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FOOD RECYCLING INTO ON-CAMPUS COMPOSTING–GREEN CAMPUS INITIATIVE IN EDUCATIONAL INSTITUTION

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ABSTRACT

India currently faces an urgent environmental crisis (even in the world). The Green Campus Initiative is one of the ways in which India's environmental challenges are being addressed. By creating more sustainable campus practices, our institution can demonstrate to students that the importance of environmental stewardship so they can bring these lessons to others outside the campus community. To reach the goals of a sustainable campus, we must act on ''closing the loop to become a self-contained facility that grows its own food, and recycles its own waste'.

The vermi culture act as an innovative supportable technology for the treatment of waste as it holds a futuristic contribution in the field of waste management. Nowadays vermiculture is successfully applied in the solid waste management. The eco-friendly process of vermicomposting act as a considerable way for reducing wastes, production of fertilizers and the balance towards maintaining ecological environment.

The study also inveterate that the vermicomposting can yield high-quality fertilizers which are better related to other commercial fertilizers in the market. The study endorses adequate time should be allotted for the project in order to uphold it towards its justifiable development. The objective of this paper is to promote the adoption of this method in college campus by effectively utilizing the food scraps from College canteen, Hostel kitchen Dining Hall and Catering Food Lab into On-campus Composting. The study aims to bring cost savings to our institution by reducing the amount of food scraps going to landfills into composting facility. To take a step further, this study provides the opportunity for new, innovative hands-on learning experiences rather than traditional text-book and lecture learning.

INTRODUCTION:

India is desperately seeking solutions to several environmental challenges that have undermined overall health and wellbeing. These challenges are related to contamination of air, water and soil, vulnerability of regions to climate change and extreme weather events, resource inefficiency and wastefulness, and erosion of local biodiversity. There are large number of institutional campuses of varying shapes and sizes—schools, colleges, etc.—which can adopt a system wide approach to environmental sustainability, promote environmentally responsible practices and behavior, experiment with

innovative solutions, combine learning and practical application, and add educational values. Simple steps and a collective environmental audit can reduce waste and promote local greenery to conserve biodiversity. This can even lead to curriculum based hands-on problem- solving experience for the campus residents while promoting real life work experience and education. The green campus movement can unleash unprecedented transformation if achieved at a scale. More and more Institutions are acknowledging green sense and are now aiming to reflect it in day-to-day practices on the campus. They are transforming places of formal learning into low carbon habitats that are resource prudent and less wasteful. Even the governments are supporting this transformation with their guidelines and mandates. For instance, Ministry of Environment and Forests and Climate Change is shaping its programme on green campuses. Indian government's National Assessment and Accreditation Council (NAAC) has included an environmental sustainability criterion in their rating of educational institutions.

KEYWORDS:

Composting, Sustainable, Efficiency, Biodiversity.

OBJECTIVES

- To effectively utilize the Food Waste from College canteen, Hostel kitchen Dining Hall and Catering Food Lab into On-campus Composting.
- To promote sustainable activities among college students who can bring changes in the society as they have enough enthusiasm to get things done.
- To impart Organic and sustainable agriculture trends within students.
- To transform the college into Sustainable and an Eco-friendly Green campus.
- To develop the new age Entrepreneurial skills within Students
- To Educate the students regarding the significance of Organic foods which is a need of an hour in post COVID-19 scenario.

COMPOSTING

About 35%–40% of the municipal solid waste generated in India comprises of organic waste. One of the oldest ways to recycle the waste is by means of composting. The manure which is obtained through this decomposition will be rich in nutrients and it's a natural process. The production of manure is by applying natural phenomenon of decomposition. The compost includes the organic manure such as Nitrogen, Phosphorous and Potassium which is act as a nutrient for plants. It is the way to recycle the yard and kitchen wastes, and is a critical step in reducing the volume of garbage needlessly sent to

landfills for disposal. The amount of disposable garbage is reduced and it is the way of reduction of the kitchen wastes as well the recycle of yard. Instead of chemical fertilizer organic fertilizer can be used for farming. The ability of the soil to hold the water can be increased by applying this organic manure and help to cultivate by retaining the soil with more organic nutrients.

TYPES OF COMPOSTING AND UNDERSTANDING THE PROCESS

Composting Basics.

Onsite Composting.

Vermicomposting.

Aerated (Turned) Windrow Composting.

Aerated Static Pile Composting.

In-Vessel Composting.

The two ways by which the composting can happen is aerobically and anaerobically. The micro-organisms oxidize organic compounds to Carbon di oxide, Nitrite and Nitrate during the aerobic composting aerobic. Due to exothermic reaction, temperature of the mass rises the carbon organic compounds is used as a basis of energy while nitrogen is recycled. During anaerobic process, the anaerobic microorganisms break down the organic compounds through a process of reduction.

The Methane and Carbon di oxide are the gases evolved during this process. The temperature of composting does not rise high but a small amount of energy is released and the anaerobic process is a reduction. Composting in pits an aerobically is called as Bangalore method. The composting by aerobic system can be done either through manually or mechanically in a open window, pits or enclosed digesters. Open window system is preferred in tropical region, while in temperate region closed digester system is used.

The Indore method is a kind of pit composting. The most of kitchen waste can be digested using this method which in turn bedding material into high quality castings which can be added to the soil and used on house plants, vegetable seedlings and flowers. Vermicomposting (worm composting) systems are modest to uphold. The time taken for this process is very less as well as less effort is required. Upholding an bounded bin exactly for 'vermicomposting' is an excellent way to take care of food wastes. With the prohibiting of holes for drainage and aeriation, worm bins for covered use are typically totally surrounded, with a lid of some sort to cover the top.

COMPOSTING BASICS

There are five chief extents that necessity be “controlled” throughout composting.

Feedstock and Nutrient Balance

Composting, or controlled decomposition, needs a appropriate steadiness of "green" organic resources and "brown" organic resources. "Green" organic material comprises grass trimmings, food leftovers, and dung, which contain bulky amounts of nitrogen. "Brown" organic materials comprise dry leaves, wood chips, and branches, which contain large quantities of carbon but little nitrogen. Procurement the right nutrient combination necessitates experimentation and endurance.

PARTICLE SIZE

Grinding, chipping, and shredding materials upsurges the superficial area on which microorganisms can feedstuff. Smaller elements also yield a more similar compost mixture and progress mass filling to help uphold optimum temperatures (see below). If the units are too small, however, they strength prevent air from graceful freely through the mound.

MOISTURE CONTENT

Microorganisms living in a dung mound require sufficient dampness to endure. Water is the important element that assistances transport materials within the compost pile and kinds the nutrients in organic material available to the microbes. Organic material contains some dampness in varying amounts, but moisture also strength come in the form of rainfall or deliberate watering.

OXYGEN FLOW

Rotating the pile, insertion the pile on a sequence of pipes, or including bulking agents such as wood chips and shredded newspaper all assistance ventilate the pile. Ventilating the pile permits decomposition to happen at a quicker rate than anaerobic circumstances. Care must be occupied, however, not to deliver too abundant oxygen, which can dry out the pile and obstruct the composting procedure.

TEMPERATURE

Microorganisms require a convinced temperature variety for optimum activity. Certain temperatures support fast composting and abolish pathogens and weed seeds. Microbial activity can increase the temperature of the pile's core to at least 140° F. If the temperature does not increase, anaerobic conditions (i.e., rotting) occur. Controlling the preceding four factors can bring about the appropriate temperature.

ONSITE COMPOSTING

Organizations that are successful to manure small amounts of wasted food can compost onsite. Composting can meaningfully decrease the amount of wasted food. Yard accompaniments and small quantities of food leftovers can be composted onsite. Animal products and large quantities of food leftovers are not appropriate for onsite composting.

FACTORS GOVERNING THE COMPOSTING PROCESS

There are various factors, which governs the composting process. They are as follows:

Temperature

pH

Moisture content

Carbon: Nitrogen ratio (C/N)

Inoculums

Oxygen supply / Aeration

Insect control

Odor

Microbial aspect of composting

Time required for composting

DATA ANALYSIS AND METHODOLOGY

Analysis of food waste generated at Hindusthan campus:

- The waste food accumulated from the girl's hostel and boy's hostel is dumped into the pit which is situated behind the hostel area.
- It has directed to breeding of mosquitoes in the neighborhood of hostel and is distressing the health of the students severely. Similar is the situation for the canteen as well.
- To examine how each person subsidizes to the food waste produced in the campus, we had conducted a survey for fifteen days and from this we got to know the total amount of food waste generated daily in the Hindusthan's campus. The output for the survey are listed in the below table.

TABLE NO. 01: DETAILS OF QUANTITY OF FOOD WASTE GENERATED DAILY

Sr. No.	DATE	QUANTITY OF FOOD WASTE(Kg)		
		GIRL'S HOSTEL	BOY'S HOSTEL	CANTEEN
01.	05/07/21	12.33	23.29	21.25
02.	06/07/21	12.40	24.76	22.86
03.	07/07/21	11.75	22.76	20.22

04.	11/07/21	13.46	25.28	21.88
05.	12/07/21	11.32	21.35	20.24
06.	14/07/21	10.98	21.88	20.54
07.	18/07/21	11.23	23.56	22.91
08.	19/07/21	12.62	25.18	20.53
09.	20/07/21	10.86	22.36	21.67
10.	21/07/21	11.54	24.30	22.43
11.	25/07/21	11.55	21.53	20.90
12.	26/07/21	10.86	21.65	20.45
13.	27/07/21	11.50	23.50	22.73
14.	03/07/21	12.26	25.27	20.95
15.	04/07/21	10.90	22.60	21.40
	AVERAGE	11.70	23.28	21.40

MATERIALS AND METHODS

MATERIALS:

The various food wastages such as bread, potato peels, onion peels, rice and carrots were used for vermicomposting during this experiment. Manyuchi et al described the vermicomposting methodology in detail.

B.METHODS

The several food wastes were vermicomposted over 30 days using *Eisenia Fetida* earthworms. The vermicompost and vermiwash formed from different food wastes were examined for the nitrogen, phosphorous and potassium (NPK) composition. The measurement of nitrogen content was measured by the Kjeldahl method (AOAC-920.87), whereas the phosphorus content was measured by the Gravimetric Quimociac method (AOAC-962.02) and the potassium content was measured using a Shimadzu 6800 atomic absorption spectrophotometer.

FOOD WASTE ANALYSIS:

The food waste sample was collected and following parameters were studied:

Moisture content

Density

Moisture content

- Moisture content of solid waste is usually expressed as the mass of moisture per unit mass of wet or dry material. In the wet mass method the moisture in the sample is expressed as percentage of wet mass of the material. Moisture content of food waste varies between 50-80%. Procedure
- Accurately weighed 500 gm sample of food waste is taken.
- It is then spread in the pan and kept in the oven for drying. Generally sample is dried at77^0C to 110^0C
- After 24 hours, oven is turned off and sample is kept for cooling for about 15 to 20 minutes.
- The weight of the dry sample is taken.

Using the formula the moisture content of food waste is calculated.

$$\text{Moisture content} = \frac{\text{Wet weight - Dry weight}}{\text{Wet weight}} * 100$$

Results: The moisture content of the food waste is 75.12%.

DENSITY

Knowledge of the waste density is essential for the design of all elements of the solid waste management system like storage, transportation and disposal. Density is defined as the weight of material per unit volume. The interest of knowing the density of waste is to access the total mass and volume of waste that must be managed. The density of food waste can be up to 290 kg/m^3.

Procedure

Accurately weighed 500 gm sample of food waste is taken.

Its dry mass is determined.

The dry density is calculated by using the formula.

$$\text{Discarded Density} = \frac{\text{Dry Mass Prepared}}{\text{Volume}}$$

Results: The discarded density of the food waste is 218.246 kg/m^3

FOLLOWING MODELS COMPOSTING FOR FOOD

- Aerobic without cow-dung
- Anaerobic with cow-dung
- Aerobic with cow-dung
- Vermi-composting

According to various researchers, cow dung helps to improve the decomposition rate of the food waste. To confirm those researches, models of anaerobic and aerobic composting with and without cow dung are prepared.

The plastic buckets with 0.02 m^3 i.e., 20 liters volume are used as vessel for the composting setup.

FOLLOWING PRACTICE IS IMPLEMENTED TO FORMAT THE AEROBIC AND ANAEROBIC COMPOSTING SETUP:

- First volume of bucket is precisely measured.
- With the help of indicator 4 cm thick coatings are marked over the bucket.
- Now the first layer of soil is given inside the bucket up to a thickness of 4 cm as mentioned earlier.
- The second layer of waste is given over the soil layer.
- Same process is continued up to a total height of 28 cm i.e., 7 alternate layers of soil and waste.

- For the setups with cow dung, a layer of fresh cow dung is introduced in-between.
- To maintain the moisture content, water is sprinkled.
- For first six days no rotation is given
- After the first six days, rotations are given after every four to six days.
- No rotations are given for anaerobic composting setups.
- For vermicomposting setup following procedure is adopted:
- First volume of bucket is accurately measured.
- Then the holes are pierced at the bucket bottom so that the extra moisture is removed as it is dangerous to the worms.
- With the help of marker 4 cm thick layers are marked over the bucket.
- The first coating of cow dung is given of 4 cm thickness.
- The second layer of waste is given over the cow dung layer.
- Then the waste layer is given over it followed by alternate layers of cow dung and soil.
- Same process is continued up to a total height of 28 cm i.e., 7 alternate layers of soil, waste and cow dung.
- Then earthworms of species *Eisenia foetida* (red earthworm) are introduced.
- No rotations are to be specified to the vermicomposting as the worms themselves rotate.

TABLE NO. 02: ROTATION DATA

Sr.	**AEROBIC**	**AEROBIC**	**VERMICOMPOSTING**
01.	25/07/21	25/07/21	No Rotation
02.	05/07/21	05/07/21	
03.	12/07/21	12/07/21	
04.	16/07/21	16/07/21	
05.	20/07/21	20/07/21	
06.	28/07/21	28/07/21	
07.	03/08/21	03/08/21	
08.	10/08/21	10/08/21	
09.	17/08/21	17/08/21	
10.	21/08/21	21/08/21	

RESULTS AND DISCUSSIONS

VERMICOMPOSTING:

The vermicompost was ready to use after a month. The texture of the compost was perfect. The worms were found to be healthy. It can be concluded that vermicomposting is best alternative for food waste composting.

AEROBIC COMPOSTING:

According to the literature available, aerobic composting requires 2 months duration for completing the entire process. The model under study was analyzed for one month. Hence, required time was not given to the model for completing the composting process. Hence the compost was not ready after a month.

ANAEROBIC COMPOSTING:

Anaerobic composting requires at least four to six months for the entire reduction of waste. The model was prepared for a month analysis. Thus, the model under study did not give the expected results.

CONCLUSION

The objective of the project was to analyze the current food waste management in Hindusthan's campus and put forward a new and effective alternative for food waste management to reduce the nuisance caused due to food waste dumped openly in the campus.

For the food waste it was observed that the suitable waste disposal method is vermicomposting. It is a quick and easy to maintain and operate composting method. Aerobic and anaerobic composting are time consuming processes.

REFERENCES

- Bhavik Gupta and Shakti Kumar Arora, (2016), “A study on management of municipal solid waste in Delhi” Journal of Environment and Waste Management, 3(1), 131-138.
- Handbook of Solid Waste Management, George Tchobanoglous, Frank Kreith
- Manual on municipal solid waste management, MoUD GOI, 2000.
- Nitin Prakash Pandit, Nabeel Ahmad and Sanjiv Kumar Maheshwari, (2012) “Vermicomposting Biotechnology: An Eco-Loving Approach for Recycling of Solid Organic Wastes into Valuable Biofertilizers” Journal of Biofertilizers & Biopesticides,

3(1), 1-8.

- Rajiv K. Sinha, Upendra Patel, Brijalkumar K. Soni, Zheng Li (2014), "Earthworms for safe and useful management of solid wastes and wastewaters, remediation of contaminated soils and restoration of soil fertility, promotion of organic farming and mitigation of global warming: A review" Journal of Environment and Waste Management, 1(1), 11-25.
- Saleh Ali Tweib, Rakmi Abd Rahman and Mohd Sahaid Kalil (2011) "A Literature Review on the Composting" International Conference on Environment and Industrial Innovation IPCBEE, 12, 124-127.