GUIDELINES AND STANDARDS FOR COMPOST IN ZANZIBAR

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Centre for Science and Environment

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Sida

We are grateful to the Swedish International Development Cooperation Agency (SIDA) for institutional support.

Citation: Sonia Devi Henam and Swati Singh Sambyal, *Guidelines and Standards for Compost in Zanzibar*, Centre for Science and Environment, New Delhi.

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
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E-mail: cse@cseindia.org
Website: www.cseindia.org

Printed at Multi Colour Services

1. Potential of compost in Zanzibar

I. Background

The Zanzibar archipelago with its 1.3 million population, generates approximately 663 tonnes of municipal solid waste (MSW) per day. Three municipal councils of Zanzibar namely Zanzibar Urban Municipal Council (ZUMC), West A and B municipal councils in total generates 132,515 tonnes of MSW per year, which is equal to 368 tonnes per day, is nearly half of the total amount of waste generated in the entire Archipelago of Zanzibar. As per ZUMC, eighty six percent of the waste is organic in nature, whereas the balance fourteen percent comprises of plastic, metal, textile, cardboard, glass, sanitary and inert waste. The estimated per capita waste generation is 0.4 – 0.5 kg per day. However, as per CSE data generated from the decentralised pilot project at Shaurimoyo the per capita estimates ranges between 0.7 – 1 kg per day in over 626 households.

The municipal council takes care of solid waste management (SWM) in four operational areas namely- Stone Town, West, North and South Town. MSW is majorly managed by centralized systems where the waste gets collected from the households and is sent to the dumpsite in Kibele. Simultaneously, the Zanzibar Environmental Management Authority (ZEMA), has also been working towards setting up decentralised waste management in the island in order to manage and treat waste at source. On 6 September 2017, a decentralised pilot project on waste management was launched in Shaurimoyo, Zanzibar (3 kms away from Stonetown), a low-income area in Zanzibar, to help in diverting waste from landfill by adopting a segregation incentive model which is frugal and wealth generating.

The stakeholders involved in this pilot are Centre for Science and Environment (CSE) India, ZEMA, Department of Environment (DoE) and local municipal councils of Zanzibar to push for decentralised waste management systems by implementation of the pilot project.

The decentralised model at Shaurimoyo has led to — composting of wet waste, recycling of dry waste with high calorific value and has ensured that only 5-10 per cent of the residual inert waste is sent to Kibele. The main purpose of this model is to work towards making SWM sustainable in Zanzibar. This has also generated wealth, so far 5 tonnes of compost has been sold.

II. Potential of compost generation in Zanzibar

Currently in Zanzibar, the awareness of composting is still in the nascent phase. In order to regulate the compost flow, the need of the hour is to develop compost standards and guidelines to provide market assistance for sale. Based on the lessons learned from the decentralised pilot project on waste management in Shaurimoyo, we realized that there is a massive potential for compost production in the island, as 86 percent of the waste is organic in nature. This also simply means that there is a scope of converting all the biodegradable waste into compost.

As per a report by the Ministry of Agriculture Food Security and Cooperatives, Zanzibar (2014), *the total cultivated land is estimated to be 370,645 acres (0.1 million hectare)*.[1] Therefore, there is a potential to use a copious amount of approximately 2.7 million tonne of compost for agricultural use alone, *assuming 5-10 tonne of compost per acre is ideal (see Box: Estimation of compost required per acre of land).*

Today, even if all the organic waste from whole Zanzibar is composted, we can generate only about 0.11 million tonne of compost per annum.[2] (See *Table 1: Potential of compost generation in Zanzibar*). This can easily be marketed and utilized. But for this, awareness and demand has to be created.

BOX: ESTIMATION OF COMPOST REQUIRED PER ACRE OF LAND

Ideally, 5 to 10 tons of compost per acre is required for soil, but lesser amounts, 1 to 2 tonne/acre, also help improve soil quality and function.

For 1 acre of land, about 5 to 10 tonne (or an average 7.5 tonne) of compost is needed.

Therefore, for **370,645 acre** of land = 7.5 * 370645 = 2,779,837.5 tonne of compost is needed (2.7 million tonne of compost).

Source: CSE, 2019

Table 1: Potential of compost generation in Zanzibar

0.11 MT of compost can be produced per annum

Potential of compost generation in Zanzibar	
Total population of Zanzibar	1.3 million
Per capita waste generation per day	0.85 kg
Per capita, wet waste generated (86 % on an average) per day	0.731 kg
Total wet waste produced in Urban Zanzibar per day	950.3 tonne
Total wet waste produced in Urban Zanzibar per annum	0.34 million tonne
Potential of compost produced from total waste generated per annum (taking reduction to 1/3rd the original weight)	0.11 million tonne

Note: Estimation of the figure has been done taking into account the ground study being done in Shaurimoyo decentralised pilot on waste management. Here the calculations were based on the assumption that waste generated per capita per day in a households falls between 0.7- 1 kg. Also, total waste generated is equal to total population of Zanzibar multiply by per capita waste generation per day.

Source: CSE, 2019

2. Guidelines and standards for compost in Zanzibar

I. Development of standards for compost

CSE in consultation with Bureau of Indian Standards (BIS) and Indian Council of Agricultural Research (ICAR) has prepared standards and guidelines for compost. Further, Department of Agriculture (DoA) alongwith ZEMA, DoE and Zanzibar Bureau of Standards (ZBS) reviewed and assisted CSE in finalising the document.

Methodology

For the purpose to formulate the compost guidelines for Zanzibar, the following methodology was adopted by CSE.

Data Sources

- **Primary**

Sample preparation: The samples of the compost product were collected from Shaurimoyo composting centre in Zanzibar. The compost was prepared from the segregated wet waste, which was dried and grinded for physicochemical analysis.

Laboratory analysis of the compost samples: The physicochemical parameters of the compost samples were carried out using Indian standard procedures namely Fertiliser Control Order (FCO) 1985[3] as currently there is no standard or specification of compost in Zanzibar. Three samples of compost were collected during the year 2018 to 2019 from Shaurimoyo and sent to the laboratory for analysis in India (*See Annexure I on compost quality test results of Shaurimoyo, Zanzibar)*. Detailed analysis of the sample result is done in the next section.

- **Secondary**

Data on compost standards of different countries was also sought so that a comparison of Zanzibar compost quality and that of other regions could be made. Published documents on compost standards of three closely related developing countries namely, Tanzania, Kenya and India was sited and studied (*Please refer to Table 2 for Comparison of compost standards in Tanzania, Kenya, India and result of Shaurimoyo compost, Zanzibar*). Further, comparative study was done between different physicochemical parameters specified by the statutory bodies of Tanzania, Kenya and India.

Analysis of Data:

pH: From our comparative study, it can be inferred that the pH of compost for India, Tanzania, Kenya and the compost test results obtained from Shaurimoyo,

Zanzibar are in the range of moderately acidic (pH 6) to moderately alkaline (pH 7.5) and reveals that *they are mature and manure based compost.*

Table 2: Comparison of compost standards in Tanzania, India and result of Shaurimoyo compost, Zanzibar

Sl.No	Parameters	India	Kenya	Tanzania	Zanzibar compost test result
1.	pH	6.5 – 7.5	6.5 – 7.5	6.5 – 8.5	7.54
2.	Moisture (%,m/m)	15- 25	15-25	15-25	7.63
3.	Electronic Conductivity(EC) [dSm^{-1} (1:5) or µS/cm) (1:2)]	4.0	Not Specified	Not Specified	14.03
4.	Total Organic Carbon (m/m, min.)	12	12	12	33.4
5.	Total Nitrogen (N) (%, m/m, min.)	1.2	>1%	1	2.32
6.	Total Phosphorus (P) (%, m/m, min.)	1.2	Total Primary Nutrients: 5%	Total Primary Nutrients: 5%	0.73
7.	Potassium (K) (m/m, min.)	1.2			0.63
8.	C:N Ratio	<20	≤ 20:1	≤ 20:1	14:1
9.	Heavy Metals				
i)	Cadmium (Cd) (mg/kg or ppm)	5	5	5	BDL**
ii)	Lead (Pb) (mg/kg or ppm)	100	30	30	6.15
iii)	Nickel (Ni) (mg/kg)	50	Not Specified	Not Specified	12.03
iv)	Chromium (Cr) (mg/kg or ppm)	50	50	50	BDL**
v)	Zn (mg/kg)	1000 (max)	500 (min)	Not Specified	93.2
vi)	Cu (mg/kg)	300 (max)	500 (min)	Not Specified	10.03

**BDL: Below Detection Limits; **ND: Not Done*
Note: Analysis of data has been done by comparing the standards of India, Tanzania and Kenya with that of the sample obtained from Shaurimoyo, Zanzibar.
Source:
1. CSE, 2019;
2. Organic fertilizer- Specification, Kenya Standard4;
3. Organic fertilizer- Specification, Tanzania Standard5
4. FCO, 1985, Government of India6

Moisture: The moisture content in Zanzibar (7.63%) is low as compared to Indian, Tanzanian and Kenyan standards (15 - 25%), and therefore the compost is dusty in nature. However, the low nature of moisture could also be due to external factors such as difference in the weather condition of the respective countries or during transportation of the sample.

Electronic Conductivity (EC): According to the Indian standards, maximum EC specified of the compost (4.0 dSm-1) is within the range of neutral salinity with 1:5 dilution factor. In contrary, the sample test of Zanzibar revealed that

the compost is relatively saline when experimented with 1:2 (14.03 µS/cm) and 1:5 (5.6 µS/cm) dilution factors, respectively. However, *it is suggested that most soluble salts are soluble nutrients, so compost with a high salt concentration may be a good source of nutrients when applied at a low rate.* However, EC is not a mandatory parameter for compost standards in Tanzania and Kenya.

Total organic carbon (TOC): According to the Indian Standards, total organic carbon (TOC) contents in the compost are expressed in terms of percentage concentration per dry weight. From our relative assessments and analysis, it was observed that the sample of Zanzibar has much higher concentration of TOC (33.4%) than the lower limits specified in the other standards (12%, minimum) compared for compost. *This ideally means that the compost sample of Zanzibar contains nearly 64.08% of the organic matter in it and has reasonably better nutrient holding capacity.*

Total Nitrogen (N): To denote, compost as having fertilising capabilities and for it to be used in agriculture, TN content must be approximately 1%, by dry weight.[7] However, the typical TN in compost is recommended to be ranging from 1.0 - 3.0%, dry weight. The compost with low TN levels (>1%) are better used as mulch and those over 3% are usually found to be immature and ammonical. So in this reference, when Zanzibar compost test results (2.32%) was compared with the given three standards (1.2%), it can be observed that though falling within the typical range, the TN contents in the test sample was marginally higher than 1%. This would conceptually mean that there might be a slightest chance of nitrogen mineralisation to occur and would have minimal effect on N fertilizer requirements for crop production.

Total Phosphorus (TP): According to the Indian standards, TP contents in the compost are usually expressed as P_2O_5 (Phosphorus Pentoxide) in terms of percentage concentration per dry weight. When evaluated with the lower limits specified in the Indian compost standards (1.2% minimum), it can be understood that the Zanzibar compost has nearly 0.5% less phosphorous (0.73%) in the sample. The low range of phosphorus depends on the type of food habit of the locals and feedstock in composting. To maximize the chemical and physical availability of the TP in feedstock, monitoring is required during composting process.

Potassium (K): Potassium is another essential macronutrient which is responsible for overall plants growth viz., for water uptakes, plant sugars synthesis, crop formulation etc. Potassium in its available form in compost exists as K_2O (Potassium Oxide) and the amount it exists in compost depends on the *feedstock and the composting process*.[8] However, its concentration in the compost is not usually high as it can be easily leached from the feedstock during the composting process. From the comparative analysis, it can be observed that the compost test results of Zanzibar (0.63%) has relatively lower concentration of K i.e. nearly 1% less than the lower limit specified in the Indian Standards (1.2% minimum) and other two standards for compost.

Carbon-Nitrogen (C:N) Ratio: C:N ratio is a good overall predictor of plant available nitrogen (PAN), which is released from the compost when applied

to the soil. The C:N ratio greatly depends on the parent material used. It is basically, not a test within itself and is rather a test for organically bound carbon and for total nitrogen. The ratio of these two essential nutrients, can be used to provide an indication of the rate of decomposition of the feedstock and to determine when ripeness has been reached.[9] Therefore, C:N ratios should be used in conjunction with some other relevant parameter for testing compost maturity.[10] *According to our evaluation, the compost test results of Zanzibar depicts stable C:N ratio (14:1) when compared to the upper limit of the Indian and Tanzanian and Kenyan Standards (20:1, maximum), which means that it will neither reduce availability of N nor C to the plants.*

Permissible Limits for Heavy Metals: The concentration of heavy metals like Copper (Cu), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg), Nickel (Ni), Chromium (Cr) etc., in the compost is of serious concern and is one of the main quality criteria, which mostly restricts the use of compost in agriculture.[11] It is significantly *dependent on the feedstock used for the composting process.* Six heavy metals namely, Cd, Cr, Zn, Cu, Pb and Ni detection was carried out in the laboratory. The results when underwent the comparative assessment with the Indian Standards revealed that the toxic metals like Cd and Cr were not present in the compost sample, and are therefore indicated as BDL (Below Detection Limits) in the table. Additionally, other heavy metals like Zn, Cu, Pb and Ni were significantly below than the critical limits specified in the Indian,Tanzanian and Kenyan standards for consideration. However, the arsenic and mercury was not included in the parameter tested.

To further validate the health of compost, pathogenic test is recommended. The compost should be free from pathogenic organisms such as *E. coli, Salmonella spp, Faecal streptococci* and *total coliforms*. ***ZBS needs to develop microbiological limits for the said pathogens.***Tanzania Bureau of Standards (TBS) has developed such pathogenic test in their organic fertiliser standards, hence ZBS could study and take assistance from the same. *(See Annexure II for Pathogenic organism requirements - Organic Fertilizer — Specification, Draft Tanzania Standard,)*

From the technical comparison made, it was comprehended that most of the value for parameters tested for Zanzibar fall into the same range of value given in Indian, Kenya and draft Tanzanian standards for compost. ZBS could use the same analysis and interpretation while making the standards and guidelines of compost in Zanzibar.

II. Proposed standards for compost in Zanzibar

After studying and analyzing the samples obtained from Shaurimoyo and comparison with the existing draft compost standard of mainland Tanzania and India respectively, compost standard in Zanzibar could be established in the proposed range as given in the table 3. (See *Table 3: Proposed standards for compost).* However, for bigger plants, parameters such as microbial composition, humus content, pathogen and weed content need to be checked regularly. There needs to be a clear synchronization between all the authorities involved for composting.

Table 3: Proposed standards for compost in Zanzibar

Sr. No.	Compost	Value
1.	Moisture	15 - 25
2.	Bulk Density	0.7 - 1.0
3.	Total Organic Carbon	>12.0
4.	Total of Nitrogen (as N), Phosphate (as P_2O_5)& Potash (as K_2O)	<1.2
5.	C:N ratio	Between 15 and 20
6.	pH	6.5 – 8.5
7.	Conductivity	>4.0
8.	Heavy Metal Content	
9. (a)	Arsenic (as As_2O_3)	10.0
9. (b)	Cadmium (as Cd)	5.0
9. (c)	Chromium (as Cr)	50.0
9. (d)	Copper (as Cu)	300.0
9. (e)	Mercury (as Hg)	0.15
9. (f)	Nickel (as Ni)	50.0
9. (g)	Lead (as Pb)	30 - 100.0
9. (h)	Zinc (as Zn)	1000.0

Source: CSE, India, 2019

3. Guidelines for good quality compost

In order to create demand for compost, the quality of compost has to be very high. To ensure good quality compost, source-segregation of waste into biodegradable and non-biodegradable is imperative. Therefore, Zanzibar needs to adopt robust waste management systems with emphasis on segregation. The following systems need to be put in place to create a demand for high-quality compost:

1. **Zanzibar should necessarily adopt sustainable solid waste management (SWM) practices focusing on source-segregation:** Each municipal council should implement effective waste management systems with a prime focus on source-segregation, decentralised treatment of wet waste, recycling and reuse supported by the recently notified urban municipal council SWM regulations, 2019 and byelaws *(Refer Annexure 3. The Urban municipal council SWM regulations, 2019)*. Source-segregation is essential for better quality compost. The following incentives can be provided to promote segregation:

    - **Incentive to households:** During the first two years of Shaurimoyo pilot project, the households were incentivized for segregating their wastes by exempting their userfee for waste collection. In Sweden, the more the household segregates, the municipality will charge them less user fee, as the fee is based on weight: more the segregation, less the weight.

2. **IEC and awareness:** There should be a push by the responsible ministries and authorities —ZEMA, DoE, ZUMC and DoA under Ministry of Agriculture, Natural Resources, Livestock and Fisheries and Farmer's Welfare, Zanzibar to ensure all stakeholders are apprised and clear on the roles and responsibilities for promotion of compost (*see Table 4: Roles and responsibilities of different stakeholders for IEC and awareness for compost*).

    Compost is a new entity for farmers in Zanzibar, therefore the authorities should create awareness and apprise the farmers on the benefits of these products through field demonstrations. In addition, direct incentive should be given to farmers to switch to organic fertilizer such as compost. Farmers can also be distributed free sample bags to test the product.

Table 4: Roles and responsibilities of different stakeholders for IEC and awareness for compost

Stakeholder	Role
Zanzibar Environmental Management Authority (ZEMA)and Department of Environment (DoE)	• Conduct awareness programmes for municipal councils from time to time in order to push them to adopt segregation-based waste management models and usage of compost in agricultural predominant areas • Push for use of compost in reclamation of wastelands
Zanzibar Bureau of Standards (ZBS)	• Develop standards of compost
Department of Agriculture	• Develop guidelines for compost • Carry out periodic tests to appraise the farmers on the importance of compost in improving soil quality • District agricultural departments to ensure that fertilizer companies sell compost to farmers along with the urea • Device market linkages with municipalities/farmers
Municipal Council	• Facilitate households to provide segregated waste and strengthen waste management systems • Encourage more decentralised composting plants to ensure a better quality of waste feed

Source: CSE, 2019

3. **Establishing testing laboratory for compost:** First and foremost, ZEMA and DoA needs to develop infrastructure and Zanzibar needs to establish a testing laboratory for compost. If this is not possible, the authority need to identify a testing facility in mainland Tanzania in order to test the compost. The compost should be tested as per the guidelines/directions prescribed by the concerned department in Zanzibar.

4. **Sampling and testing:** All finished products should be subjected to sampling for laboratory analysis using the guidelines provided by ZBS. Testing of the fertilizer shall be done as prescribed in the methods of analysis indicated in respective test methods standards.

5. **Subsidy of compost:** *A subsidy component is proposed, and it shall be given to the manufacturer/marketers.* For instance, the Indian government promised a fixed amount of subsidy under Market Development Assistance (MDA) of Rs.1500 per metric tonne (MT) for scaling up production and consumption of compost to fertilizer companies and other stakeholders involved. It is also proposed to offer subsidy to farmers if they are using compost in their farms.

6. **Packaging, marking and labelling**

   Packaging: The compost shall be packaged in materials that are clean and non-defective that protects the product from physical, chemical and moisture contamination and withstand multiple stages of handling (transportation and storage). However, plastic packaging should be avoided.

   Labelling: The following shall be legibly and indelibly marked on the package in either Kiswahili or Kiswahili and English.

   - Name of the fertilizer i.e. Organic fertilizer (only if it conforms to the standard)

- Name and address of the manufacturer/packer/importer
- Nutrient content
- Carbon/Nitrogen ratio
- Organic matter content
- Moisture content
- Batch number
- Production date and expiry date
- Handling instructions
- Directions for Use
- Storage instructions
- Country of origin

Marking: The containers/bags may also be marked with the ZBS Standards mark of quality. NOTE – The ZBS Standards Mark of Quality may be used by the manufacturers only under license from ZBS. Particulars of conditions under which the licenses are granted, may be obtained from ZBS.

7. **Marketing** and **promotion** can be done through existing manufacturers or/and through body recognized by DoA and ZEMA.

8. **Feasibility in finding the sources of funding for composting projects:** The Government should identify and allocate funds for composting projects. Apart from the government funding, multi-lateral agencies such as World Bank, International Monetary Fund (IMF), Food and Agricultural Organization (FAO), Global Environmental Facility (GEF) etc. could also assist in starting such projects. Another partner could be non-governmental organizations (NGOs), civic groups, social enterprises, trade unions, community block organizations, or even private company etc. can fund (alone or in partnership) for operating municipal compost plants. They can assist in consulting services and equipment, offering skills and information etc.

4. Guidelines for marketing of compost

A successful composting operation is a targeted strategy based on the local market environment of the region. Primarily, the target audience for a product like compost is farmers, public entities and residents.

Currently, in Zanzibar, compost is being sold at the rate of 1000 Tanzanian Shilling (Tshs) per kg by Shaurimoyo society workers (CBO) in Shaurimoyo and the compost is packaged in gunny sacks (See Figure 1 and 2 on semi branded compost in Shaurimoyo).

Key issues in compost marketing strategy are a stable and reliable supply of certified compost to the end users. Options have to be explored so that the manager of the composting facility never needs to dispose of any produced compost as waste.

I. **Progressive target for marketers:** Based on the quantity of compost in Zanzibar, the government should set a target on the compost sold based on a yearly plan. For instance, compost manufacturers such as Shaurimoyo society will have to co-market mandatorily in an annual year based on their sales. They could also do this in partnership with the marketing body or on a contractual basis with a private concessionaire.

Sample of compost after sieving

II. **Promote and encourage organic farming/ agriculture:** Since, Zanzibar is an agriculture based economy, organic farming/ agriculture could be encouraged and this could become an ideal way to resolve the issue of compost promotion. Organic agriculture brings with it numerous other benefits for sustainable development. Environmental benefits from increased organic agricultural cultivation include lower energy consumption (20-56 per cent lower per unit produced), reduced greenhouse gas emissions (on average 64 per cent lower per hectare), higher levels of biodiversity, and increased soil fertility leading to the possibility of equivalent or higher yields compared to conventional farming. Increased soil fertility can also help combat desertification by preventing erosion and land degradation.

Semi branded compost (10 kg) in Shaurimoyo

Besides environmental benefits, organic agriculture can increase food security resulting from higher productivity and therefore higher yields.

III. Market development: Compost can be difficult to market, since in many places, it is not a recognised product (i.e. people are not familiar with its use) and has no established market value. As a result, part of the process of starting the production of compost is the development of its market. Market development includes several types of activities:

Semi branded compost (1 kg) in Shaurimoyo

- Compost is much cheaper than chemical fertilizers in Zanzibar. In Zanzibar one kg of chemical fertilizer cost about 1800 Tshs as compared to compost which cost about 1000 Tshs per kg.
- Compost manufacturer can directly sell compost to farmers in branded packaging as well as loose compost.
- Giving away compost -free of charge- to high-profile users or well-respected farmers and gardeners, whose experiences people will trust and whose opinion will have influence on their peers.
- Promoting or advertising the use of compost through environmental or recycling education campaigns.
- Using compost in municipal parks, to landscape national monuments or cemeteries and to green roads and public spaces, with clear indications to identify that a composting product is being applied in the specific case, instead of chemical fertilizer. Additionally, the origin of the compost can be indicated.
- Convincing high-prestige businesses, such as hotels and resorts, to use compost on lawns and gardens.
- If available, collaborating with an agricultural education institution to test the compost on specific end-users and then make this information available for similar end-users in the market.
- Technical backup to market development will be a series of formally monitored compost yield trials. Positive results of these trials can help to convince the local agricultural sector, since they are the main clients for the final product (compost).

Annexures

I. Compost quality test results of Shaurimoyo, Zanzibar

Sr. No.	Parameters	Test Method	February 2018	December 2018	April 2019
1.	pH	FCO 1985	8.7 ± 0.21	7.66	7.54
2.	Moisture (%)	FCO 1985	18.73 ± 0.61	9.68	7.63
3.	Bulk Density (g/cm3)	FCO 1985	1.45 ± 0.14	Nil	Nil
4.	Electronic Conductivity (µs/cm)	FCO 1985	ND**	13.76	14.03
5.	Zinc (Zn) (mg/kg)	FCO 1985	ND**	88.2	93.2
6.	Copper (Cu) (mg/kg)	FCO 1985	ND**	9.86	10.03
7.	Total Organic Carbon (%)	FCO 1985	39.42 ± 0.78	32.04	33.4%
8.	Total Nitrogen (N) (%)	FCO 1985	3.82 ± 0.22	2.28	2.32%
9.	Total Phosphorus (P_2O_5) (%)	FCO 1985	1.73 ± 0.93	0.63	0.73%
10.	Total Potassium (K_2O) (%)	FCO 1985	ND**	0.51	0.63%
11.	C:N Ratio	FCO 1985	10.32	14:1	14:1
12.	Cadmium (Cd) (mg/kg)	FCO 1985	ND**	BDL*	BDL*
13.	Lead (mg/kg)	FCO 1985	ND**	5.30	6.15
14.	Nickel (mg/kg)	FCO 1985	ND**	8.10	12.03
15.	Chromium (mg/kg)	FCO 1985	ND**	BDL*	BDL*

Source: CSE, 2019
**BDL: Below Detection Limits;*
***ND: Not Done*

II. Pathogenic organism requirements

Microorganisms	Requirements	Method of test
E. coli MPN/g	Absent	TZS 731
Salmonella spp in 25 g fresh mass	Absent	TZS 122
Faecal streptococci cfu/g	<500	Annex B of TBS/AFDC 10 (5440) P3
Total coliforms cfu/g	Nil	TZS 119

Source: Organic Fertilizer — Specification, Draft Tanzania Standard, Tbs/Afdc 10 (5440) P3

III. The Urban Municipal Council Regulations, 2019

ZANZIBAR LOCAL GOVERNMENT AUTHORITY
ACT, NO. 7 OF 2014
The Urban Municipal Council Solid Waste Management Regulations, 2019
(Made under section 27(1) (c))

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REGULATIONS

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Note: For detailed information and copy of the regulations, kindly contact: Office of Zanzibar Urban Management Council (ZUMC), Zanzibar.

References

1. ZUMC 2017; 2019
2. CSE 2019
3. CSE, Field Assessment Report- Zanzibar 22-27 August, 2016
4. Pilot Project Decentralized Solid Waste Management in Zanzibar, Tanzania. Available at https://www.cseindia.org/decentralized-solid-waste-management-in-zanzibar-tanzania-8789.pdf
5. Expanding rice production project (ERPP), Available at http://documents.worldbank.org/curated/en/274631468312904648/pdf/E46350V10AFR0E0Box385313B00PUBLIC0.pdf
6. CSE, 2019
7. https://agriodisha.nic.in/content/pdf/Fertiliser_Control_Order_1985.pdf, as accessed on 30/7/2019.
8. http://www.puntofocal.gob.ar/notific_otros_miembros/ken277_t.pdf
9. http://www.puntofocal.gov.ar/notific_otros_miembros/tza183_t.pdf
10. FCO, 1985, Government of India
11. Food and Agricultural Organization of the United Nations (FAO), Farmer´s Compost Handbook Experiences in Latin America, 2015, pg. 23-25. Available at: https://bit.ly/2IT00zS, as accessed: 28th April, 2019.
12. Barker, A.V., 1997, Composition and Uses of Compost, Agricultural Uses of By Products and Wastes ASC Symposium Series, American Chemical Society, 668:140-162.
13. Anon, 1998, Testing Compost, The Ohio State University Extension Fact Sheet, ANR-15-03
14. Brinton, W.F, 2000, Interpretation of Waste and Compost Tests, Journal of the Woods End Research Laboratory, Vol 1. No.4. Available at: https://bit.ly/2HHF3G9 as accessed on 1st May, 2019
15. Pinamonti F, Stringari G, Gaperi F, Zorzi G, 1997, The use of compost: its effects on heavy metals levels in soil and plants. Resource Conserve Recycle, 21: 129-143
16. Charting the future of city compost, CSE, 2019
17. https://law.resource.org/pub/eac/ibr/eas.456.2007.html, as accessed on 9 April 2019.

(**Endnotes**)

1 Expanding rice production project (ERPP), http://documents.worldbank.org/curated/en/274631468312904648/pdf/E46350V10AFR0E0Box385313B-00PUBLIC0.pdf

2 CSE, 2019

3 https://agriodisha.nic.in/content/pdf/Fertiliser_Control_Order_1985.pdf, as accessed on 30/7/2019

4 http://www.puntofocal.gob.ar/notific_otros_miembros/ken277_t.pdf

5 http://www.puntofocal.gov.ar/notific_otros_miembros/tza183_t.pdf

6 FCO, 1985, Government of India

7 Food and Agricultural Organization of the United Nations (FAO), Farmer´s Compost Handbook Experiences in Latin America, 2015, pg. 23-25. Available at: https://bit.ly/2IT00zS, as accessed: 28th April, 2019

8 Barker, A.V., 1997, Composition and Uses of Compost, Agricultural Uses of By Products and Wastes ASC Symposium Series, American Chemical Society, 668:140-162.

9 Anon, 1998, Testing Compost, The Ohio State University Extension Fact Sheet, ANR-15-03

10 Brinton, W.F, 2000, Interpretation of Waste and Compost Tests, Journal of the Woods End Research Laboratory, Vol 1. No.4. Available at: https://bit.ly/2HHF3G9 as accessed on 1st May, 2019

11 Pinamonti F, Stringari G, Gaperi F, Zorzi G, 1997, The use of compost: its effects on heavy metals levels in soil and plants. Resource Conserve Recycle, 21: 129-143

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