, the one which is decomposed by Aspergillus sp.1was found to be more potential in promoting growth of Moong plant. Overall, good compost, not only reduces waste issues, but also contributes substantially to the economic and social sectors of a nation by increasing crop yield.
Keywords: *Compost extract, Vigna radiata, Aspergillus sps., Penicillium sps.*

INTRODUCTION:

Sustainable agriculture goal requires farming technology to be productive and environment friendly (Raja Namasivayam SK and Bharani RSA, 2012). But maximum use of chemical fertilizers and pesticides by farmers to increase yield has led to soil pollution and land infertility. Composting involves the breakdown all organic waste in the presence of microorganisms, heat and moisture.

Kitchen waste is defined as left over organic matter from restaurant, hotels and households

(Li et al., 2009; Anwar et al., 2017).Tons of kitchen wastes are produced daily in urban areas which contains variety of microorganisms such as bacteria, fungi, protozoa etc. (Sahu et al., 2017). Decomposers are now used in the production of organic fertilizers to hasten decomposition process to improve quality of the product.

Composting is the natural process of rotting or decomposition of organic matter by microorganisms under controlled condition.Fungi have the ability to produce various enzymes in large amount and less time period which could be the key factor to use them for the process of biodegradation of organic materials. However enzymes are also fascinating subject matter of study due to their wide range of applications (Weuster-Botz, D., 2000).

In the present study, compost derived from kitchen waste decomposition by fungi is studied on growth parameters of *Vigna radiata*L. plant.

MATERIAL AND METHODS:

Sample collection: Vegetable waste was collected from Kitchen of College canteenand fruit waste was collected from Kitchen as well as local fruit juice vendors.

Isolation and identification of fungal decomposers:

Fungal colonies were isolated from soil samples by serial dilution method where SDA (Sabouraud dextrose agar) media was used. The isolates were further inoculated on SDA plates by point inoculation and incubated at 28°C for 48 h in order to obtain pure fungal cultures (Khan and Yadav, 2011).Various morphological and reproductive structures were carefully observed under the microscope (Devi and Kumar, 2012) for primary identification of the fungal isolates. Four fungal isolates were used for further study.

Decomposition study and sample preparation:

Kitchen waste of vegetables and fruits were cut into small pieces. Fifty grams of vegetable waste, fruit waste and mixture of both types of wastes were taken in 250ml conical flask. Water (10 ml) and fungal spore suspension (5ml) was added in each flask and incubated for 15 days under room temperature under steady state. After 15days of incubation, in the compost obtained, 40ml of Czapek salt was added in each flask. This mixture was kept on a shaker for 4h. The mixture was filtered through muslin cloth.Half of thecompost extract (CE) was autoclaved (sterilized in autoclave at 121°C at 15 psi for 15 min.)and half remained unautoclaved. It was further centrifuged and the supernatant was used for further analysis. The experiment was done in triplicates.

Protein Estimation:

It was evaluated by following the Lowry's Protein quantitation method (Lowry et al. 1951)

Enzyme test:

Cellulase enzyme activity was determined by using the dinitrosalicylic acid reagent to measure the reducing sugars (Miller GL, 1959; Nirmalkar et al., 2021).

Evaluation of Plant growth parameters:

Seeds of Moong (*Vigna radiata* L.) were surface sterilized with Tween 20 for 10 sec. and washed two to three times with sterilized distilled water. Seeds were sown in different pots containing soil, and CE (autoclaved and unautoclaved) of vegetable waste, fruit waste and its mixture. After 4-5 days seedling length, root length and shoot length were recorded.

RESULTS AND DISCUSSION:

On the basis of its morphological and microscopic characters the species were identified as *Aspergillussp.* 1, *Aspergillus sp.* 2, *Penicilliumsp.*1 and *Penicilliumsp.* 2. Protein estimation in all the compost extracts (CE) of autoclaved as well as unautoclaved sample showed that in unautoclaved sample the protein content was more (10.8 mg/ml equivalent of BSA) (Fig. 2) however amongst all the samples highest protein content was recorded in the fruit waste CE by *Aspergillus sp.* 2 (Fig. 1 and Fig.2).

Cellulase enzyme estimation also showed the similar results. Unautoclaved sample of fruit waste CE exhibited highest activity (28 mg/ml equivalent of glucose) (Fig. 4), however autoclaved sample of fruit waste CE also showed highest activity by *Aspergillus sp.* 2 (Fig. 3).Thus it could be concluded that the unautoclaved CE exhibited highest enzyme activity and amongst the four fungal isolates *Aspergillus sp.* 2 was found to be more potent.

Distinct differences were recorded in the unautoclaved CE treated plants compared to control. There was no significant difference among the root length, shoot length and seedling length of the four fungal species amongst all the compost extracts (Table 1 and Table 2). But there was feeble growth observed in the autoclaved CE (results not shown). These findings suggest that the CE need no process of sterilization and it could be used in field trials also. The extracts of vegetables, fruits can be mixed in proper amount and can be used further with a synergy of fungal isolates.

Composts and its extracts can be used as biofertilizers as they have beneficial effect on plant growth as well as have been considered for soil amendment (Gharib et al., 2008). Effective microorganisms consisting of bacteria, yeast, fungi and actinomycetes were studied by Raja Namasivayam SK and Bharani RSA (2012). According to their findings, the application of fruit waste compost led to enhanced plant growth parameters, including increased shoot length, expanded leaf surface area, elevated total chlorophyll levels, heightened plant height, greater numbers of leaves and branches, and augmented foliage density per plant.

Mostly biocompost is made using bacteria or the alternative is of Vermicompost which is a time consuming process.It has been reported earlier that fungal isolates such as *Mucor, Aspergillus, Chaetomium, Penicillium, Fusarium,* etc. were effective at wide range of temperatures for the process of composting due to their ability to produce cellulases (Taiwo and Oso, 2004). Compost Tea also has been studied as an alternative to chemical fertilizers (Naidu et al., 2010).A complete overview of composting process using microbial count has been given by Ryckeboer et al., 2003.

In the present study the CE derived by fungal decomposition favored the overall growth parameters of *Vigna radiata*L. In an earlier report Bacterial consortium was prepared for the enhanced degradation of organic matter (Anwar et al., 2017). Thus it is suggested that a fungal consortium could be developed which would help in enhancing the composting process from the wet waste and the effect of such compost could be tested in field trials for various plants.

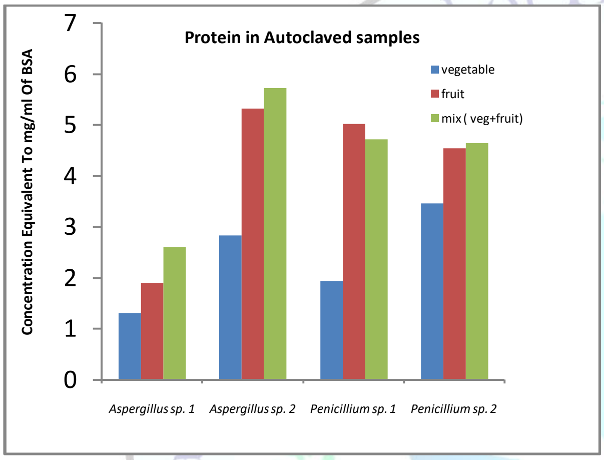

Fig. 1: Protein content in autoclaved (steam sterilized) Samples

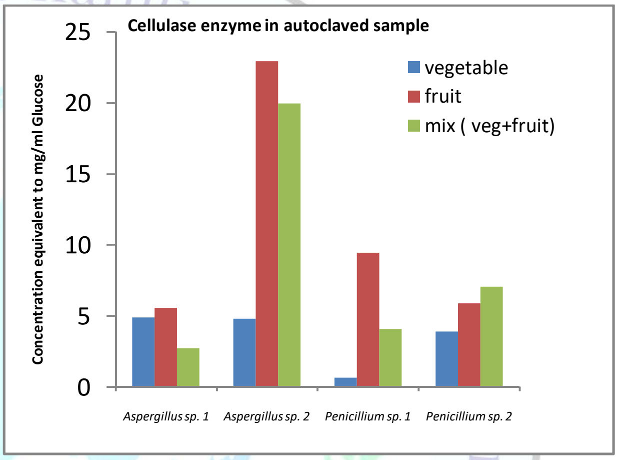

Fig. 3: Cellulase content in autoclaved samples

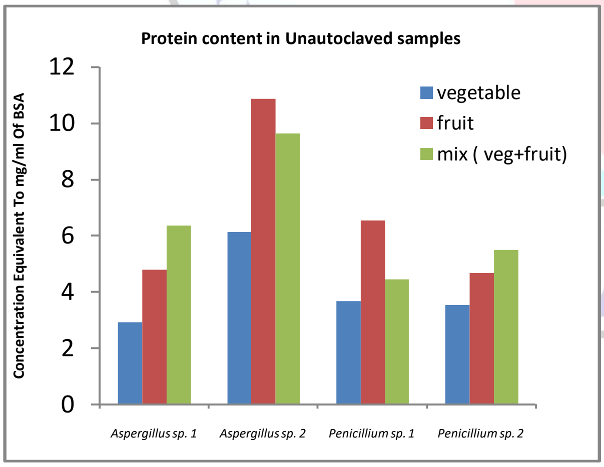

Fig. 2: Protein content in unautoclaved samples

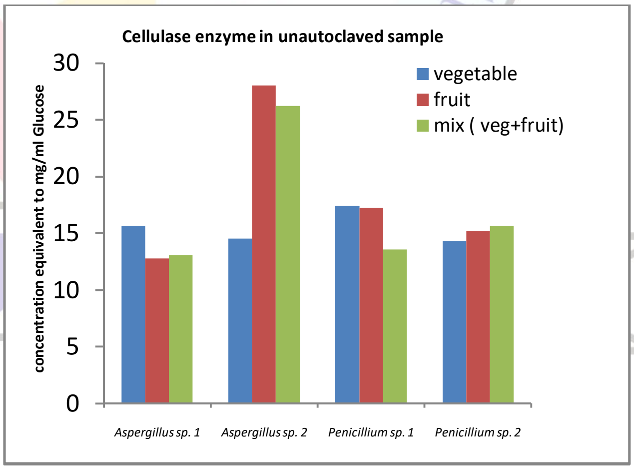

Fig. 4: Cellulase content in unautoclaved samples

Table 1: Plant growth parameters in CE exhibited by *Aspergillus sp.*1 and *Aspergillus sp.*2 (unautoclaved)

	Shoot Length*		Root Length*		Seedling Length*	
Fungus	*Aspergillus sp.1*	*Aspergillus sp.2*	*Aspergillus sp.1*	*Aspergillus sp.2*	*Aspergillus sp.1*	*Aspergillus sp.2*
Vegetable waste	18	16	10	07	28	23
Fruit waste	16	17	08	08	24	25
Mix waste (Vegetable + Fruit)	17	15	09	10	26	22
Control	07	07	05	09	12	12

***Standard deviation ±2**

Table 2: Plant growth parameters in CE exhibited by *Penicillium sp.*1 and *Penicillium sp.*2 (unautoclaved)

	Shoot Length*		Root Length*		Seedling Length*	
Fungus	*Penicillium sp.1*	*Penicillium sp.2*	*Penicillium sp.1*	*Penicillium sp.2*	*Penicillium sp.1*	*Penicillium sp.2*
Vegetable waste	17	15	7.5	08	25	23
Fruit waste	15	16	08	7.5	23	24
Mix waste (Vegetable + Fruit)	16	16	10	06	26	22
Control	07	07	05	05	12	12

***Standard deviation ±2**

REFERENCES:

1. Anwar, H., Ashraf, M., Saqib, M., Ashraf, M. A., & Ishfaq, K. (2017). Isolation and screening of biodegrading bacteria from kitchen waste and optimization of physiochemical conditions to enhance degradation. *Int J Sci & Eng Res*, *8*(4), 2229-5518.
2. Devi, C.M. & Kumar, S.M. (2012). Production, Optimization and Partial purification of Cellulase by *Aspergillus niger* fermented with paper and timber sawmill industrial wastes. *J. Microbiol. Biotech. Res., 2(1),* 120-128.
3. Gharib, F. A., Moussa, L. A., & Massoud, O. N. (2008). Effect of compost and bio-fertilizers on growth, yield and essential oil of sweet marjoram (*Majorana hortensis*) plant. *International Journal of Agriculture and Biology*. *10*(4), 381-387.
4. Khan, J. A. & Yadav, S. K. (2011). Production of alpha amylases by *Aspergillus niger* using cheaper substances employing solid state fermentation. *International J. of Plant, Animal*

Environ. Sci., 1(3), 100-108.

5. Li, R., Chen, S., & Li, X. (2009). Anaerobic co-digestion of kitchen waste and cattle manure for methane production. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, *31*(20), 1848-1856.
6. Lowry, O. H., Rosebrough, N. J., Farr, A. L., and Randall, R. J. (1951) Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193, 265–275.
7. Miller, G.L. (1959). Use of dinitrosalicylic acid reagent for determination of reducing sugar. *Anal. Chem. 31,* 426–428.
8. Naidu, Y., Meon, S., Kadir, J., & Siddiqui, Y. (2010). Microbial starter for the enhancement of biological activity of compost tea. *Int. J. Agric. Biol*, *12*(1), 51-56.
9. Nirmalkar, V., Khan, U., Ansari, S., & Shaikh, A. (2021). Solid waste treatment by fungal enzymes in artificially constructed wetland. *Res. J. Chem. Environ., 25(5),* 62-67.
10. Raja Namasivayam, S. K., & Bharani, R. S. A. (2012). Effect of compost derived from decomposed fruit wastes by effective microorganism (EM) technology on plant growth parameters of *Vigna mungo*. *Journal of Bioremediation & Biodegradation*. *3*(11), 167.
11. Ryckeboer, J., Mergaert, J., Coosemans, J., Deprins, K., & Swings, J. (2003). Microbiological aspects of biowaste during composting in a monitored compost bin. *Journal of Applied microbiology*. *94*(1), 127-137.
12. Sahu, A., Verma, K. P., Teta, A., & Karumuri, L. (2017). Effect of compost derived from decomposed kitchen waste by microbial decomposers on plant growth parameters of crops. *Journal of Pharmacognosy and Phytochemistry*, *6*(6S), 435-438.
13. Taiwo, L. B., & Oso, B. A. (2004). Influence of composting techniques on microbial succession, temperature and pH in a composting municipal solid waste. *African Journal of Biotechnology*, *3*(4), 239-243.
14. Weuster-Botz, D. (2000). Experimental design for fermentation media development: statistical design or global random search?. *Journal of bioscience and bioengineering*, *90*(5), 473-483.