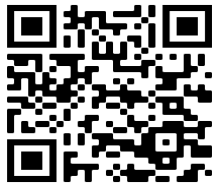





# Determination of Microbial and Physicochemical Properties of Compost Manure Made From Plant and Animal Materials in Ogwashi-Uku

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Abstract	Article History
<p>This study investigated the microbial and physicochemical properties of compost manure made from plant and animal materials in Ogwashi-Uku. The sample includes cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fishbone and eggshell. The physical qualities of the sample analysed, the moisture content for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fishbone and eggshell were 29.01, 8.58, 29.15, 18.02, 20.33 and 7.20 respectively. The water absorption capacity for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fish bone and eggshell were 66.00, 62.00, 67.00, 37.00, 50.00 and 90.00 respectively. The bulk density for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fish bone and eggshell were 0.27, 0.42, 0.35, 0.38, 0.19 and 0.74 respectively. The porosity for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fish bone and eggshell were 89.81, 84.15, 86.79, 85.66, 92.83 and 72.18. The initial pH values for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fish bone and eggshell were 7.95, 8.83, 8.77, 7.33, 7.88 and 6.84 respectively. The <i>Rhizobia</i> pH values for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fish bone and eggshell were 8.28, 8.54, 8.52, 6.85, 8.23 and 8.42 respectively and the <i>Azotobacter</i> pH values for cow dung, burnt corn husk, burnt coconut husk, burnt plantain dusk, fishbone and eggshell were 8.33, 8.50, 8.55, 7.09, 8.15 and 7.92 respectively.</p> <p><b>Keywords:</b> Cow dung, corn husk, coconut husk, agriculture, organic manure</p>	<p>Received: 12 Oct 2022 Accepted: 25 Oct 2022 Published: 29 Oct 2022</p> <p>Scan QR code to view*</p> 
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## Introduction

With the advancement of technology or the industrial age, there is a need to increase and maximize the soil life of available farmlands. This is achievable by humidification of soil instead of adding chemical fertilizer. Also with the increasing problem of waste material, the conversion of wastes to soil-enriching products is useful in maintaining the structure and fertility of agricultural products and at the same time leading to a cleaner environment (Castaldi, Garau and Melis, 2008).

Organic resources are often proposed as alternatives to commercial mineral fertilizers (Hack and Selenka, 1996). Composting process begins with the breaking down of organic material into what will eventually become humus in the soil. Agricultural wastes are essentially of plant origin holding and these can be composted for the supply of nutritious organic and therefore contain the entire nutrients essential for plant growth. (Benito *et al.*, 2012). Plants and animals wastes are freely available on most organic holding and these can be composted for the nutritious organic matter to return to the soil. Generally, organic fertilizers contain a relatively low concentrations of the actual plant nutrients and are not immediately available for plant utilization. Hence, the fortification of organic waste and their compost as a source of organic nutrients are imperative for sustainable agriculture. Also, the fortification of compost with chemical fertilizer enhances agronomic effectiveness of both the

organic matter and nutrients by reducing the amount of fertilizer and improving the quality of compost (Bustamante *et al.*, 2010). The use of liquid organic fertilizer containing beneficial micro-organisms for supporting organic farming has gained much global interest (Benson and Othman, 1993).

Composting provides a means for recycling solid waste and has the potential to manage most of the organic material in the waste stream including restaurant wastes, leaves, farm wastes, animals manure, paper products, waste materials mainly of animals and plants origin are potential sources of organic matter (Bustamante *et al.*, 2010). And benefit derived from the utilization of these organic materials ranges from the improvement of soil fertility to a reliable means of waste disposal. Bustamante *et al.* (2010) report that processing organic waste by compost will provide an opportunity to reduce bulk and odour while increasing the nutritive value of the materials. Composting cannot be considered a new technology as it is gaining interest as a suitable alternative for chemical fertilizers, as its process reduce or eliminate toxicity and the final product of compost can be used to improve soil fertility and quality (Epstein, 1997).

Microorganism like worm and millipedes breaks down large aggregate of organic matter by mechanical means. There are larger organisms present in

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compost known as the physical decomposers that chew and grind their way into compost heap and are higher up in the food chain (Strainer *et al.*, 1998).

Generally, the composting of organic material has been or remained of little or no recognition by the agricultural sector and waste management, because of lack of awareness by subsistent and commercial farmers. This study would provide awareness to farmers who do not have access to NPK fertilizer because of its high cost hence, the fortification of organic waste and their compost as a source of organic nutrient is imperative in sustainable agriculture, as organic fertilizer are not immediately available for farmers utilization.

Production of organic waste is creasing while soil is progressively loosing organic matter due to intensive cultivation and climatic condition this make the recycling of organic waste a useful alternative to incineration landfill or rubbish dump recycling of these organic waste after appropriate biological treatment can produce valuable organic matter and be a great interest in counties where nutrient deficient and poor soil prevail (Hassan *et al.*, 2001).

## Materials and Methods

### Sample collection

The sample was collected from Ogwashi-Uku environment some of the samples were waste products of organic products from farmlands and kitchen wastes. This organic materials were properly collected and stored for basis of further research.

The sample of this study are mainly organic materials which are as follows

- i. Cassava peels/husk
- ii. Plantain peels/husk
- iii. Eggshells
- iv. Fish bones
- v. Burnt corn husk
- vi. Burnt coconut husk
- vii. Cow dung

The samples were collected from selected sites of different agricultural location which are Ogbe-Ofu, Agidiasei and Campus C in Ogwashi-Uku.

The organic materials collected were dried in an ambient temperature, it was then ground to powder using a blender. This powdered organic materials was kept in a container and labeled appropriately and then the coconut and corn husk were carefully burnt and the whole samples weighed and placed in an air-tight transparent container and labeled properly. This sample were further taken to the laboratory for appropriate findings or analysis.

### Physical Analyses of Carrier Materials

Physical parameters such as pH, moisture, bulk density, porosity and water absorption capacity of the carrier materials were estimated using standard methods for soil as described by FAO (2008).

### pH Determination

The analysis of pH was carried out according to the method of FAO (2008). The pH meter was calibrated using two buffer solutions (pH 7.0 and 10) buffer solutions were dispensed in the beakers and the electrode was inseted in the beakers containing the two buffer solutions, and the pH adjusted. The instrument indicating pH as as per the buffers is ready to test the samples. Ten grams of soil sample was weighed and placed into a 100 ml beaker. The suspensions were stirred for 30 minutes, filtered and the pH and temperature on the calibrated pH meter was recorded.

### Moisture Content Determination

The procedure for determining the soil moisture was carried out according to the method of FAO (2008) hundred grams of soil sample was weighed into the crucibles and placed in the electric oven after removing the lid. The samples were kept at 105 °C until it attained a constant weight. The samples were cooled, first in the switched- off oven and then in a desiccator and weighed. The loss in weight is equal to the moisture contained in 100g soil sample. The percentage of moisture is calculated as:

$$\text{Moisture percent} = \frac{\text{Loss in weight}}{\text{Oven} - \text{dry weight of soil}} \times 100$$

### Bulk density and Porosity

The method of Nolan *et al.* (2011) was adopted in bulk density determination. Bulking density was performed by suspending a funnel above a measuring cylinder. The funnel was filled with the sample and allowed to flow freely into the measuring cylinder. The excess material on top of the measuring der was scraped off. The Sample and the cylinder were then weighed and the weight/volume (bulk density) was calculated in Kg m<sup>-3</sup>.

Porosity was determined from the respective bulk density values using the equation below:

$$\text{Porosity} = 1 - \text{bulk density} \times 100$$

### Water Absorption Capacity

In accordance with Ahn *et al.* (2008) method, a wet sample of known initial moisture content was weighed (Wi) and placed in a beaker. After soaking in water for 1-2 days and draining excess water through Whatman #2 filter paper, the saturated sample was weighed again (Ws). The amount of water retained by dry sample was calculated as the WHC. The water holding capacity (gwater/g dry material) is calculated as:

$$\text{WHC} = \frac{[Ws - Wi] + MC \times Wi}{(T - MC) \times Wi}$$

Where: Wi is the initial weight of the sample (g), Ws is the final weight of the sample (g) and MC is the initial moisture content of sample (decimal).

### Test Organism, Inoculum Preparation, Inoculation of the Carrier and Curing

Nitrogen fixers identified as *Rhizobium* sp. COOU and *Azotobacter* sp. COOU10, were collected from Laboratory of Microbiology Department, Chukwuemeka Odumegwu Ojukwu University, Uli, Anambra State. The organisms were grown in nutrient broth at 30 °C for 48 h. Fifty milliliters of this inoculum containing about 25 X 10<sup>7</sup>CFU/mL was aseptically added into 50g of carrier material contained in a sterile 500 mL conical flask. Both were mixed thoroughly using a sterile spatula. The flask was stoppered with cotton wool. Curing was carried out at room temperature for seven days (Ogbo and Odo, 2011).

### Chemical and Microbiological Analyses

The chemical composition of carriers determines, among others, nutrient availability and toxicity or lack of it to the inoculant. pH was determined on a pH/Temperature meter. Viable counts of test organisms in carriers were determined at 30°C/ 48 h on nutrient agar (Himedia, India).

Microbial counts CFU/mL) during various stages of the study (21 days) were used to determine or deduce the toxicity of carrier materials to the test organism and their shelf life during storage of the biofertilizer. All chemical and microbiological tests were performed in triplicate (Ogbo and Odo, 2011).

## Results and Discussion

Table 1 shows the result obtained from the analysis of the different organic samples and it was compared with FAO (2008) describe standards. The following was deduced from the table which shows the physical properties (Water Absorption capacity, Bulk density, Porosity, pH.).

The results indicate that the bulk density value ranged from 0.19-0.74 g/cm<sup>3</sup> for different compost types. The highest value of bulk density (0.74) was found for fish bone and eggshell. Compost and the lowest value of bulk density (0.19), was found for plantain husk compost. This was adopted from Nolan *et al.* (2011) method in bulk density by determination.

The moisture content value ranged 7.20 to 29.01% for different compost types. The lowest value of moisture content (7.2 was found for fish bone and eggshell compost and the highest value of moisture content (29. 01%) was obtained for coconut husk compost.

Regarding the water holding capacity value ranged from 37.00 - 40.00% for different compost types. The lowest (37 00%) was found for cassava dusk and the highest (40.00%) was obtained for fishbone and eggshells.

The porosity value ranged from 72.08 to 92.53% for different compost types. The lowest value of porosity (72.08%) was found in fishbone and eggshells and the highest value of porosity (92.53%) was found in plantain dusk compost. The porosity depends on the bulk density and moisture content.

The porosity decreased with increasing bulk density and moisture content. The result indicates that the porosity of compost decreased from 92.83% - 12.08% when the bulk density increased from 0.19g/cm<sup>3</sup> - 0.74g/cm<sup>3</sup> and the result also showed that the porosity of compost decreased from 92. 85% - 2.08% when the moisture content increased from 7.20 - 29.01%. This result agreed with those obtained by Ahn *et al.* (2008) and Nolan *et al.* (2011).

Table 2 and 3 show the survival and growth of *Rhizobia Spp* and *Azotobacter Spp* in the carrier materials during curing.

**Table 1:** The physical qualities of carrier materials detected in the 6 sample analysis is given in the table below

Samples	Moisture content (%)	Water absorption capacity (%)	Bulk density (g/cm <sup>3</sup> )	Porosity (%)	Initial pH	Rhizobi a final pH	Azoto bacter final pH
Cow dung	29.01	66	0.27	89.81	7.95	8.28	8.33
Burnt com husk	8.58	62	0.42	84.15	8.83	8.54	8.5
Burnt coconut husk	29.15	67	0.35	86.79	8.77	8.52	8.55
Cassava husk	18.02	37	0.38	85.66	7.33	6.85	7.09
Burnt plantain husk	20.33	50	0.19	92.83	7.88	8.23	8.15
Fishbone & eggshell	7.2	90	0.74	72.18	6.84	8.42	7.92

NB : % percentage, g/cm<sup>3</sup> = Grams per centimeter cube

**Table 2:** Survival and growth of *Rhizohia sp* in the carrier materials during curing

S/N	Sample	Week 7 count (cpu/ml x 10 <sup>4</sup> )	Week 21 count (cpu/ml x 10 <sup>4</sup> )	Week 35 count (cpu/ml x 10 <sup>4</sup> )
1	Cow dung	8.60	12.80	15.50
2	Burnt corn husk	6.10	13.40	14.70
3	Coconut husk	9.70	9.90	18.70
4	Cassava dusk	4.00	9.00	13.70
5	Burnt plantain	7.20	15.30	15.60
6	Fishbone & eggshell	4.10	4.50	12.60

N/B: cfu/ml= colony forming unit per millilitre

**Table 3:** Survival and growth of *Azotohacter sp* in the carrier materials during curing

S/N	Sample	Week 7 count (cpu/ml x 10 <sup>4</sup> )	Week 21 count (cpu/ml x 10 <sup>4</sup> )	Week 35 count (cpu/ml x 10 <sup>4</sup> )
1	Cow dung	4.80	12.80	14.30
2	Burnt corn husk	3.30	4.50	14.00
3	Coconut husk	6.20	11.80	12.70
4	Cassava dusk	4.10	4.60	32.20
5	Burnt plantain	2.80	6.60	19.20
6	Fishbone & eggshell	9.60	11.30	13.90

N/B: cfu/ml= colonhy forming unit per millilitre

## Conclusion

An experimental study was carried out successively to determine some physicochemical and microbial properties of different compost types. The obtained results shared or indicate that pH value ranged from 6.84-8.83 for different compost types. The moisture content value ranged from 7.20-29.15%. The bulk density values ranged from 0.19-0.74%, porosity ranged from 72.08-92.83 the pH influenced the growth of the *Rhizobia* and *Azotobacter* during curing. The chemical composition of carriers determines, among others, nutrient availability and toxicity or lack of it to the inoculants.

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