International Research Journal of Engineeringand Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 11 | Nov 2020 www.irjet.net p-ISSN: 2395-0072

A Study on Composting by using Natural Accelerating Ingredients

Payal R. Shrirao[1], Dr. M. N. Hedaoo[2]

[1]*Post Graduate Student (Civil Engineering Department, Government College of Engineering, Amravati).*
[2]*Associate Professor (Civil Engineering Department, Government College of Engineering, Amravati).*

Abstract - *Solid waste management has becomea critical issue in cities as well as in rural areas (villages) due to increasingurbanization and changing lifestyle. This paper studies on the composting process of organic waste. Organic wastes are wastes that easily bio degradable. These wastes are produced from many sources. Without proper management, these waste could create several environment problem. Therefore, composting is the best low cost alternative solution to overcome this problem. The composition from organic waste that could be used as nutrients for crops, soil additive and for environmental management. Normally the time taken for compost preparation in most methods is rather long, ranging from 100-180 days. But in this paper work has therefore been done to accelerate the composting process. It is possible by the introduction of suitable natural accelerating ingredients with demonstrate efficiency in the rate of organic matter decomposition. Compost will be made using organic waste and for accelerating ingredients, accelerators like Cow dung, Wheat bran, saw dust, Coconut coir, Sugarcane powder, Sugarcane bagasse charcoal, Jaggery, Egg shell powder, Wooden ash, Used tea powder, Lime powder and Dry neem leaves were used. Composts prepared from different organic wastes differ in their quality and stability, which further depends upon the composition of raw material used for the compost production. However many factors can contribute to the quality of the compost products as different types of organic wastes have different concentrations of nutrients Nitrogen, Phosphorous and Potassium (N, P, K) which are the common macro nutrients present in fertilizers. The main focus of this project work was to test for the possibility and feasibility of producing compost/organic fertilizer from the waste streams generated from the different phases and analyze the best natural accelerating ingredients proportion, as an alternative to chemical or artificial fertilizers.*

***Key Words*: Accelerators, Coconut coir, composting, Cow dung, Dry neem leaves, Egg shell powder, Jaggery, Lime powder, Saw dust, Sugarcane bagasse charcoal , Sugarcane powder, Used tea powder, Wheat bran, Wooden ash.**

1. INTRODUCTION

Several environmental problems arise from waste as they are not being properly managed. At present, there is a big problem regarding collection, transportation and disposal of waste. The main methods of disposal includes dumping, heaping, land filling and burning and the main problems are environmental pollution, leachate, foul smells, greenhouse gases, spread of diseases and other health hazards. We are facing environmental and socio- economic problems in dealing with current and future planning of disposal and management of waste. Though, proper legislative rules and Standards regarding waste disposal have been made which are not strictly obeyed and waste stuffs are not properly handled and they often pollute the environment. Hence more sustainable and eco-friendly waste management systems are to be made and adopted. However, inappropriate waste management technique is the main control in production of good quality compost. Composting of waste results into several benefits such as increased soil fertility and soil health thereby increased agricultural productivity, improved soil biodiversity, reduced ecological risks and a better environment. It destroys harmful pathogens and reduces the volume ofwaste.

Composting is the process in which aerobic micro-organisms converts organic matter into hygienic, biostable product by thermophilic. This natural process is affected by some environmental conditions like temperature, moisture content, pH and aeration and substrate characteristics like C/N ratio, particle size, nutrients contents and free air space. During degradation of organic matter, moisture content influences the changes in physical and chemical properties of waste material. The composting process may be more fruitful when the carbon to nitrogen ratio and the moisture content will be specific according to the material of compost. For maintaining the moisture and carbon to nitrogen ratio the natural accelerating ingredients play a very vital role in the composting. The accelerating ingredients are very effectual to control the air supply, moisture and maintain the Nitrogen (N), Phosphorus (P), Potassium (K) content and other important composting parameters. Compost will be made using organic waste and accelerators like Cow dung,

Wheat bran, saw dust, Coconut coir, Sugarcane powder, Sugarcane bagasse charcoal, Jaggery, Egg shell powder, Wooden ash, and Used tea powder, Lime powder, Dry neem leaves. The production of organic fertilizer contains small amount of nitrogen and low mineralization rate needing more nitrogen for crop production. Amount of nitrogen ranges from 0.05% to 2.5% at the maximum depending on the substrates used in producing organic fertilizer, as observed. In this study, proportion of accelerating ingredients of different samples was applied in composting to increase the N, P, K content of the organic fertilizer. Farmers conducted different composting methods based on the simplicity of the methods, availability of materials and the capability of the farmers to do the method. The intricacy of the method determines the quality of the organic fertilizer output. There are different researches published into the use of different sources to its effect in decomposition. However, limited researches published on the production of natural accelerators and efficiency of different composting methods in terms of yield and economic value which include income, profit and production costs.

1.1 METHODOLOGY

This study utilized the Accelerating Ingredients in Composting Technique and preparation of accelerators for waste management. The methodology includes different phases of the dissertation work, viz collection and preparation of samples along with preservation, determining various pre-treatment characteristics of the samples and obtaining, recording the results of the laboratory tests.

Figure 1.1: Flowchart of Preparation of Accelerators

1.1.2 Collection of Accelerating Ingredients

Fresh cow dung, wheat bran, saw dust, coconut coir powder, sugarcane bagasse charcoal, sugarcane bagasse powder, jaggery powder, eggshell powder, lime powder, neem leaves powder, used tea powder, wooden ash were collected from household and Local Market, Amravati. They are easily available in any local market. Following table shows the Various types of Accelerating ingredients and their function;

Accelerating Ingredients	Functions
Cow dung	Regulates carbon content, bulk density, pH
Wheat bran	Regulates potassium, phosphorus content
Saw dust	Regulates moisture, pH, aeration, bulk density, temperature
Eggshell powder	Regulates water and gases & it contains calcium carbonate
Jaggery powder	It improves potassium
Sugarcane bagasse powder	Regulates carbon content, pH, moisture
Sugarcane bagasse charcoal	It improves carbon
Lime powder	It improves Nitrogen, phosphorus, potassium
Coconut coir powder	Regulates pH, temperature
Neem leaves powder	It contains higher level of nitrogen
Wooden ash	It contains calcium carbonate, iron, zinc
Used tea powder	It contains Nitrogen

Table 1: Various types of Accelerating ingredients and their function

1.1.3 Storage of Ingredients

After collecting all accelerating ingredients which were in powdered forms stored in the plastic container.

1.1.4 Sample Collection, Transportation and Preservation

Sample collection is another step in any experiment. A well collected representative sample from the source can help to determine the characteristics of the whole lot more accurately. This in turn proves vital in increasing the reliability of the tests and its applicability to the field conditions. The containers used for collection of the sample need to be clean and washed thoroughly. There are high chances of getting contaminated while its handling and preservation. Another aspect of sampling is accurate and clear recording of the sampling data. It contains the details of the sample like volume of the sample, identification number, date and time of sampling. The documentation of the sampling data helps in correctly identifying and corelating the results of analysis with the right sample.

1.1.5 Preparation of Accelerators samples

Various samples shall be prepared with keeping basic ingredients constant such as Fresh cow dung, Cow dung powder, Wood ash and Saw dust. This samples shall be chemically analysed for basic components of compost such as Carbon, Nitrogen, Potassium, Phosphorus.

Procedure:

1. Weight all the ingredients and plastic bottle with the help of electric weight machine.
2. Put all the measured ingredients in a container separately.
3. Mixed all the ingredients properly with water.
4. Separate lumps in mixture if any.
5. Fill that prepared mixture in plastic container.
6. Take weight of that mixture.

7. Closed the plastic bottle and keep it in room temperature.
8. Open the plastic bottle and give aeration to that prepared sample after 15 days for some time and again closed thecontainer.
9. After 30 days, Send these sample to Laboratory for NPK test.
10. This same procedure will repeated for all the 6 samples.

Table 1: Various accelerating ingredients and their proportions for Sample 1

Accelerating Ingredients	Sample 1 (g)
Fresh cow dung	150
Dry cow dung powder	150
Saw dust	150
Wood ash	150
Sugarcane bagasse powder	150
Sugarcane bagasse charcoal	150
Jaggery	100
Speedup compost	10
Water	500ml

Table 2: Various accelerating ingredients and their proportions for Sample 2

Accelerating Ingredients	Sample 2 (g)
Fresh cow dung	100
Dry cow dung powder	50
Saw dust	75
Wood Ash	80
Sugarcane bagasse charcoal	20
Tea powder	70
Coconut coir powder	30
Jaggery	75
Speedup compost	10
Water	340ml

Table 3: Various accelerating ingredients and their proportions for Sample 3

Accelerating Ingredients	Sample 3 (g)
Fresh cow dung	100
Dry cow dung powder	100
Wheat bran	100
Saw dust	100
Wood ash	80
Sugarcane bagasse charcoal	20
Sugarcane bagasse powder	10
Speedup compost	10
Water	350ml

Table 4: Various accelerating ingredients and their proportions for Sample 4

Accelerating Ingredients	Sample 4 (g)
Fresh cow dung	100
Dry cow dung powder	100
Wood ash	80
Sugarcane bagasse charcoal	20
Neem leaf powder	200
Lime powder	1 tsp
Speedup compost	10
Water	350ml

Table 5: Various accelerating ingredients and their proportions for Sample 5

Accelerating Ingredients	Sample 5 (g)
Fresh cow dung	100
Dry cow dung	100
Wood ash	80
Sugarcane bagasse charcoal	20

Coconut coir powder	100
Jaggery	25
Egg shell powder	25
Neem leaf powder	25
Lime powder	25
Speedup compost	10
Water	350ml

Table 6: Various accelerating ingredients and their proportions for Sample 6

Accelerating Ingredients	Sample 6 (g)
Fresh cow dung	100
Dry cow dung	100
Wood ash	80
Sugarcane bagasse charcoal	20
Saw dust	100
Speedup compost	10
Water	350ml

Figure 1: Schematic Representation of Sample


Figure 2: Schematic Representation of Sample

Figure 3: Schematic Representation of accelerator


Figure 4: Schematic Representation of Prepared 6 accelerators

2. RESULTS AND DISCUSSION

The aim of this chapter is to study the most influential parameters and to get a consistent product quality. Laboratory studies are the most satisfactory method for obtaining results. N, P and K is an essential nutrients needed by plants in large quantity. When the samples get mature, it will have nice smell and in dark brown or blackish color. Since the compost is the organic fertilizer for plants, it must contain the nutrients that a plant requires. The nutrients that plants require in large amount are called macronutrients such as Nitrogen, Phosphates, Potassium, Calcium, Magnesium, and Sulfur. The compost will be sent to Fertilizer control laboratory, Amravati to determine the content of the Accelerators. Fertilizer control laboratory

provides laboratory analysis service to test the element in Accelerators. The elements which can be tested are Nitrogen, Phosphates, Potassium. Nitrogen Phosphates (P) and Potassium (K) are the primary nutrients required by the microorganisms involved in composting. They are also the primary nutrients for plants, sonutrient concentrations also influence the value of the compost. Many organic materials contain enough quantities of nutrients for composting. Excessive or insufficient carbon or nitrogen will affect the process. Carbon provides both energy and growth; nitrogen is essential for protein and reproduction.

2.1 Experimental Analysis

Different accelerating ingredients was used in the preparation of accelerators. The accelerators was made of natural ingredients and has a capacity depends upon in different proportion. It has a big feeding surface to ensure easy contact between the composting materials and the atmospheric oxygen. There was six different sets of experiments with the samples. Aeration was achieved by turning to samples after 7 days, 14 days properly. The temperature of the samples were also maintained. Each sample contains an approximately 800 gm to 100 gm of substrates. Each sample pile lasted for 35 days while a sample from each composter were taken to analyzed the Total Nitrogen, Total Phosphates, Total Potassium in the Laboratory.

Figure 5: Photographic Representation of Prepared Accelerators samples for tests

2.2 Analysis of the characteristics of natural accelerating ingredients in the samples

Table: Result analysis for samples

Sample No.	Parameters		
	Total Nitrogen (%)	Total Phosphates (%)	Total Potassium (%)
Sample 1	2.55	0.73	1.4
Sample 2	2.27	0.69	1.9
Sample 3	1.44	1.19	1.5
Sample 4	1.44	0.89	3.4
Sample 5	2.28	1.42	2.1
Sample 6	2.27	1.91	2

Chart 1: Graphical Representation of Variation in percentage composition of N, P and K for sample 1

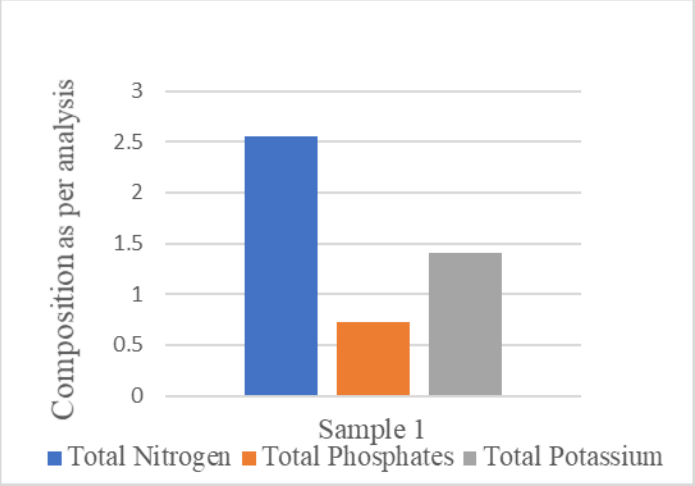


Chart 2: Graphical Representation of Variation in percentage composition of N, P and K for sample 2

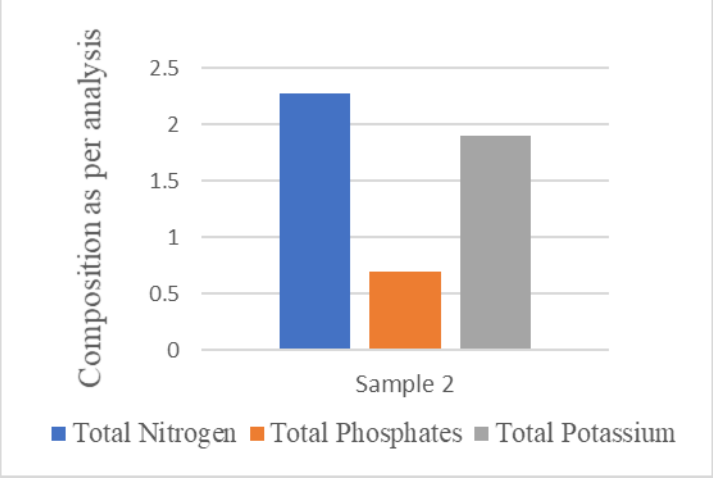


Chart 3: Graphical Representation of Variation in percentage composition of N, P and K for sample 3

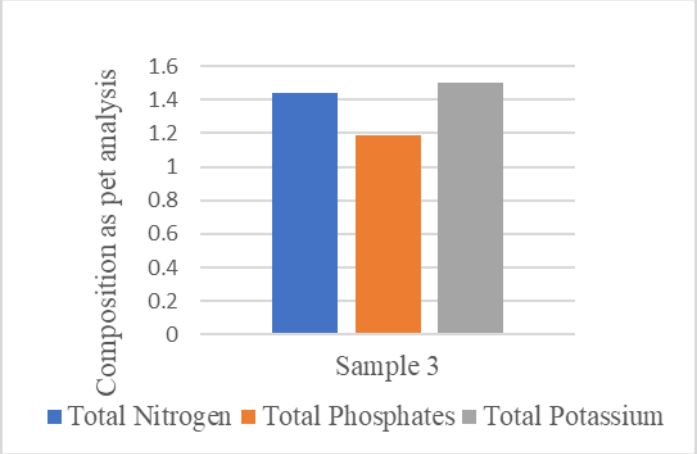


Chart 4: Graphical Representation of Variation in percentage composition of N, P and K for sample 4

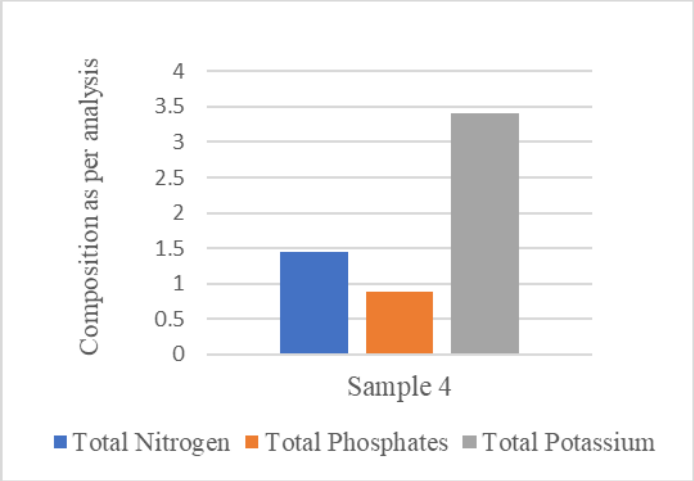


Chart 5: Graphical Representation of Variation in percentage composition of N, P and K for sample 5

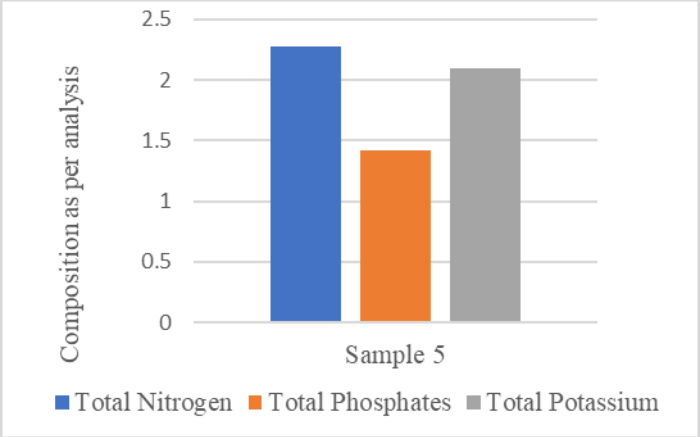
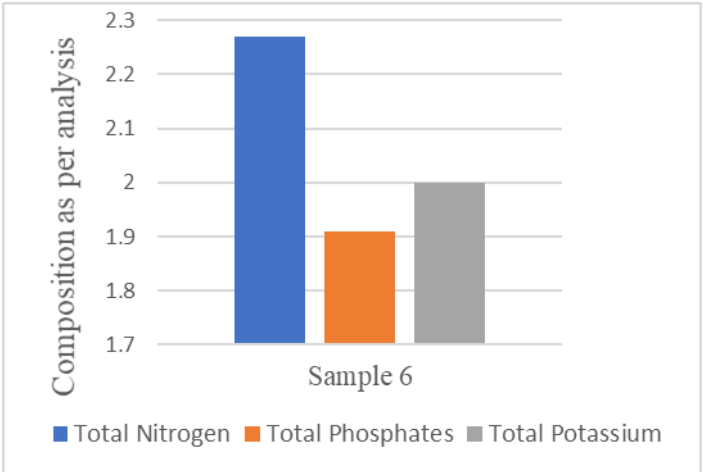


Chart 6: Graphical Representation of Variation in percentage composition of N, P and K for sample 6



2.3 Concluding Remark

All the experiment work was described and all the results were also shown by using graphical representation. From this concluded that the test was done in the lab shows nearly same results. From the chemical and physical properties, sample no. 5 and sample no.6 is suitable to be used as a Accelerators for composting process. This study also suggests that accelerators prepared with the natural accelerating ingredients is a feasible product and has a potential for commercialization as well as being environmental friendly.

3. CONCLUSIONS

Basic principles of good agricultural practice should be equally important to the application of accelerators to an environment. It can be regarded as an important component of the integrated nutrient supply system and hold a great promise to improve crop yields through environmentally better nutrient supplies. So this research study presents some of the approach and analysis to be made for the selection of accelerators to be used.

The study is to be understood that the importance of producing accelerators by using natural accelerating ingredients for rapid composting. In the present study has been analyze the six samples. Also the experimental work results presented are of a small duration time. Local and natural resources to support the sustainability of environmental and human health, especially in the developing countries. So the direct implementation on full scale may not be justifiable.

1) Keeping in view, the negative impact of chemical fertilizer, its our duty to find an alternative solution to the traditional ongoing.
2) Since "necessity is the mother of invention" our world is moving towards an alternative form of sustainable agriculture and organic farming.

3) The production of high-quality compost can be enhanced by biological, physiochemical properties of raw material andcompost.
4) Study indicated the usefulness of different accelerators, for improving composting process to prepare high quality compost.
5) It can be reduce the cost, labor, time duration, and increase the compost quality and nutritive values of compost.
6) We can perform tests for Accelerator samples.
7) Hence the technology of processing waste to compost and its use as soil amendments must be practice as it is a complete clean energy solution and causes less environment pollution.

Thus, it is recommended that more and more development of such ecofriendly organic composting technology must be encouraged for effective waste management.

ACKNOWLEDGEMENT

Any accomplishment requires work and efforts of many people. We would like to acknowledge Principal, Head of Civil Engineering Department and my Guide, Government College of Engineering, Amravati for their support.

REFERENCES

[1] A. D. Neklyudov, G. N. Fedotov, "Intensification of Composting Processes by Aerobic Microorganisms: A Review", ISSN 0003-6838, 2008, Vol. 44, No. 1, pp. 6–18.

[2] A. M. Martin, a J. Evans, "Comparative effects of peat and sawdust employed as bulking agents in composting", Bioresource Technology 44, 1993

[3] Abhishek Raj, Manoj Kumar Jhariya, "Cowdung for eco-friendly and sustainable productive farming", Environmental Science, Volume: 3, October 2014.

[4] Asadu Christian Oluchukwu, Aneke Gibson Nebechukwu, "Enrichment of nutritional contents of sawdust by composting with other nitrogen rich agro-wastes for bio-fertilizer synthesis", journal of Chemical Technology and Metallurgy, 2018.

[5] Asef Iqbal Mohammed, "Studies on Enzymatic Characteristics of select Cultures for Preparation of Beneficial Microbial Consortium for Composting of Municipal Solid Waste," Vol. 2, June 2011.

[6] C.V. Joy, L.P. Chither, "Technical handbook manual" for Scientific Waste Management.

[7] Cherryl D Miranda, "A multipurpose approach in utilising the cow dung", https://www.researchgate.net/publication/335219463

[8] Dalia A. Nakhla, Y.I. Mahmoud, "Production of compost and organic fertilizer from sugarcane residues", Advances in Ecological and Environmental Research, 69-89, February 25, 2017.

[9] Dr. A. Subba Rao, "Rapid Composting Methods", Indian Institute of Soil Science January, 2013.

[10] Dr. A. Subba Rao, "Rapid Composting Methods", Silver Jubilee Year of IISS (1988-2013) January, 2013.

[11] Dr. G. Selvakumar and Dr. A.N. Ganeshamurthy, "Scientific Composting for Solid Waste Management", Plant Operators and Engineers of BBMP, 6th March, 2017.

[12] Dr. Soham Trivedi Rai University, "Solid Waste Management Using Composting Technology", https://www..net/publication/304621742

[13] E. Afriyie, E. Mensah, "Comparative study of composted and uncomposted digestates, chicken manure and cow dung as fertilizers and their effects on soil properties", Global journal of engineering, design and technology. ISSN: 2319 – 7293 Vol. 2(4):12-22.

[14] Francisco Grau, Hyunwook Choo, "Engineering Behavior and Characteristics of Wood Ash and Sugarcane Bagasse Ash", 12 October 2015.

[15] G. Selvakumar, D. Kalaivanan, "Scientific Composting for Solid Waste Management", ICAR-Indian Institute of Horticultural Research, March 2017.

[16] Hamideh Faridi, Akbar Arabhosseini, "Application of eggshell wastes as valuable and utilizable products: A review", Vol. 64, 2018 (2): 104–114.

[17] Hazren A. Hamid, Hasnida Harun, Norshuhaila Sunar, "Development of organic fertilizer from food waste by composting in uthmpagoh", Sustainable Environmental Technology: Volume 1 2018 ISBN.

[18] Hemanth Kumar K J1, Dr. B. Sadashive Gowda, "Characteristics analysis of Low Cost Bio digester Using Jaggery waste", International Research Journal of Engineering and Technology (IRJET), Volume: 05, Jan-2018.

[19] Ieshita Pan, Bomba Dam, S. K. Sen, "Composting of common organic wastes using microbial inoculants", 14 October 2011.

[20] Justine Barthod. "Composting with additives to improve organic amendments. A review", Agronomy for Sustainable Development (2018).

[21] K. Azim, B. Soudi, "Composting parameters and compost quality: a literature review", Org. Agr 29 March 2017.

[22] K.C. Das, E.W. Tollner, "Comparison of Synthetic and Natural Bulking Agents In Food Waste Composting", Compost Science & Utilization, (2003), Vol. 11, No. 1, 27-35.

[23] Madhavi Gaonkar, A.P.Chakraborty, "Application of Eggshell as Fertilizer and Calcium Supplement Tablet", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 3, March 2016.

[24] Manish Batham, Richa Gupta, "Implementation of Bulking Agents in Composting: A Review", Research article of Bioremediation & Biodegradation, ISSN: 2155-6199 JBRBD, Volume 4 Issue 7. 1000205.

[25] Minakshi Gurav, Smita Sinalkar, "Preparation of organic compost using waste tea powder", ISBN:National Conference on Biodiversity : Status and Challenges in Conservation - 'FAVEO' 2013.

[26] Modupe Stella Ayilara, "Waste Management through Composting: Challenges and Potentials", 30 May 2020.

[27] Mohammad Arshad, "Effect of waste physico-chemical properties on decomposition rates and nutrients release during composting", International Journal of Biosciences | IJB | ISSN: 2220-6655. Vol. 12, No. 1, p. 330-337, 2018.

[28] Monika Jakubus. "A Comparative Study of Composts Prepared from Various Organic Wastes Based on Biological and Chemical Parameters", 18 June 2020.

[29] Ms. Dipti Kumar Kale, Dr. Mrs. P.D. Anthappan, "Solid waste management by use of Effective Microorganisms Technology", Asian J. Exp. Sci., Vol. 26, No. 1, 2012.

[30] Nancy Dickson, Tellus Institute, Boston, "Composting To Reduce The Waste Stream A Guide to Small Scale Food and Yard Waste Composting", NRAES-43 July 1991

[31] Nasser Abd El Kader, "Turning, compacting and the addition of water as factors affecting gaseous emissions in farm manure composting", Bioresource Technology 98 (2007) www.sciencedirect.com

[32] Noelly de Queiroz Ribeiro ,Thiago Pereira Souza, "Microbial additives in the composting process", vol.41 no.2,April 2017.

[33] Nyle A. Pardillo, "Production Efficiency of Organic Fertilizer from Different Composting Methods", Asia Pacific Journal of Multidisciplinary Research, Vol. 6, No. 4, November, 2018.

[34] Patel Devangi Maheshkumar, S. M. Usman, "AReview on Preparation of Compost Using Bio-Culture from Different Organic Wastes and Assessment of Growth of Vegetable Plant" International Journal of Innovative Research in Science, Engineering and Technology Vol. 7, Issue 3, March 2018.

[35] Pilar Román, María M. Martínez, "Farmer´s compost handbook", Food and Agriculture Organization of the United Nations, 2015.

[36] Piyush Chandna1, Ramesh Chander Kuhad, "Assessment of bacterial diversity during composting of agricultural byproducts," Chandna et al. BMC Microbiology 2013.

[37] R. Sakthivadivu1, K. Sivakumar, "Chemical changes during composting of poultry waste coir pith waste and sugarcane top", International Journal of Science, Environment and Technology, Vol. 4, No 1, 2015.

[38] R.V. Misra, R.N.Roy, "On farming composting methods", Food and agriculture organization of the united nation 2003.

[39] Sayed G. Khater, "Some Physical and Chemical Properties of Compost", International Journal of Waste Resources Waste Resources 2015.

[40] Shuokr Qarani Aziz, Imad Ali Omar, "Design and study for composting process site", International Journal of Engineering Inventions e-ISSN: 2278-7461, p-ISSN: 2319-6491 Volume 7, Issue 9 September 2018 PP: 09 - 18.

[41] Siti Zulaiha Hanapi, M.Awad, "Biofertilizer: Ingredients for Sustainable Agriculture", https://www.researchgate.net/publication/316463792 January 2012.