

PAPER • OPEN ACCESS

Spectroscopy Analysis for Quality Control Measurement in Waste Management

To cite this article: A. Jayanthiladevi *et al* 2020 *J. Phys.: Conf. Ser.* **1712** 012037

View the [article online](#) for updates and enhancements.



240th ECS Meeting ORLANDO, FL

Orange County Convention Center Oct 10-14, 2021



Abstract submission due: April 9

SUBMIT NOW

SPECTROSCOPY ANALYSIS FOR QUALITY CONTROL MEASUREMENT IN WASTE MANAGEMENT

A.Jayanthiladevi¹, Arun Gnana Raj², Nik Alif Amri Nik Hashim³, V. Ramesh Kumar⁴, V.Nagaraju⁵ and R.Regin⁶

¹Professor-Computer Science & Information Science, Srinivas University, Karnataka, India., ² Solution Architect,Qanawat LLC,Dubai,UAE., ³ Faculty of Hospitality, Tourism and Wellness, Universiti Malaysia Kelantan, ⁴ Assistant Professor Department of Sports Management, Tamil Nadu Physical Education and Sports University,Chennai., ⁵ Professor / Department of ECE Rajalakshmi institute of technology., ⁶ Assistant professor ,Department of Information Technology Adhiyamaan College of Engineering ,Hosur ,Tamilnadu.

*Corresponding author e-mail: drjayanthila@gmail.com

Abstract. This work explains about the physic-chemical characteristics of composites to evaluate the applicability in various purposes over agricultural area. Spectral characteristics of compost materials are compute with spectroscopy with Fertility index and clean index. This FI of composites was observed for sampling with various classification of higher fertilizing potential. Composites are utilized as fertilizer owing to low fertilizing potential. The concentration has been determined within permissible limits of fertility standards. It is known that these composites is more appropriate option for waste processing as it diminishes weight of organic waste. This analysis is performed with spectroscopy analysis.

Index words - composites, spectroscopy analysis, waste management, agricultural region, quality control

1. Introduction

Various scenarios of waste management is extremely unsatisfactory. It is known that total was generated in India. The overall waste generated was collecting waste efficiency is 70% and treating remaining proportion of not being collected. Average collection of effectual waste is significantly effectual with lacking of waste management. Moreover, improved migration rate from rural to urban regions are overwhelm growth of various cities. This may causes further increased growth in urban regions. Waste fraction variations based on economic condition. At present, solid waste rate in variation may vary from rural to urban location. This is expected to improve further urban regions. The waste management produced in most cities is problem crisis is slightly higher in management. Moreover, increased generation of waste management are influx with population and growth of cities. Some crucial stage of reached owing to unavailability of appropriate facilitates dispose those quantities of wastes. This inappropriate management of solid waste is crucial concern in developing countries. Specifically, with dumping wastes are easier and cost effectual for disposal. The waste



management lack comprises of treatment and collection may leads to global warming as organic waste fraction is cause of gas emission.

Composition, incineration, burning, recycling and dumping in landfills are certain other components of waste management process. Moreover, waste disposal is a matter for growing world. With faster increase in population rates may influence is generation and characteristics patterns of waste management with improved industrialized and urbanization for developing a proper waste management systems.

Waste management characteristics are a crucial feature in appropriate waste management. Waste management produced from various services comprises of sweeping, animal waste, domestic wastes, market wastes, commercial wastes and industrial wastes. However, solid waste comprises of higher amount of hazardous and toxic characterization and owing to direct exposure of waste leads to environmental pollution.

Waste management has some traits which are specifically various from other regions including climatic variations, lesser population density, dumpsites which makes it complex to appropriate waste management. Moreover, waste management is extremely sensitive owing to influences other factors like increased developmental activities, socio-economic conditions. With raised industrialization and superior level of resources causing improved management generation and complex composition of waste management. Increased rate of waste generation is economic prosperity in regions. In context to this, bio-degradable fraction is produced more significantly on superior side in comparison to plain regions in country. Average physical characterization of waste variations are studied in regions.

The outcomes are revealed that more fraction of waste comprises of bio-degradable waste, second highest fraction of total waste in India. Chemical characterization of waste revealed that appropriate amount of moisture content and organic matter is presented in solid waste. Compositing is biological decomposition process that may transforms organic matter into stabilized nutrients content by microbial activities that are utilized for nourishment and enrichment of soil fertility. Composting process uses controlled condition to biologically decompose solid wastes. Moreover, composting consumes lesser time for degradation than composting an-aerobic materials. The most promising solution is to enhance solid waste management system with minimal amount of solid wastes, maximal amount of waste recycling and resource recovery. The application relies over agriculture which is of low cost to incineration or landfill disposal. This compost is measured as a soil fertilizer as it comprises of maximal nutrients to plants comprising phosphorus, nitrogen, potassium and organic materials that may boost soil properties by improving water and soil aeration with holding capacity.

It is essential to show compost of soil waste that has probability of bio-accumulation of metals and may cause threat to humans and breaks down the food chain. The presence of these kinds of metals may leads to blood related problems and bone disorders, neurological and kidney damage. Various compost generating companies may use diverse techniques and non-uniform feedstock that leads to production of various compost grades. Moreover, compost nature is extremely influenced by type, composting facilities, methodologies and maturation period. Compost nature is generated from mixed waste which is of poor quality and non-marketable financial loss. Certain standards are fixed to grade compost generation and come use of grade pertaining. Some standards may be prescribed by fertilizer control order. Quality control standards may suffers from diverse disadvantages that may include compost quality with fertilizing factors however non-complaint context of metal allowed for potential reuse. This may harm and restricts organic waste utilization. Some standards may fails in identifying complete quality owing to composting type and inputs provided. It may reject superior quality by generating better techniques. Revised approaches are used for classification to maximize compost potential and eliminate contamination of agricultural soils and offer superior resource utility for manufacturers based on computational fertility index and clean index values. This facilitates identification of compost application that ranges from growth of higher crop values, food crops and gardening.

This investigation concentrates on providing spectroscopic analysis from dump-sites of regions that may includes various agricultural regions of India to examine structural changes and nutrients

concentration during this compost processing. This is assessed for potential usage for determining fertility and clean index.

2. Proposed Method

Generally, metal analysis was performed on atomic spectroscopy absorption with acetylene and correction lamp utilized as fuel for superior concentration when thermal atomization in furnace as carrier gas was considered as lower concentration.

Compost quality analysis

Compost quality samples at both locations are classified as 'Fertility Index' and 'Clean Index' with revised indices approaches to demonstrate composted usability produced with market value. Determination criteria of weighting factor are given for parameters are discussed in various literatures. To provide a conclusion, weighting factor for various parameters is change based on five point scale based on significance towards soil productivity enhancement. Fertility index values of diverse samples are computed with certain functionalities in Eq. (1):

$$FI = \frac{\sum_{i=1}^{n} S_i w_i}{\sum_{i=1}^{n} w_i} \quad (1)$$

Where S_i is source value and w_i is weighting factor of fertility factors of analytical data. Weighting factor may changes from 1 to 5 dependent on toxicity level of various factors. Clean index of diverse compost are evaluated with subsequent computation provided in literature. Superior value of CI is specified by lesser amount of heavy metal contamination and vice versa as in Eq. (2):

$$CI = \frac{\sum_{j=1}^{n} S_j w_j}{\sum_{j=1}^{n} w_j} \quad (2)$$

Here, S_j is score value, w_j is weighting factor of heavy metal factors of analytical data. The compost quality computation is done with nutrient level and maturity is essential to provide probable use of compost produced. Preliminary factors used for compost quality computation are given in Table. Compost sample temperatures over subsequent decomposition process are measured to be 60° C for various regions. Similar compost samples are recorded when composting was performed. Temperature change is attributed to exothermic procedure provided by microbial organic matter decomposition. This shows that decomposition process, temperatures are divergently computed with comparison of temperature sensed after degradation completely. Total Organic Carbon shows amount of organic factors available in solid waste composite materials. It is noted that TOC for these regions are specified. Moisture content of agricultural field is measured as an essential factor in helping storage and transporting ease of complete compost materials. Range of moisture content for both regions may vary based on ranges revealed. However, these values are drastically higher than standard prescription by fertility control order. Compost sample pH values are provides based on various ranging factors from 7 to 8. Therefore, pH values of these samples within alkaline-neutral range thereby shows organic decomposition matter. With various studies municipal pH waste composed may changes. pH alkaline causes ammonium gas formation in air that pretends to raise harmful pathogenic bacteria in atmosphere.

Electrical conductivity is also an essential factor to provide nutrition level and chemical properties of compost. Electrical conductivity values are observed as 6dS/m in composting periods. Values of these studies may slightly rises with permissible limit in India. Clean index and fertility index of compost are quality factors for demonstrating compost gradients with market value. There are seven classes of compost quality classification based on determination. This provides finest quality compost and market value which is utilized for high value crop and organic farming. Remaining classes are useful and not plied for organic farming. Weighting factors and score value to compost for fertility index and clean index computation. FI determines compost sampling and observed for various days. Therefore, compost is classified as maturation period. As well CI value is also computed for sampling periods. This compost may fulfil certain criteria with standards as metal concentrations are lesser than FCO standards.

3. Results and discussions

This section discusses in detail about the compost computation and the characteristics of compost that are related to spectroscopy and physico-chemical analysis. Table 1 and Table 2 depicts compost standardization and FI/CI values respectively. Fig 1- Fig 6 depicts solid waste analysis with spectroscopy for 20th, 40th and 60th day respectively.

Table I: Compost standardization

S.No	Parameters	Standardization
1	C/N ratio	20
2	Potassium	1
3	Phosphorus	0.5
4	Nitrogen	0.5
5	Organic carbon	6
6	Magnesium	-
7	Calcium	-
8	Moisture	20-25
9	Conductivity	<4
10	pH	6.5-7.5
11	Temperature	-

Table 2: FI and CI values

S.No	Class	FI	CI
1	A	>3.6	>4.1
2	B	3.2-3.6	>4.1
3	C	>3.6	3.2-4.1
4	D	3.2-3.6	3.2-4.2
5	RU-1	<3.2	-
6	RU-2	>3.6	>4.2
7	RU-3	>3.6	-

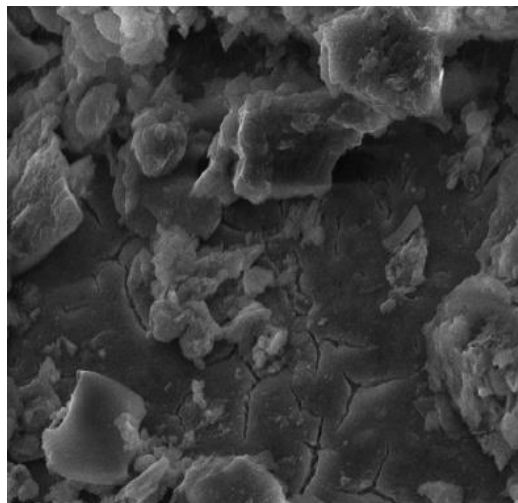


Fig 1: Solid waste in 20th day

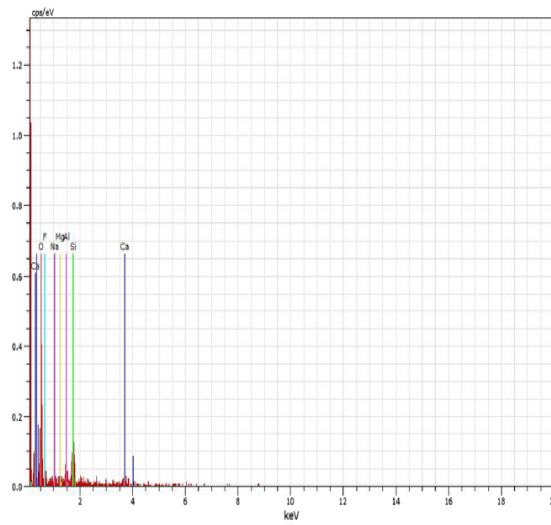


Fig 2: Spectroscopy analysis of SW in 20th day



Fig 3: Solid waste in 40th day

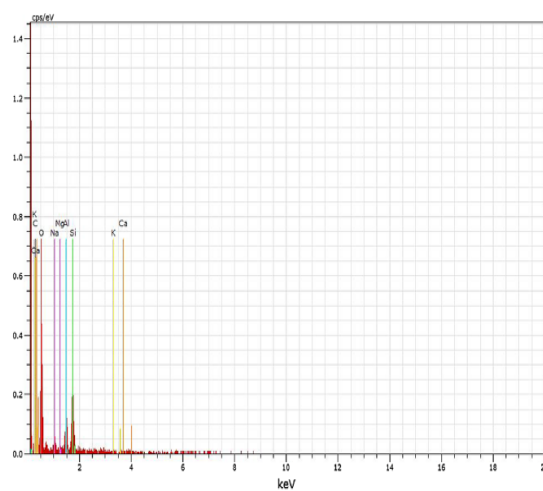
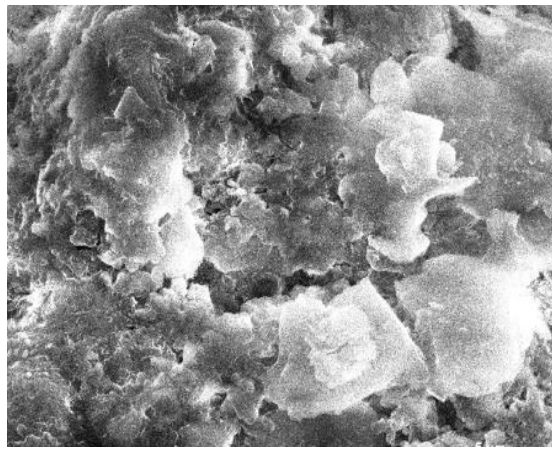
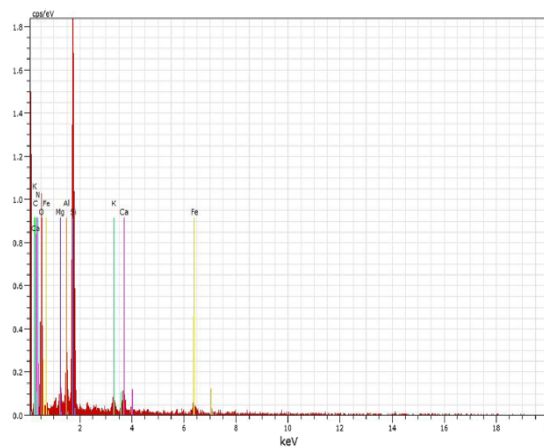


Fig 4: Spectroscopy analysis of SW in 40th day

Fig 5: Solid waste in 60th dayFig 6: Spectroscopy analysis of SW in 60th day

The solid wastes are generated with higher biodegradables proportion that is easily produced as compost and utilized as natural fertilizer. Moreover, prevailing scenario of extremely not fulfilling. At varying time, two compost pits are studied under working condition and stops composting process owing to its non-economic viability. This trend is a state of prevailing composting system that may gradually loses its functionality. Closure cause may shows geographical issues, communication breakdown and functionality under partnership, non feasibility produced and lack of funds for smoothing plant operation. The foremost cause was availability lack in compost plant operation.

As noted from this study, compost produced in these locations is of higher quality. However, plant that is installed in dump regions may process bio-degradable waste may works in certain working scenario.

4. Conclusion

Physical characteristics of solid wastes are rich in organic content. Therefore, composting is an appropriate option for organic fraction of waste management as it is extremely cost effectual and it is utilized as plant fertilizers and assist in waste burden reduction. It is noted that various investigations based on physic-chemical properties may give compost moisture content, electrical conductivity and complete organic carbon with permissible limits. Heavy metal at initial degradation of organic materials was higher however with rise in time and completion process decrease in heavy metal concentrations. Clean index and fertility index analysis shows that compost has limited usage on fertility control. To consider this compost value and usability based on agricultural view point. It is

essential for appropriate segregation waste and compost treatment to application and used for higher values of food crops.

References

- [1] Adefemi SO, Awokunmi EE (2009) The impact of municipal solid waste disposal in Ado Ekiti metropolis, Ekiti State, Nigeria. *J Environ Sci Tech* 3:186–189
- [2] Bruun JM, Hansen TL, Christensen TH, Magid J, Jensen LS (2006) Application of processed organic municipal solid waste on agricultural land - scenario analysis. *Environ Model Assess* 11:251–265
- [3] Gomez G, Meneses M, Ballinas L, Castells F (2008) Characterization of urban solid waste in Chihuahua, Mexico. *Waste Manag* 28:2465–2471
- [4] Hargreaves JC, Adl SM, Warman P (2007) A review of the use of composted municipal solid waste in agriculture. *Agric Ecosyst Environ* 123:1–14
- [5] Kiran BM, Srikantaswamy S (2014) Heavy metals assessment in municipal solid waste dumpsite, Mysore, Karnataka, India. *Int J Adv Res Eng Tech* 5:88-93
- [6] Malakahmad A, Idrus NB, Abulqumboz MS, Yavari S, Kutty SR (2017) In-vessel co-composting of yard waste and food waste: an approach for sustainable waste management in Cameron Highlands, Malaysia. *Int J Recycl Org Waste Agric* 6:149–157
- [7] Manohara B, Belagali SL (2016) Evaluation of energy dispersive scanning electron microscopy and X-ray fluorescence techniques for analysis of compost quality. *R Soc Chem*
- [8] Mazumdar NB (2007) Composting municipal solid waste: the Indian scenario. *Int J Environ Technol Manag* 7:326–350
- [9] Pandyaswargo AH, Gamaralalage D, Premakumara J (2014) Financial sustainability of modern composting: the economically optimal scale for municipal waste composting plant in developing Asia. *Int J Recycl Org Waste Agric* 3:66
- [10] Rana R, Ganguly R, Gupta AK (2018) Physico-chemical characterization of solid waste management from tricity region of northern India. *J Mater Cycl Waste Manag* 20(1):678–689.
- [11] Sethi S, Kothiyal NC, Nema KA, Kaushik MK (2013) Characterization of municipal solid waste in Jalandhar City, Punjab, India. *J Hazard Toxic Radioact Waste* 17:97–106
- [12] Sharma A, Ganguly R, Gupta AK (2017) Characterization of municipal solid waste in Sundernagar, Himachal Pradesh, India. *Res J Pharm Bio Chem Sci* 8:276
- [13] Shekdar AV (2009) Sustainable solid waste management: an integrated approach for Asian countries. *Waste Manag* 29:1438–1444
- [14] Sudharmaidevi CR, Thampatti KCM, Saifudeen N (2017) Rapid production of organic fertilizer from degradable waste by thermochemical processing. *Int J Recycl Org Waste Agric* 6:1–11
- [15] Mazumdar NB (2007) Composting municipal solid waste: the Indian scenario. *Int J Environ Technol Manag* 7:326–350