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AN EXPERIMENTAL STUDY ON BIO-DEGRADATION OF ORGANIC WASTE BY USING COMPOSTING

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Abstract: Biodegradation is the disintegration of material by bacteria, fungi or other biological mean. The term is often used in relation of ecology waste management and the natural environmental and bioremediation and is now commonly associated with environmental friendly product that is capable of composting back in to natural element organic material that can be degraded aerobically with oxygen or anaerobically without oxygen. Biodegradable matter is generally organic material that serves as a nutrient for micro-organisms. The micro-organism are so numerous and diverse that a huge range of compounds are biodegraded including hydrocarbons. Eg: oil artificial used biphenyls (pcbs) poly aromatic artificial (pahs). The artificial fertilizer is more harmful, so it will affect the human being and gives side effect also. So in this study, we replace fertilizer in our biodegradation fertilizer. It is a fertilizer and its cost is also low. The cow dung, fruit and artificial and coir pith are collected easily so it can be prepared artificial. It gives high nutrient when compared to the artificial fertilizer. The source of organic materials are from sugar industries and other waste, which in turns reduces the dumping of waste which forms the leachate and pollute the soil and ground water. Cow dung which provides considerable percent to increase the nutrient value in terms of Carbon, Nitrogen ratio and other nutrient values. And it is used as the bio-fertilizer in agricultural industry.

Index Terms: Bio composting, Coir pith, Distillery effluent, Litter waste and press mud

I. INTRODUCTION

Press mud and bagasse are commonly known as major wastes of the sugar industry. Sugarcane press mud & bagasse are soft, spongy amorphous and dark brown to brownish white material containing lignin, cellulose, hemicellulose fibers. In India, it has been estimated that the annual production of sugarcane waste and press mud is 24 to 28 million tonnes and 3.6 to 3.9 million tonnes respectively, while the production of coir pith is about 900 million tones. Lignin degradation takes more time because of its structural complexity. Lignin is a natural polymer having complex three dimensional structures, the phenolic compounds. While cellulose and starch contain glucose units. Pectins contain galacturonic acid monomers. Hemicelluloses contain mannans, xylans and galactans. Most of the part of these wastes is usually burnt in the field due to lack of proper management techniques, which creates severe environmental pollution and health hazards. Also when these organic wastes when applied without composting to the soil may lead to temporary lock up of nutrients as a result of impaired C:N ratio may not be beneficial to crop. Hence, composting of organic wastes is necessary to reduce the lignin and cellulose contents, there by the nutrient availability is improved.

II. GENERAL

The material used for the composting process are press mud, distillery effluent, litter waste and coir pith waste with cow dung.

III. PRESS MUD

In india,sugar industry with 400 sugar mills ranks as the second major agroindustry in the country. press mud a by-product of sugar mill is produced at 30-35 kg per ton of cane crushed. Production of sulphidation and carbonation press mud is estimated to be 3% and 7% respectively of the quantity of cane crushed in a sugar factory following sulphidation and carbonation process respectively present was undertaken to analyze the compost prepared by using bacteria and micro-organism

Press mud is soft, spongy, amorphous ad dark brown white material containing sugar, fiber, and coagulated colloids including cane wax, inorganic salts and soil particle. It consist of 80% water and contains 0.9 to 1.5 sugar, organic matter, nitrogen, phosphorus, potassium, calcium, sulphur and coagulated colloids and other material is varying amounts. When cost of chemical fertilizers is skyrocketing and not affordable by

formers, press mud has promise as a source of plant nutrient and a medium for raising sugarcane seedlings and as carrier for leguminous inoculants. Press mud like other organic material effect the physical, chemical and biological properties of the soil. However, due to it is bulky nature and wax content it usually give less benefit in the year of direct application in the fields. Composting and vermicomposting could be an alternative to the problem for promoting its use in agriculture. Press mud from the sugar mills is a very useful source of fertilizer as well as some chemicals. Its usefulness as fertilizer is based on nutrient content of the mud and spent wash as shown below: the press mud-N- 1.15 to 3.0%; P27 fertilizer varies with the process used. It has the following advantages:

1. Very low power requirement
2. Zero discharge to inland water resources and freedom from river or ground water pollution.
3. Organic fertilizer produced is rich in micro-nutrients and can reduce the requirement of chemical fertilizers.

It is also provides bacteria for nitrogen fixing, phosphates, humus that will keep the soil healthy and develop the self-reclamation cycle. Since bio-composting is accompanied by a raise in temperature, chances are that the fertilizer is free from all pathogens, harmful bacteria, weeds and seeds. Fertilizer is free flowing, easy to handle, to pack and transport. The press mud has to be stored in large open areas and large lagoons are to be set up to store the spent wash. However, the long-term effects of application of this fertilizer remain to be studied. Press mud from the sugar industries is a very useful source of fertilizer as well as some substances. The major use that has recently been developed in india is in bio-composting (usually trade named as bio earth) where it is treated with the spent wash from the distillery.

Table 1: Composition of press mud

S. No.	Composition	(%)
1	Crude wax	5-14
2	Fiber	15-30
3	Crude protein	5-15
4	SiO	4-10
5	CaO	1-4
6	PO	1-3
7	MgO	0.5-1.5
8	Total ash	9-10

Its usefulness as fertilizer is based on the nutrient content of the press mud and the spent wash as shown in below.

Table 2: Nutrient content of press mud & spent wash

Composition	Press mud (%)	Spent wash (mg/L)
Nitrogen	1.15-3.0	2630
Phosphorus	0.60-3.50	201
Potassium	0.30-1.80	222

Figure-1 (Press mud)

IV. DISTILLARY EFFLUET FROM SUGARCANE INDUSTRY

Spent wash produced from distillery industries is rich in organic material and characteristically less toxic and easily amenable for microorganisms. An attempt is made to use the spent wash an ameliorant to enhance the organic manure from composting and also the direct apply of the cultivating field. Bioassay study results of many plant has proved the protective character of distillery spent wash an ameliorant for composting and using. The present result also advocates a new eco-friendly, economical and environmentally safe strategy to utilize the distillery effluent for producing valuable organic fertilizer that reduces environmental hazards to meet the needs of agriculturalists and the industrialists. This is also rich viable ad healthy bio fertilizer.

Figure-2 (Distillery effluent)

V. LITTER WASTE

Litter consist of waste products that have been disposed improperly, without consent, at an inappropriate location. Any solid or liquid domestic or commercial refuse, debris or rubbish, paper, fabric, wood, food, garden remnants and clippings, soil, sand or rocks are used as litter waste.

VI. COIR PITH

Coir pith has been widely utilized in agriculture due to its physical properties such as high porosity and water holding capacity rendering it suitable for employing as plating materials. The coir pith contains high carbon to nitrogen (C/N) ratio, 75 to 186, together with 35% to 54% lignin content. therefore, coir pith is highly resistant to biological degradation. Composting in general converts organic materials into a readily usable from as indicated by the decline of the C/N ratio. Although composting is of high potential as effective method for treating coir pith to land application, efficacy of coir pith composting suffers still from several drawbacks. For example, we have found that several months were necessary in order to obtain matured coir pith compost even though the aeration was provided. Though few attempts have been made to accelerate composting of coir pith such as inoculating with different microbes, improving the process of design to ensure the success of oxygen distribution with in the compost pile.

Figure-3 (Coir pith)

VII. COW DUNG

The use of cattle manure, or cow dung, in the garden is a popular practice in many rural areas. This type of manure is not as rich in nitrogen as many other types; however, the high ammonia levels can burn plants when the fresh manure is directly applied. Composted cow manure, on the other hand, can provide numerous benefits to the garden. Cattle manure is basically made up of digested grass and grain. Cow dung is high in organic materials and rich in nutrients. It contains about 3 percent nitrogen, 2 percent phosphorus, and 1 percent potassium (3-2-1 NPK). In addition, Cow dung contains high levels of the ammonia and potentially dangerous pathogens. For this reason, its usually recommended that it be aged or composted prior to its use as cow manure fertilizer. Composting cow manure several benefits. In addition to eliminating harmful ammonia gas and pathogens (like E. coli), as well as weed seeds, composted cow manure will add generous amounts of organic matter to your soil. By mixing this compost into the soil, you can improve its moisture-holding capacity. This allows you to water less frequently, as the roots of plants can use the additional water and nutrients whenever needed. Additionally, it was will improve aeration, helping to break up compacted soil. Composted cow manure fertilizer makes an excellent growing medium for garden plants. When turned into compost and feed to plant and vegetables, cow manure becomes a nutrient rich fertilizer. It can be mixed into the soil are used as top dressing. Most composting bins are piles are located within easy reach of the garden. Heavy manures, like that of cows, should be mixed with lighter materials, such as straw or hay, in addition to the usual organic substances from vegetable matter, garden debris, etc. Small amounts of lime or ash may also be added. An important concentration when composting cow manure is the size of your bin or piles. If it's too small, it will not provide enough heat, which is essential for the composting process. Too big, however, and the pile may not get enough air. Therefore, frequently turning the pile is necessary. Composter cattle manure adds significant amounts of organic material to the soil. With the addition of cow manure fertilizer, you can improve the overall health of your soil and produce healthy, vigorous plants.

Figure-4 (Cow dung)

VIII. COLLECTION OF MATERIAL

The press mud was collected from government Sugars Limited at palacode, Tamil nadu and it was powdered and stored. The litter waste was collected from canteen and it was partially degraded, moistened and used for further studies. The coir pith wastes was collected from Pollachi, Tamil nadu and it was partially degraded, moistened and used for further studies.

IX. EXPERIMENT WORK

The collected materials will be measured and mixed with the proposed proposition and placed in the tray in which composition will be take place. The tray will be remain open for the aerobic process to be take place in the tray with the materials present.

To initiate the process, Cow dung will be applied on the tray mixed with water, this process will be continued every week in order to maintain the moisture content in the tray which provides suitable temperature and moisture to composting. The set up will be mixed regularly for maintaining the moisture and temperature. The ratio of the mixture will be discussed below. Comparison of the above blends with below mentioned ratio mix and finally determining the best blend proposition for the ingredients. The proposition of the feed stock will be T1=1:2:1, proposition of T2=1:2:1, Proposition of T3=1:1:1:1 in addition the Cow dung will be applied for the compost. In Blend 1, Press mud is added 1 kg and 2 kg of Litter waste with 1 kg of distillery effluent. In Blend 2, 1 kg of Press mud, 2 kg of coir pith with 1 kg of distillery effluent. In blend 3, 1 kg of Press mud, 1 kg of coir pith with 1 kg of distillery effluent and 1 kg of litter waste are added. These blends are added and placed in the tray for composting process. Finally, cow dung will be added in the tray for initiate the composting process. The process will be continued for 2, 20, 40 and 60 days and nutrient value will be observed of these particular days and determining the optimum blend which produces the maximum nutrient value in the framed blends. Soon after the determining the optimum blend value, the comparison study will be continued by altering the proportion of the optimum blend, At last, the optimum blend with the effective mix proportions will be determined in the study.

In simple heap and windrow system is the most admired and economic of a nonreactor, agitated solid a bed system. Mixed feedstock are placed in rows and turned periodically. The length, width and height of the triangular heaps are 3 m, 0.5 m and 0.5 m, respectively. Oxygen is primarily supplied by natural ventilation, which results in the increase of buoyancy of hot gases in the windrows. These feed stock materials are in three different pots.

IX(i) proportion-1

Figure-5 (proportion-1)

IX(ii) proportion-2

Figure-6 (proportion-2)

IX(iii) proportion -3

Figure-7 (proportion-3)

Water is sprayed in the mixed feedstock periodically and simultaneous mixing is done. The initial chemical composition of the materials in the four pots is given in the table and the chemical compositions are again evaluated after in 10, 20, 30 and 40 days is shown in Table. Factors affecting the composting process are Moisture. Optimum moisture content is essential for the microbial proliferation during composting. Aerobic decomposition can proceed at moisture on pavilion between 30 to 100% if adequate aeration can be provided. Initially the moisture content may be between 45 to 75% optimum conditions is 50 to 65%. Ph

The pH of compostable material influences the type of organisms involved. In the composting process, fungi tolerate a wider pH rang 5.5 to 7.8 than bacteria. The optimum pH range for most bacteria is between 6.0 to 7.5 and proper temperature control is an essential for aerobic composting process.

XI(i)Temperature

The high temperature (about 50°C) is essential for the destruction of pathogenic organisms and undesirable weeds. Optimum decomposition takes place between 55 to 60°C.During compositing process the temperature increased to around 50°C and then decrease gradually it increased again after turning.

XI(ii) C: N ratio

C: N ratio. The carbon and nitrogen ratio affects the speed of the composting process and the volume of material finished. In other words, the rate at which organic matter decomposes during composting is principally dependent upon the C: N ratio of the material. During composting, microorganisms utilize carbon as a source of energy and nitrogen for building cell structure. More carbon than nitrogen is needed. But if the carbon is excessive, decomposition decrease.

XI(iii)Aeration and culture addition

Bacterial culture, which enables quick bioconversion of organic is sprayed on the press mud in the beginning and mixed thoroughly using aero tiller. This mixing makes the press mud and it encourages the decomposition process by added culture. About 1 Kg of bio culture is required for one tone of press mud.

X. RESULTS AND DISCUSSION

Composting of sugarcane and distillery industrial wastes are change and its impact on microbial population. In the present study, press mud a sugarcane waste with change like coir pith waste and litter waste in compost preparation and its impact on microbial population were studied.

Table 3: Combination of waste composting

No. of trails	Mixed feedstock
Pot 1	Press mud + Distillery effluent
Pot 2	Press mud + Litter waste + Distillery effluent
Pot 3	Press mud + Coir pith waste + Distillery effluent
Pot 4	Press mud + litter waste + Coir pith + Distillery effluent

Composting temperature increased to 60°C to 70°C and 20th day. However the temperature decreases gradually after 40th day of composting. The pH of the substrate increase gradually during composting due to the degradation of nitrogen containing materials in the raw materials to soluble organic nitrogen, the foundation of NH4+ ions and the release of hydroxide by hydrolysis. The same phenomenon was found in our study. Pot 4 press mud added with changes like litter waste and coir pith waste shows the increased microbial activity and also decreased carbon content. It also contains an increased N, P, K, Ca and Mg in the finished in.

10.1 Average results in different days/pot in%

Table 4: Chemical composition of the wastes on the initial day

Pot	Temp (0C)	pH	Carbon	Nitrogen	Phosphorous	Potassium	calcium	Magm
T1	52	7.0	31.60	1.12	1.35	0.85	4.33	1.16
T2	55	7.28	32.12	1.21	1.48	0.94	4.42	1.22
T3	50	6.98	33.74	1.34	1.59	1.02	4.78	1.34

Table 5: Chemical composition of the wastes on the10th day

T1	53	7.46	30.54	1.28	1.52	1.34	4.46	1.22
T2	56	7.51	31.06	1.32	1.72	1.42	4.48	1.35
T3	53	7.118	32.58	1.40	1.81	1.58	4.84	1.48

Table 6: Chemical composition of the wastes on the 30th day

T1	50	7.61	29.12	1.36	1.68	2.24	4.52	1.28
T2	48	7.66	29.14	1.46	1.76	2.34	4.64	1.46
T3	48	7.34	30.12	1.56	1.96	2.40	4.96	1.86

Table 7: Chemical composition of the wastes on the 40th day

T1	42	7.25	26.0	1.19	1.46	0.63	4.19	1.17
T2	43	7.75	27.66	1.54	1.72	2.86	4.23	1.34
T3	40	7.56	26.43	1.57	1.84	2.94	4.12	1.52

XI. CONCLUSION

Composting is a microbiological non-polluting and method of disposal and conversion of this organic waste. Compost temperatures are increase for 60°C to 70°C on day 10 to 20th day. However the temperature gradually decreases after 40th days. This is why the thermo temperature was reached when the wastes were loaded on dry basis due to the assimilatory activities of micro-organisms present in the mixed feedstock. The reduced C/N ratio material is suitable than the raw manure. The result in this laboratory scale study showed that, solid waste pollutants from sugar and distillery waste addition with coir pith and liter waste could be converted into organic fertilizer through the process of aerobic composting. Hence, good results are obtained during this process. Cost of bio composting operation is comparatively less and natural aeration is preferred for the economic benefit of this process.

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