

Utilization of Paper Waste for the Production of Organic Compost

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ABSTRACT: At Present condition it is better to replace chemical fertilizers with natural fertilizers. Since waste management plays vital role in today's sustainable development criteria, we have chosen paper and food waste from our college canteen along with activated carbon from the market. By treating by-product in anaerobic and aerobic process for the final result.

Since we are using paper as a by-product, so nitrogen content will get lost & it will lead to decrease in efficiency of final result. Source is obtained from the college canteen (source: food waste, paper waste, activated carbon). Test for final product will be tested in small scale area. Our product is suitable for organic farming.

I. INTRODUCTION

Chemical fertilizers used in the present scenario are non-renewable and harmful to human health. Its long term use has drastically changed the PH value of the soil. So, in order to reduce the usage of chemical fertilizer, there is a need for organic fertilizers. The best way to get organic fertilizers economically and efficiently is by producing them from wastes which has higher nutrient content.

Organic fertilizers improve the soil structure by increasing the soil's ability to hold water and nutrients. It will boost microbial and fungal activities thereby providing a healthy environment for its growth. It helps in plant growth and soil fertility. Agriculture is mostly done using chemical fertilizers which causes intervention of these chemicals into the food chain which are leading causes for many health issues.

Therefore, by replacing chemical fertilizers by organic fertilizers, these problems can be drastically minimized leading to a healthier food consumption and safe food chain.

Generation of paper wastes has been enormous in the recent years. In India, every year around three million tonnes of waste paper is recovered, which is only about 20% of the total paper wastes. When we compare the data with other countries, the amount is comparatively very low. Hence the paper waste utilized in our project is comprised of waste papers obtained from private institutions located in Chennai, India. Activated carbon also called as activated charcoal is a form of carbon that is processed to have more surface area leading to high degree of microporosity. This small volume pores increase the surface area thereby increasing the adsorption rate.

Activated charcoal rids the soil of impurities, repels insects, and prevents mold and odours. It's also extremely porous, meaning that when you drown your leafy friends in water, it will absorb the excess, thereby preventing root rot. Adding charcoal to soil produces bigger plants and helps fertilizer work more efficiently.

Vermicomposting is a process where compost is produced with the help of earthworms. Earthworms feed on organic wastes and excreta, changing it into compost. Red worms and African earthworms are most efficient in the production of the vermicomposting.

Plant bio stimulants also called as microbial consortia (Plant Growth Promoting Microbes) are applied to improve crop production and nutritional quality of Agri food products. They are often included in agricultural management practices aimed at reducing chemical inputs, increasing productivity and recovering the natural equilibrium in Agri-ecosystems. They are involved in carbon exchange and augment the capacity of the plant to absorb water plus nutrients, thus counteracting negative effects of biotic and abiotic stresses.



Mixing/ Shredding: Propagation of food waste, leaves, newspaper and other bulking agents are mixed together proportionally using either a scale or a bucket. As a part of the mixing process, the waste needs to be broken up or shredded.

Pre-composting: After mixing, the material experience a period of intense microbial activity, which causes the temperature inside the pile exceeds 100 degrees Fahrenheit. Pre-composting involves placing the mixed pile outside of the bin for a number of days to cool.

Digester loading, preconditioned material is loaded into the digester at a depth of not greater than six inches per day. A shovel can be used for loading the material.

Harvesting: Worm-processed material is removed from the lowest portion of the digester through the force of a scraper bar, which is drawn across the bottom inch of material. It helps the material to fall through a supporting screen. This material is a mixture of vermicompost and worm casting. After being removed by the scraper, the material falls out from the bin by gravity where it can be collected for storage.

Storage: The mixture of vermicompost and casting is removed with either a wheelbarrow or front-end loader and is stored for a long-term. In storage, the material can be exposed to air dryer due to its fine particle size.

Spreading: Vermicomposting and worm casting are spread on gardens or used for other landscaping projects

II. MATERIAL USED AND MIX PROPORTION

In this experimental study paper waste, food waste, soil, activated carbon, earthworms are used.

A. Paper waste

TAB. 1

Amount	Purpose	Total composition
0.75 kg	Decrease the nitrogen content	3.6%

B. Food waste

TAB. 2

Amount	Purpose	Total composition
9 kg	Increase the minimum level of nutrients	42.35%

C. Soil

TAB. 3

Amount	Purpose	Total composition
9 kg	Maintain the temperature of process	42.35%



D. Activated carbon

TAB. 4

Amount	Purpose	Total composition
1.5 kg	increase the Adsorbent value	7%

E. Earth worm

Species involved in this process is *Eudrilus Eugeniae*. Earthworms helps to increase the amount of air and water that gets into the soil. They break down organic matter , like leaves and grass

III. METHODOLOGY

COLLECTION OF SOURCE:

The samples (FOODWASTE AND PAPER WASTE) are collected from the selected institutions .Sample will differ from place because in mess we collect food waste, whereas paper waste is collected from the college canteen.

FABRICATION OF REACTOR:

The anaerobic digester reactor is made by the stainless steel. The dimension of the particular digester divided by depth 80.4 cm , length 46 cm , breadth 52 cm must tightly closed

MIXING OF SAMPLES:

The samples are mixed under various proportions in the anaerobic reactor.

Physical composition in %

Rice – 38.71

Bakery product – 18.74

Meat – 25.15

Fat – 13.03

Bones – 2.19

Fruit and vegetables – 2.16

Chemical composition in %

Moisture – 38.4

Carbohydrates – 25.56

Crude protein – 17.26

Crude fat – 15.27

Fiber -0.3

Ash – 3.21

LOADING THE SAMPLE INTO THE REACTOR:

The mixed samples are enclosed in the digester tank by careful manner. Before enclosing reactor must be found with 0% of moisture. Presence of moisture may leads to the formation of fungal attack in the samples.

COMPOSTING PROCESS OF SAMPLES:

The Composting is carried out by the anaerobic digestion process. The adequate temperature is maintained. During this process the particular reactor must be place ideal for the work.

TESTING:

The fertilizer is tested to determine the efficiency and the following parameters stated below:

- 1)Nitrogen, Potassium, Phosphorous content (N P K content)
- 2)Carbon: Nitrogen ratio (C: N)
- 3)Cellulose and lignin content

OBSERVATION OF OUTPUT:

The fertilizer output produced from various reactors is observed for various parameters. These parameters must be with proper quantity for the observation process

COMPARATIVE STUDY:

The characteristics of fertilizers produced under various proportions are studied. This study helps to determine the comparative analysis of fertilizer produced. study must be compare with the normal fertilizer in process



FABRICATION PROCESS

IV. RESULTS

RESULTS :

The following tables denote the lab results of aerobic and anaerobic samples that are obtained from the reactors respectively.

S.No	PARAMETERS	UNITS	RESULTS
1	pH	-	7.7
2	Colour	-	Brown
3	Odour	-	Pungent
4	Conductivity	dsm^{-1}	2.19
5	Moisture	%	11.4
6	Bulk Density	g/cm^3	1.00
7	Particle Size	-	Minimum 90% Material passed through 4.0mm IS sieve
8	Total Nitrogen as N	%	0.49
9	Total Phosphate as P_2O_5	%	0.32
10	Total Potassium as K_2O	%	0.44
11	C : N Ratio	-	17.1
12	Total Organic Carbon	%	4.1
13	Arsenic as As	mg/kg	BDL(DL:0.1)
14	Mercury as Hg	mg/kg	BDL(DL:0.2)
15	Chromium as Cr	mg/kg	86.68
16	Copper as Cu	mg/kg	22.44
17	Zinc as Zn	mg/kg	40.15
18	Nickel as Ni	mg/kg	26.48
19	Pathogens	-	Absent

TABLE 5- AEROBIC PROCESS

S.NO	PARAMETERS	UNITS	RESULTS
1	pH	-	8.3
2	Colour	-	Brown
3	Odour	-	Pungent
4	Conductivity	dsm ⁻¹	2.84
5	Moisture	%	20.5
6	Bulk Density	g/cm ³	1.01
7	Particle Size	-	Minimum 90% material ough 4.0mm IS sieve
8	Total Nitrogen as N	%	0.56
9	Total Phosphate as P ₂ O ₅	%	0.37
10	Total Potassium as K ₂ O	%	0.55
11	C : N Ratio	-	18.9
12	Total Organic Carbon	%	4.9
13	Arsenic as As	mg/kg	BDL(DL:0.1)
14	Mercury as Hg	mg/kg	BDL(DL:0.2)
15	Chromium as Cr	mg/kg	70.14
16	Copper as Cu	mg/kg	18.48
17	Zinc as Zn	mg/kg	26.94
18	Nickel as Ni	mg/kg	22.63
19	Pathogens	-	Absent

TABLE 6- ANAEROBIC PROCESS



OBTAINED REULT

V. CONCLUSION

This paper shows the way by which the paper waste can be composted along with food wastes, paper wastes and cattle dung whereas the decomposition process is enhanced in the presence of vermicomposting and aerobic heterotrophic pollution. From the observation of the results, we can see that Nitrogen content is not sufficient as per the minimum needs of the vermicomposting. Only trace amounts of nitrogen is recorded in the results.

The test result also indicates that the Potassium and Phosphorous content are within the range proposed in FCO (1985). Paper waste material is characterized with high values of pH, organic carbon. However, other nutrient such as total nitrogen available phosphorus and exchangeable potassium were found in very trace amounts. The process of vermicomposting activity significantly modified the physical and chemical properties of paper waste material (such as colour, odour, moisture, conductivity, bulk density and C: N ratio, nitrogen, phosphorous and potassium content respectively) that can be an important tool for organic farming. Also the addition of Activated carbon catalyzed the decomposition rate thereby decreasing the number of days needed for decomposition as we obtained the result in just 45 days.

The C: N ratio values of aerobic and anaerobic samples are 17.1 and 18.9 which is less than the permissible range (20) that is proposed in Fertilizer Control Order (FCO) 1985. The pH of the aerobic and anaerobic sample is 7.7 and 8.3 which is near the range of the proposed limit of the FCO (1985). Absence of the foul odour is observed in both the samples. Phosphorous (P) which is largely responsible for root growth and flower and fruit development is near the proposed limit of FCO (1985). The value of the Phosphorous in the aerobic and anaerobic sample is 0.32 and 0.37. Potassium (K), the nutrient that helps the overall functions of the plant perform correctly. The value of the Potassium in the aerobic and anaerobic sample is 0.44 and 0.55. The data shown in table clearly indicates that there was no mortality of worms in the decomposed wastes. Total organic carbon (TOC) values which denote the amount of carbon in the organic compound also recorded minimum amounts and do not satisfy the criteria in FCO (1985). This can be viewed as a result of paper wastes and cow dung that facilitate the removal of organic carbon content of the sludge.

According to the article “Nitrogen Fixation by Legumes” by Robert Flynn and John Idowu, Legumes need less nitrogen content fertilizer that can be used grown on sandy or low organic matter. Grain legumes such as peanuts and soy beans release nitrogen into the soil as the plant decomposes. Microorganisms decompose the plant and release the nitrogen into the soil as they die. Most crop residue contains far more carbon than nitrogen and soil bacteria need both. Improving the soil with peanut planting allows around 2/3 of the fixed nitrogen to be left in the soil, which is then available to the following year’s crop rotation. The results also establishes that due to the low nitrogen content, it cannot be used as a organic fertilizer for leafy vegetables, but due to the good potassium and phosphorous content, it can be used as a fertilizer in the flower growth. Also there is increase in the number of earthworms which precisely pinpoints the reproductivity of earthworms in the reactor bed. Further the resulting nutrient content of vermicomposting from paper waste is used as a fertilizer to a plant and compared that plant with a commercial plant growth medium which had inorganic nutrients added

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