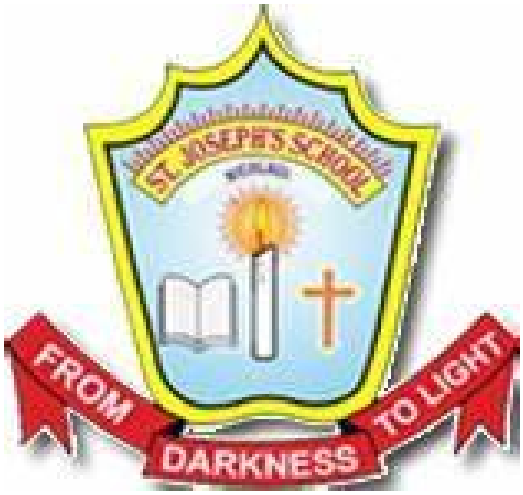
ST. JOSEPH'S SCHOOL



Maharajganj

Session – 2025-26

By Science club juniors

A study on Kitchen waste compost.

Under the guidance of

Akanksha Patel

ACKNOWLEDGEMENT

firstly, we are thankful to almighty for providing a strength to present our study in the best possible manner as also complete this study on time.

It is our privileged to express our sincerest regards to our director **Mr. C.J. Thomas sir** for his sincere guidance, valuable inputs, encouragement, wholehearted cooperation and constructive criticism throughout the duration of our work.

we highly grateful to the principal **Mrs. Lily Thomas ma'am** for her incisive perspective, providing me needed facilities and also her support in completing the work.

We are also thankful to our teacher and the in charge of eco club **Miss. Akanksha Patel** for encouragement and express the deepest sense of gratitude to her.

we would like to express our gratitude towards our parents for their kind cooperation and encouragement which help us in completion of our project our thanks and appreciations also goes to members of our school and people who have willingly help us out with their abilities.

Date: **ECO CLUB**

St. Joseph's School

TABLE OF CONTENT

KITCHEN WASTE COMPOST

Abstract: In India, most of the food waste is sent to landfill and produce methane gas which causes greenhouse effect. Hence, the aim of this research is to reduce the food waste at landfill by composting using designed compost bin. The objectives of this research is to reduce the amount of food waste; develop a composting process for managing food waste and improves its quality for possible use in the growth of plants as well as develop a composter for composting process. Food wastes were collected and put into the designed composter with the consideration of all the parameters that is related to aerobic composting. At the end of the composting process, the temperature of the compost was at ambient temperature and had a pH near to neutral. It showed that the compost produced consists Nitrogen as N, Phosphorus as P_2O_5 and Potassium as K_2O which are all in the accepted range of mature organic fertilizer. In conclusion, the composting of basic food waste in campus can produce an acceptable organic fertilizer for plant use will greatly reduce the amount of generated food waste.

1. Introduction

From the year 2000, the global urban population has increased from approximately 2.9 billion to nearly 5 billion people by 2030, representing a rise from about 47% to 60% of the total world population. This growth was largely concentrated in urban areas, particularly in less developed regions. The explosion of population and increment of urbanization with changing lifestyles create more and more wastes being generated in many cities and townships. This ever-rising shift of the world population is already evident and will produce even more remarkable amounts of urban food waste, which in turn will add pressure to the already overloaded municipal solid waste transportation system and landfill sites [1]. According to the Central Pollution Control Board (CPCB) Annual Report for the year 2021-22, India generated an average quantity of **170,338 tons of solid waste daily**.

Earlier data from the CPCB's 2020-21 report indicated a total generation of approximately 160,039 tons per day (TPD).

Key details from the 2021-22 report include:

- **Total waste generated:** 170,338 TPD
- **Waste collected:** 156,449 TPD (a collection efficiency of about 92%)
- **Waste treated:** 91,512 TPD (approximately 54%)
- **Waste landfilled:** 41,455 TPD (about 24%)
- **Unaccounted waste:** 37,373 TPD (about 22% of the total generated waste)

Most food waste has been land filled together with other wastes, resulting in various problems such as emanating odor, attracting vermin, emitting toxic gases, contaminating groundwater by the leachate and wasting landfill capacity [2]. Methane (CH4) and carbon dioxide (CO2) emitted as a result of microbial activity under uncontrolled anaerobic conditions at dumping sites are released into the atmosphere and contribute to global warming [3].

Composting is a good idea to reduce the amount of solid waste in the landfill. Composting is a controlled decomposition where natural breakdown process occurs. Composting is the transformations of raw organic materials into biologically stable, humic substances suitable for a variety of soils and plant uses [4]. Organic fertilizers are the end product of composting. Organic fertilizers are natural fertilizer which made up from vegetables, fruits, animals and many more. Organic fertilizers are crucial in agricultural sector because they have positive effect on soil without damaging ground water and plants [5].

2. Methods and Procedure

2.1 Composting

Composting involves the conversion of organic residues of plant and animal origin into manure. The main product of composting is the compost which is rich in humus and plant nutrients and the by-products are carbon dioxide, water, and heat. It needs oxygen to carry out the composting process which is called as aerobic composting.

2.2 The Composting Process

In the completion of the composting food waste by using compost bin, there are three sections of procedure to complete the compost. Materials selection is the first section which lists out what is needed for the composting process. The next step is the design of compost bin which will be used for composting. The third section of the research is the composting process which includes the analysis of the content in the compost. All the materials selected will be put into the composter. Attention will be given to the whole composting process. Aeration, moisture content, temperature need to be constantly supervised. The content of the compost is then being analysed in laboratory.

2.2.1 Material Selection

The material selected is the food waste from the household. The food waste such as vegetables, fruits peels, coffee ground, egg shells and tea leaves are used as the materials for the composting process. Besides dry leaves, soil, shredded paper and newspaper are added into the compost as well to reduce the excess moisture. They are the materials that can absorb water due to their ability of absorption.

(a) (b)

Fig: (a) The greens (kitchen waste); (b) The browns (shredded wood).

Note: the compost should not include cooked food, meat, or fish as they contain pathogen, which may contaminate the compost. Hard items such as bones or oily and greasy items such as cheese also should not be put into the composting process.

2.2.2 Carbon and Nitrogen Source

In composting process, greens and browns are needed as the basic source as the composting materials. They are used to be called as Carbon and Nitrogen source. By greens we mean the kitchen waste, while browns mean dry leaves, sawdust, shredded paper and soil.

Table 2.1 shows the source of Carbon and Nitrogen to be put into the composting process.

Table 2.1: List of Carbon and Nitrogen source

Greens (High in Nitrogen- N)	Browns (High in Carbon- C)
Discarded vegetables or vegetable peels	Dry leaves and shredded wood
Fruit peels	Soil
Coffee and tea grounds	Shredded paper and newspaper

3. Methodology

3.1 Design of the Compost Bin

A plastic container has been chosen. There are a few holes pierced on the lid of the container in order to provide the compost with air. As mentioned previously, bacteria need oxygen to keep up the respiration process that happens within aerobic systems. Additionally, putting the compost in a closed container is better. The bin will cover the compost from the rain and will help to retain the temperature inside. Closed container is also used to avoid bad smell or odour and prevent other animals from disturbing the process. The container will be on a base so that it can be on a height to avoid the rodants and insects. The waste should be mixed time to time for proper aeration. As the waste mixture is tumbled in its passage down the length of the drum, the material is gradually broken down and is well mixed with oxygen and water. The consequent increase in granularity causes increasingly intense biological activity leading to a well-established decomposition process. The composter is made to allow a healthy composting process. Therefore, its design takes some factors into consideration. Aeration and temperature are the parameters that relate to the design of the composter. In this research, the designed composter will be pierced with some holes and will be rotated for ventilation in order to improve the aeration for the composting process. Besides, the compost temperature may vary from 25°C to 70°C. Therefore, the composter has to retain heat by not easily lose heat to the surrounding. Figure 3.1 shows the design of the rotary compost bin.

Fig: the bin with holes for aeration.

3.2 Composting Process

The composting process included the method of composting by considering the characteristic of the materials chosen. The end product of composting is tested in laboratory to obtain the content of the compost.

3.2.1 Composting Method

The composting was basically done layer by layer. The browns and greens were layered alternatively until it reaches half of the container. Then, it was rotated for mixing and breaking down of the size of the materials.

Step 1: The bottom of the compost bin was filled with a thick layer of browns such as soil and shredded newspapers. These help to soak up excess moisture and improve aeration.

Step 2: The prepared greens was added into the composter. They should form a layer above the browns that were added in step 1.

Step 3: A few handfuls of compost starters were added into the composter. Then, they were mixed with the greens that are added in the previous step.

Step 4: Another layer of shredded browns was added into the composter. About the same amount of browns was added as greens from step 2. Then, this new layer was mixed with the greens and compost starters from the previous step. This introduces air spaces into the compost pile, ensuring an aerobic situation and effective composting process. It also prevents the compost pile from smells and pests.

After layering all the materials, a handful of water was sprinkled into the composter and some turmeric powder was added to avoid ants. The composter was placed at a warm place. This helps the microorganisms in the compost work more efficiently, as they thrive in warmer temperatures. A dry layer at the top also functions as a first line of defence against flies that are seeking moist places to lay their eggs on. The composter was put under partial sun exposure to keep the compost pile warm. The composter was avoided from direct sunlight as extreme temperatures would kill the beneficial microorganisms [7]. The composter was then being rotated every day for mixing and aeration purpose.

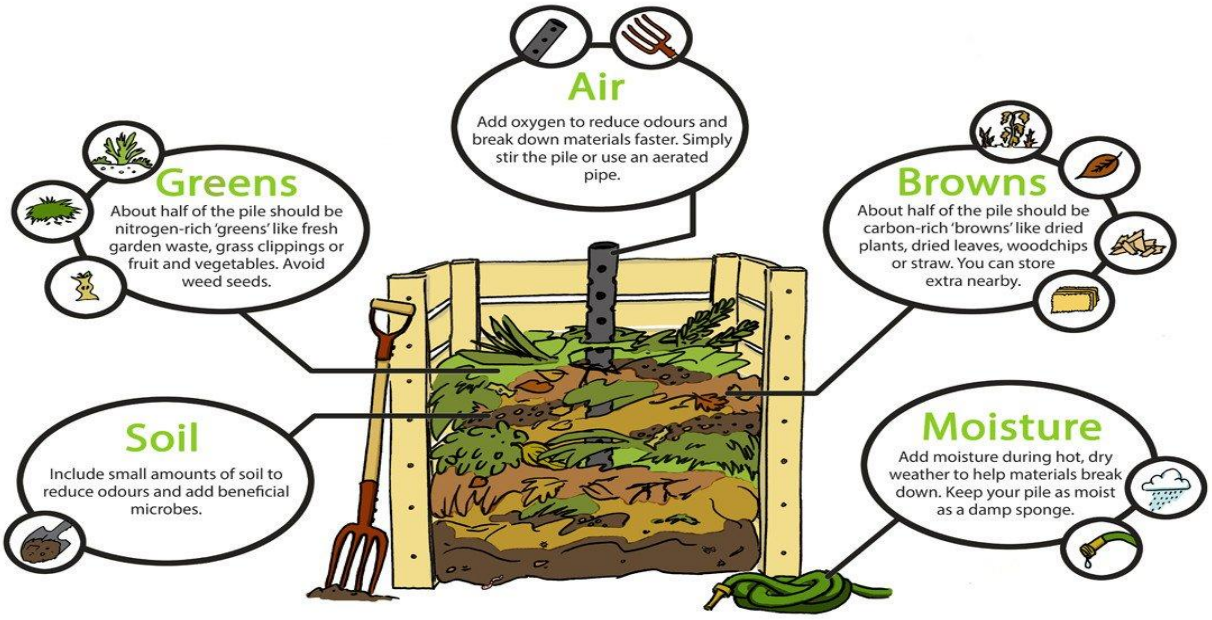


Fig: the layering of greens and browns.

4. Results and Discussions

4.1 Temperature profile

The temperature has been widely recognized as one of the most important parameters in the composting process. Initially, the temperature of the compost pile was 32°C. Due to the breakdown of the available organic matter and nitrogenous compounds by the microbial activities, the temperature of the pile increased to the thermophilic phase [8]. The thermophilic phase lasted for 4 days corresponding to the maximum temperature at 42°C, 41°C and 40°C on day 2, 3, 4 and 5. When the temperature reached around 40°C, the mesophilic bacteria will begin to die and leave the floor to the thermophilic bacteria who will take over. The temperature will stabilize during this stage, which will last no longer than 3 days due to the small size of the compost and the regular turning [9]. During the cooling phase, the microbial activities and organic matter decomposition rate slowed down and the temperature of the compost pile gradually decreased. The compost pile decreased to ambient temperature on day 27 which is considered to have entered the maturation phase.

Fig: the compost under shade with optimum temperature.

5. Conclusion

The objectives of this research was to reduce the amount of food waste, develop a composting process for managing food waste and improve its quality for possible use in the growth of plants as well as develop a composter for composting process. This research is considered a success as the organic compost from food waste composting can be used as the fertilizer because the content of it is in the acceptable range for mature fertilizer. The percentage of total Nitrogen, total Phosphorus and total Potassium is 0.9%, 0.8% and 0.4% respectively. The final product has soil-like smell and dark brown in colour which means it is matured enough to be used.

Fig: the final compost is ready for the plants.

Fig: students adding the compost into plants.

References

[1] B. K. Adhik, “Urban Food Waste Composting,” Degree. Thesis. McGill Univerisy, 2005.

[2] H. S. Shin, S. K. Han, Y. C. Song, and C. Y. Lee, “Performance of UASB reactor treating leachate from acidogenic fermenter in the two-phase anaerobic digestion of food waste,” Water Res., vol. 35, no. 14, pp. 3441–3447, 2001.

[5] W. Parawira, Anaerobic Treatment of Agricultural Residues and Wastewater Application of High-Rate Reactors, Department of Biotechnology, Lund University. 2004.

[6] P. Leslie R. Cooperband, “Composting: Art and Science of Organic Waste Conversion to a Valuable Soil Resource,” Lab. Med., vol. 31, no. JUNE, pp. 283–290, 2000.

[7] T. L. Min, “Production of Fertilizer using Food Wastes of Vegetables and Fruits,” 2015.

[8] S. M. Tiquia and N. F. Y. Tam, “Characterization and composting of poultry litter in forced-aeration piles,” vol. 37, pp. 869–880, 2002.

[11] Rim Toumi, “Design Of A Composting Bin To Convert AUI’S Biomass to An Organic Fetilizer,” 2017.