International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

EXPERIMENTAL STUDY ON PHYSICOCHEMICAL PROPERTIES OF COMPOST BY PARTIAL REPLACEMENT OF ORGANIC MATTER WITH DAIRY SLUDGE

Sri G. Nani Babu [a], Sri D. Venkata Durga Prasad [b]

[a] *Asst. Professor, School of Renewable Energy and Environment, IST, JNTUK, Kakinada.*
[b] *Asst. Professor, Department of Civil Engineering, Pragathi Engineering College, Surampalem.*
**Email id:* [a] nani.anu25@gmail.com

ABSTRACT

Organic wastes are wastes that are easily biodegradable. These wastes are produced from many sources such as agricultural waste, market waste, kitchen waste, urban solid food wastes and municipal solid waste. The main objective of the present study is to decompose the organic matter along with dairy sludge with different ratios through the Aerobic composting process, analyze the various controlling parameters during the process, test the physicochemical parameters of finished compost and compare it with the standards prescribed by AP Horticulture Department and to pick optimum dairy sludge and vegetative matter ratio and the benefits of this project were also discussed. In this study dairy sludge along with organic matter in four different ratios like 100% vegetative matter,40:60, 50:50, 60:40 was mixed for 15 days and allowed to decomposed for 45 more days and the finished compost physicochemical parameters were analyzed. Results from this study were compared with standards set for compost by AP horticulture department and the results of this study have met Standards fixed by Horticulture department. Although all the compost samples satisfied the required standards fixed by AP Horticulture department in terms of all physicochemical parameters sample 3 is found to best with dairy sludge to vegetative matter ratio of 50:50 was found to be best with Moisture content 20.91%, pH 7.4, EC 3.5dsm^{-1}, Organic Carbon 22%, Nitrogen 1.6%, Phosphorus 0.78%, Potassium 0.91%, C:N ratio 13.75:1, Zinc 67.8 ppm, Iron 1420 ppm, Copper 14.20 ppm, and Manganese 31 ppm.

In Sangam dairy an average of 600 KLD Wastewater was treated per day with assumed consistency of sludge as 1% and 120 mg/L suspended solids present in Wastewater and thereby leading to annual generation of 1248 ton of compost which generates an annual revenue of 62,40,000/- and an annual profit of about 50 lakhs excluding construction operation and maintenance costs.

Key Words: biodegradable, Wastewater, compost, sludge

1. INTRODUCTION

The large volume of sludge produced from wastewater treatment in dairy industry coupled with environmental pressure and the stringent sludge regulations of reuse or dispose, remain the problematic issue in achieving sustainable sludge management. Although sludge represents only 1% to 2% of the treated wastewater volume, the management is highly complicated in terms of the treatment and processing technologies and has a cost usually ranging from 20% to 60% of the total operating costs for the wastewater treatment plant. To reduce the total variable cost emerge, the industry can explore the option of optimally utilizing the sludge to produce value-added products by selecting a suitable sludge treatment and processing. As consequences, the disposal cost of sludge into the landfill and incinerator is expected to minimize and the dairy industry can earn profit from the value-added products. In general, sludge consist more than 95% of water and must undergo various treatment processes such as preliminary operations, thickening, stabilization, conditioning, dewatering, heat drying, and thermal reduction, before its reuse or final disposal. The removal of water content is a fundamental unit operation for the reduction of the sludge volume to be treated or disposed. In sludge processing phase, water removal takes place in thickening and dewatering stages.

1.2 Effects of Wastewater on receiving Stream/ Sewers

Wastewaters are basically organic in nature and slightly alkaline when fresh When discharged into stream rapid depletion of DO occurs

Growth of sewage fungi covering the entire bottom of the stream and the submerged parts of the hydraulic structures within it. The waste is said to carry, occasionally, the bacteria responsible for TB.

The milk waste becomes acidic due to the decomposition of lactose into lactic acid under anaerobic conditions. Resulting condition precipitates casein from the waste, which decomposes further into a highly odorous black sludge.

At certain dilutions the dairy waste was found to be toxic to fish. Usually situated in rural areas and hence question of discharging into sewers does not arise. In large cities, combined treatment of domestic sewage and dairy waste may be considered if the latter constitutes only 10% in volume of former. Dairy waste to be discharged fresh as putrefied waste may cause corrosion of the sewers.

1.3 Objectives of the project

The following are the objectives of the current study.

1. To study the importance of dairy sludge management
2. To study the physicochemical characteristics of waste water from the dairy industry
3. To determine the physical and chemical properties of finished compost
4. To replace conventional sludge drying as a sludge management practice with a simple and cost-effective composting process
5. To study the variations in the physicochemical properties of finished compost with different dairy sludge and organic matter ratios and to pick the optimum ratio of dairy sludge and organic matter.
6. To study socio-economic benefits of composting by finished compost.

1.4 ENVIRONMENTAL BENEFITS OF COMPOSTING

Properly managed compost operation promotes clean and readily marketable finished products, minimizes nuisance potential and is simple to operate (World Bank, 1996). There is a reduction in landfill space where composting is operated as waste management technique (He **et al.,** 1992, Awomeso **et al.,** 2010). There is also a reduced surface and groundwater contamination, which is a phenomenon in landfill. According to WHO, 900 million people experience diarrhea or contact diseases such as typhoid and cholera through contaminated water (WHO, 2008). Through composting waste blocking of rivers, canals, drainages could be reduced (World Bank, 1996). As a flexible waste management, composting enhances cycling of materials, low transportation coat. In composting there is a minimal emission of greenhouse gases with subsequent effect on climate change and global warming **(Sec et al., 2004).** Moreover, the addition of compost to the soil reduces soil erosion as well as improvement of soils structure, aeration and water retention.

2.LITERATURE REVIEW

1) Ieshita Pan, "Composting of common organic wastes using microbial inoculants" volume -1, September, 2020, this article includes It is important to use renewable resources to maximize crop yields and minimize the environmental hazards associated with chemical residues. Composting is an age-old practice for the biological conversion of organic waste to a humus-like substance which can enhance physical, chemical and biological soil properties. To explore the effect of microorganisms in the composting process, three potent bacterial isolates were selected. Their morphological, cultural and biochemical characteristics were identified. There are many efficient hydrolytic bacteria and other physiologically important microorganisms present in compost. Several isolates from the Bacilli and Pseudomonas genera were selected based on their hydrolytic potentials for this study. The isolates were applied as a starter culture in the composting of various organic waste substrates, and a consortium of was able to efficiently decompose all the substrates tested. The chemical composition of end products, even from the initial experimental stage, was consistent with national and international standards for composting. The experimental results indicate that the consortium is more effective than any individual isolate. The data show enough promise in the sustainable production of organic fertilizer using the consortium to instigate a pilot plant experiment.

2) **Tahseen Sayara, Department of Environment and Sustainable Agriculture, Faculty of Agricultural Sciences and Technology, "Recycling of Organic Wastes through Composting: Process Performance and Compost Application in Agriculture": 22 November 2020,** Composting has become a preferable option to treat organic wastes to obtain a final stable sanitized product that can be used as an organic amendment. From home composting to big municipal waste treatment plants, composting is one of the few technologies that can be practically implemented at any scale. This review explores some of the essential issues in the field of composting/compost research: on one hand, the main parameters related to composting performance are compiled, with especial emphasis on the maturity and stability of compost; on the other hand, the main rules of applying compost on crops and other applications are explored in detail, including all the effects that compost can have on agricultural land. Especial attention is paid to aspects such as the improvement of the fertility of soils once compost is applied, the suppressor effect of compost and some negative experiences of massive compost application.

3) **Naveen Desai, Asst. Professor, Civil Engineering Department, BLDEA College of Engineering Bijapur, India, International Conference on Solid Waste Management, 5IconSWM 2015, "Composting – Solution for Milk Sludge",** The ever-growing industries, human population and urban areas have increased the generation of waste materials, which is polluting the entire environment. As the environment gets affected, indirectly human race is also affected. Industrial waste management has become a big issue in the present era. Though there are different methods of waste disposal, most of them lead to soil deterioration, toxic effect and increased pollution on land, air, water and living beings apart from being very expensive. We need an eco-friendly one stroke solution for disposal of waste, which not only manages the waste but in return gives some beneficial end product. Vermi composting is one such promising eco- friendly method which helps in reducing the pollution and simultaneously produces good quality compost using minimal space, labour and cost. Here an attempt is made to decompose milk sludge mixed with paper and garden waste with earthworms by vermi composting. In one tank substrate is formed with paper and garden waste, milk sludge and cow dung in the ratio 3:1:1. And in another tank a ratio of 7:2:1 was considered. The reproduction of earthworms in the form of cocoons and the chemical composition of the generated manure after 30, 45, 60 days are noted and analysed. It is noted that the manure generated from the first pit has a favorable C:N ratio and decomposes fast, whereas the second pit manure with a higher nitrogen content decomposes slowly and this type of manure can be used for potato, soya bean and corn plant. Milk sludge, highly odorous and difficult to dispose can be treated by this simple eco-friendly method.

4) **S. R. Juliastuti, IPTEK, Journal of Proceeding Series, Vol. 1, IPTEK, Journal of Proceeding Series, Vol. 1, 2014 (eISSN: 2354-6026), "Pre-treatment of Sludge Milk Wasteas Source Of Composting using Microbes"**, **October 2019,** an organic fertilizer application in high concentration causes damaging in agriculture field. An alternative way to protect the soil, is using organic fertilizer (compost). Sludge milk waste as source of composting can be used, but it has high lipid content and causes hardening on composting process. Using combination microbes such as Rhizopus oligosporous (R. oligosporous) and Aspergillus Niger(A. Niger) in pre-treatment of sludge milk waste can cause reducing of lipid content. Objective of this research is to know the influence of Rhizopusoligosporous (R. oligosporous) as anaerobic fermentation microorganism and Aspergillus Niger (Angier) as aerobic fermentation microorganism of sludge milk waste pre-treatment forfurther composting process, and to compare composting products against technical requirement organic compost used. The research method used is the anaerobic fermentation with addition of Rhizopus oligosporous and aerobic fermentation with Aspergillus Niger. Process variables were 100 ml R. oligosporous and A. Niger /3 kg sludge waste (3,33% v/w), 200 ml R.oligosporous and A. Niger/3 kg sludge waste (6,67%v/w), and 300 ml R.oligosporous and A. Niger /3 kg

sludge waste (10%v/w) during incubation period of 72 and 96 hours. Process was continued through composted the pre-treatment sludge by adding the biofertilizer and bone powder. After composting of pre-treatment waste then Carbon, kalium, lipid, nitrogen, phosphate and water content were analyzed. Temperature and pH were also monitored. Results of this research shows that R. oligosporous and A. Niger can reduce lipid content of sludge milk waste. The best variable is A. Niger 6,67 % v/w with incubation period of 96 hours and can be proved with the lipid content of 10,44 % and reducing of lipid content per cell of microorganism as 0,00036 ppm. Composting process has enhanced 1,57 % N, 5,16 % P and 1,2% K. This compost was in accordance with the technical requirements of organic fertilizer in Indonesia.

3.METHODOLOGY

3.1 STUDY AREA:

The Dairy was established at Vadlamudi village of Guntur District by the NDDB in the year 1977. The milk producers of Krishna, Guntur and West Godavari districts generously contributed and donated one day of milk value for the purchase of 34.46 acres of land to construct a dairy plant, subsequently. 53acres of land was purchased to construct staff quarters and technical inputs program facilities. The Guntur District Milk Producers Co-operative Union Ltd., was registered under the APCS ACT-1964 on 23-02-1977. The Government of AP has handed over the feeder Balancing Dairy to the Union Board along with two chilling centers located at Narasaraopet and Gurajala on 01-08- 1978. There were 91 registered milk societies at that time. The Government has also contributed Rs. 81 Lakh to the union as share Capital.

The union has been converted to the A.P MACS Act 1995 with valuable support from NDDB on 01- 02-1997 to facilitate more democracy and freedom to the affiliated societiesas well as in the governing of the union. As a requisite for conversion, the union had repaid the share capital of Rs. 81 Lakhs to the Government of A.P by obtaining an interest-free loan from NDDB. Further, Sangam Dairy was incorporated as "**Sangam Milk Producer Company Limited**" under Part IX-A of the Companies Act 1956 on 18- 06-2013. The name "Sangam Dairy" is due to the presence of the "Sangameswara" temple at Sangam Jagarlamudi village near the vicinity of Vadlamudi Village. The Dairy is located on the Guntur - Tenali state highway at a distance of about 15km from Guntur and 10km from Tenali giving a good architectural view to attract visitors. It is one of the most familiar visitor spots in the Guntur District.

3.2 Wastewater Generation

ETP Process

1. The wastewater is first let to bar screen for screening the coarse particles.
2. The screened effluent is sent into oil & grease trap to remove the oil and grease and collected in an effluent collection tank where it is homogenized using air through air blower.
3. pH correction will be done by acid dosing pump.
4. The homogenized effluent is pumped to UASB Reactor for the effective reduction of BOD/COD, Overflow effluent is sent to Aeration tank where the second stage of BOD/COD reduction takes place. The aeration tank is provided thorough air blower for air distribution.
5. Then the wastewater sludge mixture will be allowed to flow by gravity into a secondary clarifier, where alum will be added at inlet of the clarifier and will act upon the suspended solids and make them to coagulate.
6. Partial amount of effluent from clarifier will be re-circulated to aeration tank to maintain the MLSS, where the clarifier sludge will be settled at the bottom and the clear supernatant would overflow into the clarified water tank.
7. Hypochlorite solution will be dosed in the clarified water tank for disinfection.
8. The sludge from the secondary clarifier will go to the sludge drying bed for drying and disposal. Similarly, the UASB reactor sludge will be collected in the sludge drying beds for drying and disposal.

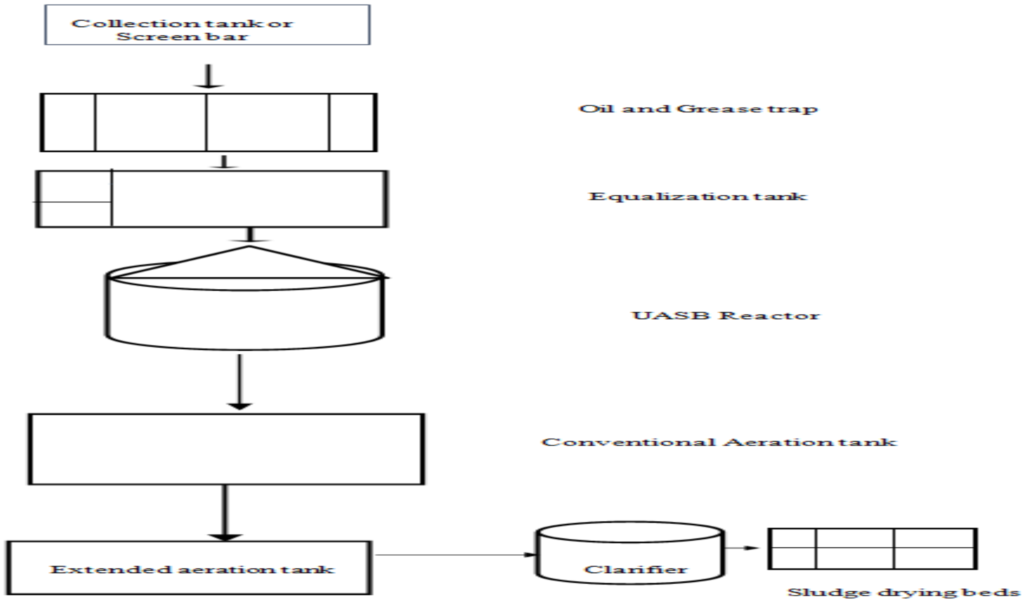

Fig: 3.1 Wastewater generation process

3.2 METHODOLOGY USED

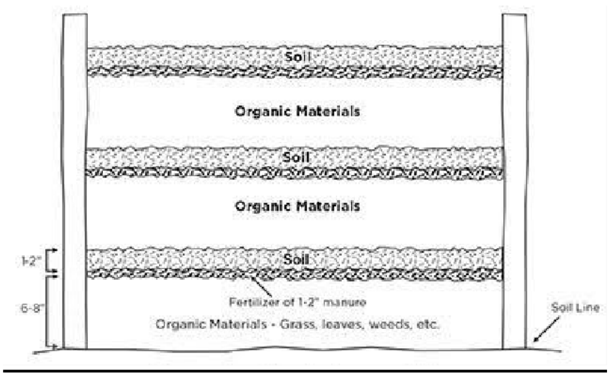

Figure 3.3 composting bins

Figure 3.4 Cross section of layering in compost

Procedure

1. Initially the compost drums were prepared for aerobic conditions by providing

holes of diameter 4mm for proper ventilation using hand driller, since we aimed to prepare the biological compost using aerobic process.

2. Dry leaves were introduced as the first layer in the drums to absorb the moisture content inside the drums and a layer of coconut peat is introduced above the dry leaves.

3. Raw vegetable waste of different kinds which were collected from Sangam dairy canteen, placed above the coconut peat uniformly for a thickness of 3 to 4 cm and artificial microbes are introduced and again covered with coconut peat of thickness1to 2 cm in 1st drum 40% sludge and 60% vegetable waste in 2nd drum equal proportions of sludge and vegetable waste in 3rd drum 60% sludge and 40%vegetablewaste in 4th drum.

4. The raw materials inside the drums were rotated for every 3 to 4 days for better decomposition of organic materials and for proper circulation of air inside the drums.

5. This process was repeated for 15 days continuously.

6. After finishing the filling of raw materials for 15 days the drum was left for 45 days, so that the raw materials were decomposed completely due to microbial action. The final compost obtained was free from raw materials and possessed definite moisture content.

7. The compost was carried out for further tests.

3.3 RAW MATERIALS USED

3.3.1 Bio-degradable waste:

Biodegradable waste includes any organic matter in waste which can be broken down into carbon dioxide, water, methane or simple organic molecules by micro-organisms and other living things by composting, aerobic digestion, anaerobic digestion or similar processes.

Figure 3.5 Biodegradable waste in Sangam dairy canteen

3.1.2 *Coconut peat:*

Cocopeat is a natural fiber made out of coconut husks. The extraction of the coconut fiber from husks gives us this by-product called cocopeat.t is used as a media for the degradation process, the **composition** as follows;

Coconut peat has a high lignin (30-31%) and cellulose (26.8%) content. It C:N is around 1112:l surrounds the cellulose in cell walls and is relatively inert to hydrolysis. Because of the highlignin content left to it, coir waste takes decades to decompose.

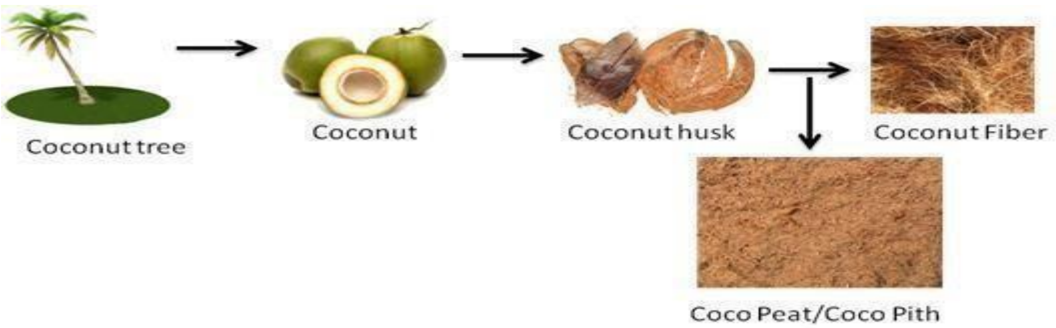

Figure 3.6 coconut peat

The specifications that have to be fulfilled by Cocopeat :

Density <0.1, Electrical Conductivity <0.5 m S/cm, pH<5.9-6.5, Water holding capacity <8- 9times, Pore space >90%, Expandability > 6 times of the compressed volume. Clean and high- quality coir contain natural rooting hormones and anti-fungal properties.

PROPERTIES OF COCONUT PEAT:

1. Excellent water retention properties. Cocopeat needs less watering (up to 65%) as compared to peat moss. It holds water rather than shedding it like the traditional peatmoss.

2. The rapid re-wet ability and quick draining characteristic of Cocopeat also reduces the loss of nutrients through leaching.

3. The pH content of Cocopeat is neutral to slightly acidic, and is therefore very beneficial for plants

4. The coconut peat is a better natural soil conditioner; it prevents the hardening of potting soil and increases soil porosity.

5. The coconut peat is resistant to bacterial, weed, fungal growth, and is truly pathogen free.

6. Naturally high lignin content promotes the development of favorable micro-organisms.

7. Cocopeat can be used as a soil-less growth medium for hydroponics.

8. It is good both for indoor and outdoor use.

9. Cocopeat is entirely organic. There are no harmful effects on the environment when disposed.

3.1.3 *Microorganisms:*

The main purpose of introducing the microbes is to enhance the degradation process which results in a decrease in composting duration. **Cellulolytic** and **ligninolytic** microbes which come under the fungi group are used which will work even in low moisture content and themicrobes which we introduced in this process were suggested by an organic waste management company.

Cellulolytic microorganisms are mostly utilizing carbohydrates for their energy but are unable to use proteins or lipids as energy source for their growth (Lynd, Weimer, Van Zyl, & Pretorius,2002).

Within the cellulolytic organisms are bacteria, actinomycetes and fungi, both aerobic and anaerobic, mesophylls or thermophilic. Each group of microorganisms according to their physiological characteristics adapts to some particular materials and it is necessary to determine, according to the biomass characteristics, the most suitable species for their management.

Figure 3.7 microbes used in the process

3.2 CLASSIFICATION OF WASTE

Figure3.8 Waste Classification.

3.3 QUALITY OF COMPOST:

It is the choice of the material to be composted one of the factors that have a verbatim influence on compost quality. The choice of product quality to be composted is of great importance in order to obtain high-quality products from organic wastes (Varank,2006).

The first step of obtaining compost material of considerable quality in compost production is the use of separated separately in the source and other wastes and uncontaminated organic wastes as raw material

The key to making great compost is getting the right mix of ingredients so that the pile breakdown efficiently leaving us with compost that is both rich in nutrients and high in humus.

3.4 GOOD COMPOST INGREDIENTS:

Compost ingredients can be divided into two basic categories, Brown Materials and Green materials.

The following table 3.1 shows the green and brown materials.

Green waste (good in nitrogen)	Brown waste (good in carbon)
Vegetables & fruits	Leaves
Grass Clippings	Hay& Straw
Fresh Manure	Paper &Cardboard
Coffee Grounds	Woody Prunings
Feathers	Eggshells
Plant cuttings	Tea Bags
Young Hedge Trimming	Corn Cobs

3.4.2 *Green Materials*

Compared to brown materials, green compost materials are much higher in nitrogen. Nitrogen is an important element in amino acids and proteins, and is a vital protein source for the compost microbes, helping to speed up the process of decomposition.

Green materials that are very high in nitrogen should be used sparingly, especially fresh grass clippings.

1. *Vegetable Peelings (12:1) (C/N):*

Most of the raw material for decomposition in this study is vegetable waste only.

This category consists of any pieces of fruits and vegetables. Most of us have an endless supply of this type of material: potato peelings, apple cores, banana peels, any bits and pieces of uncooked vegetables that would otherwise have gone into the garbage bin. It is best to avoid using cooked vegetables in your compost because oils used in cooking will slow down decomposition and may attract rodents and other animals. One solution for those who wishto compost cooked vegetables is to use a closed plastic bin with wire mesh on the bottom.

2. *Grass Clippings (20-30:1):*

Grass clippings are very high in nitrogen. While that may seem like a good thing, and it is,there are also a few things to consider. First, it is often best to leave grass clippings on the lawn where they will decompose naturally and help to feed the soil.

If you do want to add grass clippings to your compost use them sparingly at first, adding a very thin layer on top of a layer of brown materials, or by mixing them thoroughly with other green materials. If they are applied too thickly, they tend to form slimy clumps or mats that do not permit air circulation. The mats do not break down very well and release an unpleasant smelling (but harmless) ammonia gas.

3. *Coffee Grounds (20:1)*

Coffee grounds are high in nitrogen and really help to heat up your compost. You can compost any kind of coffee grounds and if you use a paper filter just toss it in as well.

4. *Plants and Plant Cuttings (20-40:1)*

Most plants and plant cuttings can be composted including annual weeds without mature seeds, any remains of spent or harvested plants and flower tops collected from deadheading.

3.4.3 *Brown Materials:*

Composting relies on the right ingredients to be successful. Brown materials such as leaves, straw, hay and sawdust are high in carbon and are a source of energy for the compost microbes**.**

1. *Leaves (50-80:1):*

Leaves are generally an excellent ingredient for your compost. Those living in areas with a large bounty of autumn leaves should make the most of it and find some neighbors willing to pass on their leaves. Living green leaves are considered "green materials", whereas the dead, dry leaves that fall from the trees in autumn are seen as "brown materials"

Autumn leaves are a great source of carbon and contain a surprising amount of nutrients that can be returned to the soil through compost.

Although whole leaves are acceptable, it is better to shred the leaves before adding them to the compost pile. Shredded leaves tend to mat together excluding air from the pile. Leaves can be shredded in a number of ways.

2. *Eggshells*

Eggshells contain calcium and are a useful addition to the compost pile. The shell does take a long time for decomposition, so it's a good idea to crush them before adding. Do not include wholeeggs in your compost, just the shells.

3. *Sawdust (400:1)*

Sawdust and wood chips contain very low amounts of nitrogen and are very slow to break down in the compost pile. Use sawdust in very thin layers or mix thoroughly with a green material such as kitchen scraps or grass clippings. Large wood chips will take a very long time to breakdown and are often put to better use as much.

4. RESULTS AND DISCUSSION

Table 4.1 Determination of Moisture content (dry wt.)

Determination of moisture content						
Sample No	Initial weight of container (W_1) gm.	W_1+wet soil in the container (W_2)gm.	Final weight of container (W_3) (gm.)	(W_W) Wet Weight of compost (W_2-W_1)gm.	(W_d) Dry weight of compost (W_3 - W_1)gm.	% of moisture content $((W_w - W_d)/(W_d))*100$
1	37.33	83.5	75.4	46.17	38.07	21.27
2	36.4	78.9	70.9	42.5	34.5	23.18
3	36.91	85	77.2	45.1	37.3	20.91
4	36	79.1	74.1	43.1	38.1	13.12

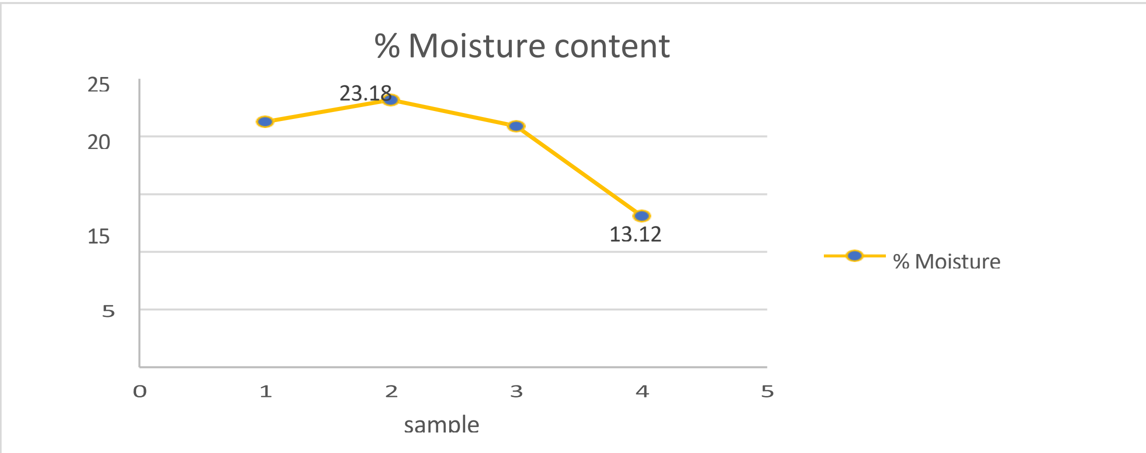

Table 4.2 Determination of pH

Determination of pH	
Sample no.	**Value**
1	7.5
2	7.4
3	7.2
4	7.3

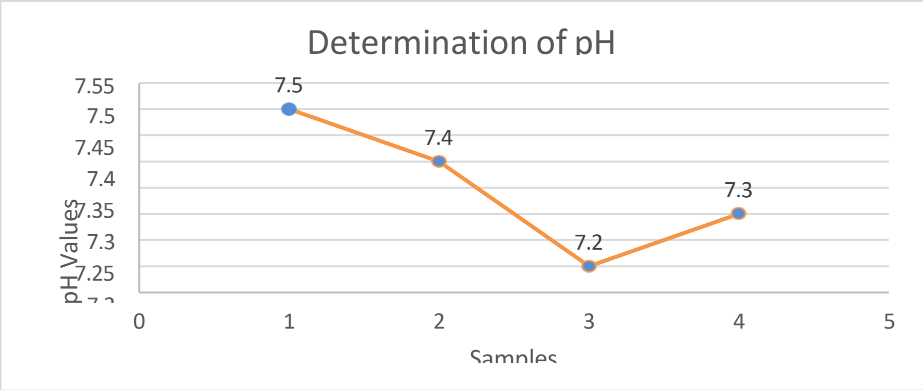

Table 4.3 Determination of Electric Conductivity

Determination of EC	
Sample no .	**Value(ds/m)**
1	3.2
2	3.4
3	3.5
4	3.0

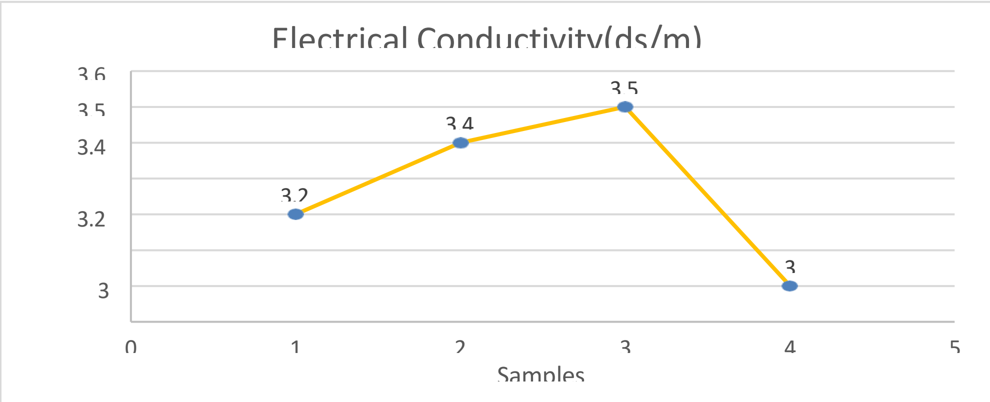

Table 4.4 Determination of total organic carbon

Determination of TOC	
Sample no.	**Value (%)**
1	17
2	20
3	22
4	19

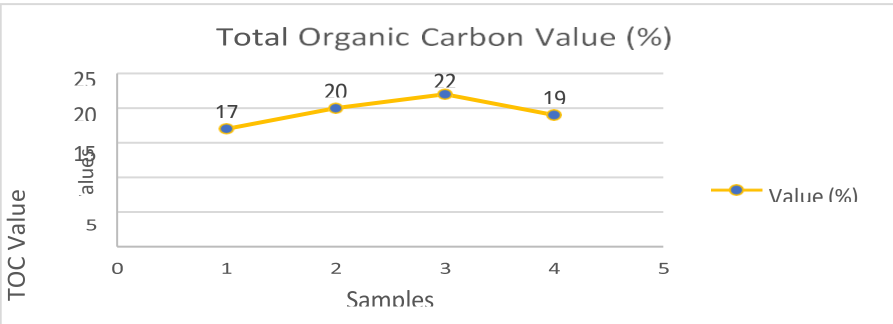

Table 4.5 Determination of Nitrogen

Determination of TN	
Sample no.	**Value (%)**
1	1.0
2	1.5
3	1.6
4	1.3

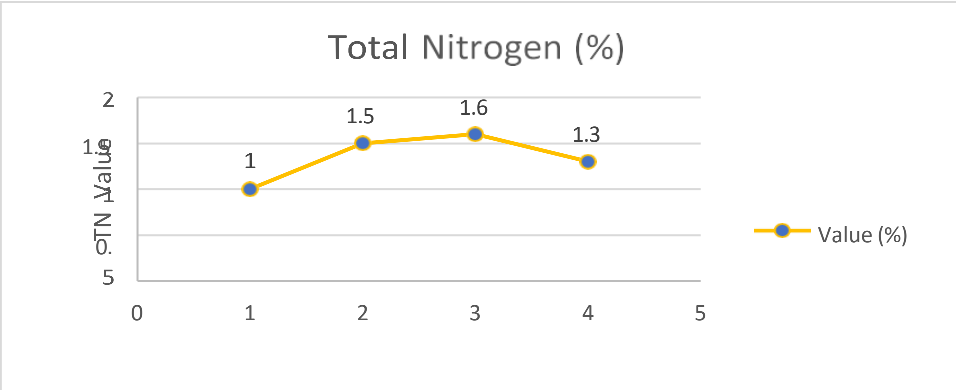

Table 4.6 Determination of Available Phosphorous

Determination of Available Phosphorous	
Sample no.	**Value (%)**
1	0.60
2	0.65
3	0.78
4	0.93

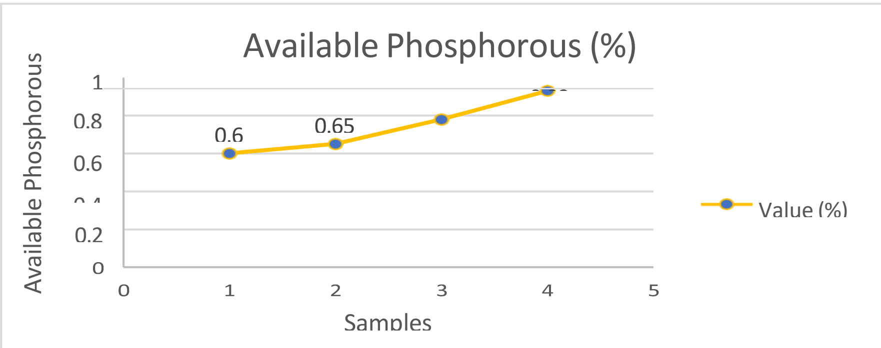

Table 4.7 Determination of Available Potassium

Determination of Available Potassium	
Sample no.	**Value (%)**
1	0.73
2	0.86
3	0.91
4	1.2

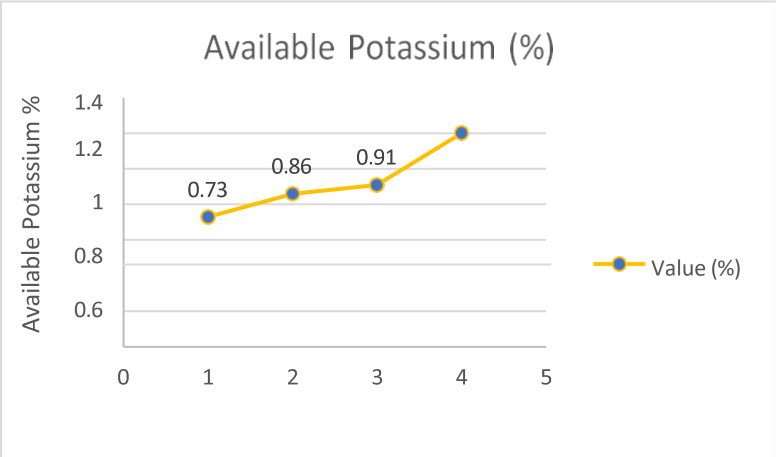

Table 4.8 Determination of C:N ratio

Determination of C:N Ratio			
Sample No.	**Total Organic Carbon**	**Total Nitrogen**	**C:N**
1	17	1.0	17:1
2	20	1.5	13.3:1
3	22	1.6	13.75:1
4	19	1.3	14.61:1

Table 4.9 Determination of Micronutrients

Determination of Micronutrients (ppm)				
Sample No.	**Zinc**	**Iron**	**Copper**	**Manganese**
1	53.26	2010	18.57	52
2	60	1480	16.31	44
3	67.8	1420	14.20	31
4	64.2	1376	12.03	27

STANDARD QUALITIES OF FINISHED COMPOST

Standards related to compost product: It is Standards for process control, standards for hygiene requirements, standards for heavy metal content, standards for organic pollutants, and standards for the physical & chemical composition of composts. Table
5.10 below shows the test results & standard Requirements of finished Compost

Table 4.10 Comparison of compost Physicochemical Characteristics with Standard Parameters prescribed by A.P horticulture department

S.NO	Test Parameter	Requirements Standard	Results			
			S 1	S 2	S 3	S 4
1	Colour	Brown to black	Black	Black	Brown	Brown
2	Odour	No Foul Odour	Earthy	Earthy	Earthy	Earthy
3	Moisture (%) by weight Maximum.	25.0	21.27	23.18	20.91	13.12
4	pH	6.5-7.5	7.5	7.4	7.2	7.3
5	Electrical Conductivity (as dsm^{-1})not more than	4	3.2	3.4	3.5	3.0
6	Total Organic Carbon(%) by weight, Minimum	14.0	17	20	22	19
7	Total Nitrogen (as N) % by weight, Minimum	0.5	1.0	1.5	1.6	1.3
8	Total Phosphorous (as P_2O_5) % By Weight, Minimum	0.5	0.60	0.65	0.78	0.93
9	Total Potassium (as K_{20}) % by Weight, Minimum	0.5	0.73	0.86	0.91	1.2
10	C:N Ratio	<20:1	17:1	13.3:1	13.75:1	14.61:1
11	Zinc (ppm), Maximum	1000.00	53.26	60	67.8	64.2
12	Iron (ppm)	-	2010	1480	1420	1376
13	Copper (ppm), Maximum	300.00	18.57	16.31	14.20	12.03
14	Manganese (ppm)	-	52	44	31	27

Figure 4.1 Compost After 15 Days Figure 4.2 Finished Compost

ECONOMICS IF APPLIED IN LARGE SCALE

Quantity of SS per hour = 120× 10−3 × 30 = 3.6 kg/hr Assuming consistency of sludge = 2%
Total quantity of sludge per hour = 3.6/0.02= 180kg
If sludge is discharged for every 24hrs
Quantity of sludge generated per day = 180×24 =4320 kg/day Operating capacity of ETP = 600kld
Operating hours of ETP = 20 hours Weight of the compost after layering=13.2kg Weight of the finished compost sample=5.3kg Percentage loss=60%
Quantity of sludge generated per month=130 ton

Quantity of finished compost for first 2 months=130x0.4 =52 ton

After 2 months for every 15 days 52 ton of compost is generated Quantity of annual finished compost for 1st year =21x52=1092ton Company price of compost per kg = Rs.5/-
(Note: Although market cost of compost per kg is more than 10 sangam dairy will give it for Rs.5/- as a part of corporate social responsibility program (CSR) which is mutual benefit for farmers as composting increases crop productivity and for industry to save fuel and transportation charges etc.)
Capital investment cost for construction of 20 compost pits of size (4mx4mx3m) = Rs.10 Lakhs Annual revenue for the dairy from 1st year compost =1092000×5=Rs.54,60,000/-

Assuming annual operation and maintenance cost = Rs.3,00,000/- Total cost for construction and maintenance= Rs.13,00,000/-
Total profit for 1st year of construction =54,60,000-13,00,000 = Rs.41,60,000/-

From second year onwards there is no construction cost but there is need for skilled supervisor for continuous monitoring and better control.
assuming his annual salary as 3 lakhs.

Total revenue from 2nd year on wards after construction of compost pits=24x52x1000x5

= Rs.62,40,000

Annual operation and maintenance cost = Rs.3,00,000/-

Salary of skilled supervisor = Rs.3,00,000/-
Total profit for industry from second year onwards = 62,40,000-6,00,00 =Rs.56,40,000/-

6. CONCLUSIONS

1. Out of four samples, sample-3 50:50 proportion (dairy sludge and vegetative matter) to get the closest properties of compost as prescribed by AP Horticulture department.

2. The sample-3 of 50:50 proportion (dairy sludge and vegetative matter) finished compost have C:N ratio of 13.75:1, As per standards it is to be < 20:1.

3. The macronutrients like Nitrogen, Phosphorus, Potassium are 1.6, 0.78, 0.91 % by weight respectively and found to be rich in content.

4. Market cost of compost is Rs.10/- but as a part of social responsibility Sangam dairy will sale it for Rs.5/-.

5. Annual revenue will be generated by finished compost for 1st year is Rs.54,60,000/- and an annual profit of 41,60,000/- excluding capital investment, operation and maintenance, miscellaneous costs.

6. However, revenue lost by industry for not practicing any one of the waste to wealth practice until now is Rs. 11.2crore, in this connection the approx. revenue loss of industry was calculated as Rs.10crore (in least case).

6. REFERENCES

1. Tahseen Sayara, Department of Environment and Sustainable Agriculture, Faculty of Agricultural Sciences and Technology, "Recycling of Organic Wastes through Composting: Process Performance and Compost Application in Agriculture": 22 November2020.

2. Ieshita Pan, "Composting of common organic wastes using microbial inoculants"volume -1, September, 2020.

3. S. R. Juliastuti, IPTEK, Journal of Proceeding Series, Vol. 1, IPTEK, Journal of Proceeding Series, Vol. 1, (eISSN: 2354-6026), "Pre-treatment of Sludge Milk Waste as Source Of Composting using Microbes", October 2019.

4. Suhash Gonawala,HemaliJardosh,"Organic Waste in Composting: A brief review" january 2018.

5. Yusuf Alparslan Argun, Ayse Karacali, Ulas Calisir, NamikKilinc "composting as a Waste management Method" July 2017.

6. Aeslina Abdul Kadir, Nur Wahidah Azhari and Siti Noratifah Jamaludin " An Overview of Organic Waste in Composting"September 2016.

7. Anuradha Tanksali, Procedia Environmental Sciences , "Solution for Milk Sludge by the process of composting techniques", International Conference on Solid Waste Management, September 2015.

8. Naveen Desai, Asst. Professor, Civil Engineering Department, BLDEA College of Engineering Bijapur, India, International Conference on Solid Waste Management "Composting – Solution for Milk Sludge" September 2015.

9. Sachin Jayaprakash, Lohit HS and Abhilash BS " Design and Development of Compost Bin for Indian Kitchen" Department of Industrial Design, M.S.Ramaiah University of Applied Sciences, Bengaluru, june 2015.

10. Ozturk I., Demir I, Altinbas M, Arikan O.A, Ciftci T, Cakmak I, Ozturk ., YildizS., Kiris A. "Compost Handbook (Technical Book Series - 1) "march 2015

11. Uygun S.," Evaluation of the Mechanization Applications in Some CompostProduction Facilities in Turkey" June 2006

12. Bulent topkaya, baharkalkanoglu "Composting a sustainable solid waste management scheme" march 2004