Scientia Africana, Vol. 23 (No. 3), August, 2024. Pp 147-152
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DETERMINATION OF PROXIMATE ANALYSIS OF INDIVIDUAL AND COMBINED SAMPLES OF *Dioscorea alata, Musa parasidiaca AND Xanthosoma sagittifolium* PEELS

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Received: 11-06-2024
Accepted: 22-06-2024

https://dx.doi.org/10.4314/sa.v23i3.14

Journal Homepage: http://www.scientia-african.uniportjournal.info
Publisher: *Faculty of Science, University of Port Harcourt.*

ABSTRACT

This study investigates the proximate composition of yam (Dioscorea alata), cocoyam (Musa parasidiaca) andplantain (Xanthosoma sagittifolium) plant wastes, with a focus on evaluating the impact of the individual and combined plant wastes. Tubers of yam (Dioscorea alata), cocoyam (Musa parasidiaca) and plantain (Xanthosoma sagittifolium) used in this study were obtained from Obibi in Etche Local Government Area of Rivers State, Nigeria. Yams are tubers, plantains are fruits, whereas cocoyam is derived from corms, underground stems, and swollen hypocotyls. All these crops can be propagated by vegetative parts and these include tubers (yams), sucker (Plantain) and side shoots, stolons, or corm heads (cocoyam). Peels from the yam tubers were obtained by using a kitchen knife to carefully remove the peels. The peels were then immediately oven dried at 45°C for 24 hours. The dried peels were then ground through a 40-mesh screen using a Wiley. Analyses conducted isproximate determination using AOAC method. The results highlight the high ash content of Yam and Cocoyam Peel, which contributes to mineral enrichment; the enhanced moisture content of Plantain Peel, which has implications for water retention; and the low fat and oil content of Cocoyam Peel, which suggests that it is appropriate for use as a low-fat organic material. Yam Peel has a high crude fiber level, which indicates that it has the capacity to improve the structure of the soil. On the other hand, Yam and Cocoyam Peel stand out because it has largest protein content, which is essential for the development of plants. Plantain and cocoyam peel have the largest carbohydrate content, making it an excellent source of energy for the bacteria and plants that live in the soil below it. These findings have practical implications for sustainable agriculture by optimizing crop yields in diverse agro ecosystems.

Keywords: peels, proximate, *Dioscorea alata, Musa parasidiaca and Xanthosoma sagittifolium*

INTRODUCTION

In recent years, the issue of environmental protection has become one of the most important priorities of international politics. The problem of progressing degradation of the environment is primarily caused by large amounts of industrial waste. This particularly concerns waste products of the food industry, as they contain significant amounts of organic substances. About 0.16 of solid waste is obtained per ton of processed potato (Pathak *et al.*, 2018). Such waste includes potato wastewater, pulp and peel formed during the industrial processing of potatoes for food purposes. This waste, under conditions of improper management, may pose a threat to the environment, e.g. risk of microbial contamination or soil damage (Kozich *et al.,* 2013). The peels are mostly regarded as waste and are discarded indiscriminately in landfills, drainages and road sides; consequently posing a threat to the environment (Auta and Kumurya, 2015; Baiyeri *et al.,* 2011). Reports have shown, peels as being good potential substitute for corn starch in the diet of snails and also incorporated with other waste materials in the diet of pigs (Okareh *et al.,* 2015; Omale and Okafor, 2008). Meanwhile, in the chemical industry, peels have shown potential for the generation of important chemicals like ethanol and also alkali for the manufacturing of soap. As a way of ensuring a safer environment, attempts have been made to use polyphenolic resol resins from the ethanol extract of plantain peels for the adsorption of heavy metals since the peels show high retention affinity for lead, nickel and chromium (Andres *et al.,* 2015). In the food industry, flour made from peels have been reportedly used to enrich wheat flour at various percentages in producing snacks like cookies and sausages; serving as a good source of fiber, antioxidants and potentially benefiting humans in the management and prevention of life style related diseases (Gilver and Liliana, 2017; Arun *et al.,* 2015). Several studies have reported the antifungal and antibacterial activities of different parts including the peel of plantain plant for the treatment of a large number of human ailments (Auta and Kumurya, 2015). The ethanol extracts of the peels were used against eight human pathogenic microbes; five bacteria and three fungi and they proved effective against these human pathogens which have been implicated in several human diseases (Ighodaro, 2012). The aim is todetermine the proximate analysis of individual and combination samples of yam, cocoyam and plantain peels. Thus, the peel extracts have been suggested for use in pharmaceutical and medical formulations. Some of the main pharmacological effects of the plantain plant including the peels are; antiulcer, analgesic, wound-healing, hair growth promoter, haemostatic activity among others (Alexandre *et al.,* 2019; Aruwa *et al.,* 2019; Barroso *et al.,* 2019; Mohamad Sukri *et al.,* 2019).Agricultural-based industries produced the vast amount of residues every year. If these residues are released the environment without proper disposal procedure that may cause to environmental pollution and harmful on human and animal health. Most of the agro-industrial wastes are untreated and underutilized, therefore in maximum reports disposed of either by burning, dumping unplanned landfilling. These untreated wastes create different problems with climate change by increasing number of greenhouse gases. The use of fossil fuels also contributing the effect greenhouse gas (GHG) emission (Bos and Hamelinck, 2014). So, now it is a worldwide concern to dictating the improvement of alternative cleaner and renewable bioenergy resources (Okonko *et al.,* 2009). These wastes cause a serious disposal problem (Rodríguez-Couto 2008). For example, the juice industries produced a huge amount of waste as peels, the coffee industry produced coffee pulp as a waste, and cereal industries produced husks. All over the world approximately 147.2 million metric tons of fiber sources are found, whereas 709.2 and 673.3 million metric tons of wheat straw residues and rice straws were estimated, respectively, in the 1990s (Belewu and Babalola 2009). As per the composition of these agro-industrial residues are concerned, they have high nutritional prospective, therefore they are getting more consideration for quality control and also categorized as agro-industrial by-products (Graminha *et al.* 2008).

MATERIALS AND METHODS

Tubers of yam, plantain and cocoyam (*Dioscorea alata, Musa parasidiaca and Xanthosoma sagittifolium*) used in this study were obtained from Obibi in Etche Local Government Area of Rivers State, Nigeria. Peels from the yam tubers were obtained by using a kitchen knife to carefully remove the

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peels. The peels were then immediately oven dried at 45^{o}C for 24 hours. The dried peels were then ground through a 40-mesh screen using a Wiley mill and stored in a desiccator until when they were analyzed.

Determination of Proximate Analysis of samples

Moisture Content

Procedure:

The empty crucible was weighed, and 2g of the sample was transfer into the crucible, the crucible was placed in the oven and allowed for one hour. Removed and allow to cool in a desiccator. The crucible was reweighed and the weight used for calculation.

Calculation:

% Percentage of moisture =   X 100

Ash Content

Procedure:

The sample was weighed into a tare crucible. Placed in a cool muffle furnace, and was allowed to burn for 12-18hrs (or overnight), the muffle furnace was turned off and sample allow to cool to at least 250^{o}C. The door was opened gently to avoid losing ash that may be fluffy, safety tongs were used to transfer crucible to a desiccator. The crucible was covered and desiccator closed, then was cool to room temperature and reweighed. The ash content was calculated and findings were recorded.

Total Carbohydrate

Procedure:

100mg of the sample was weighed into a boiling tube. Hydrolysed by keeping it in boiling water bath for 3 hours with 5mL of 2.5 N-HCl and was cool to room temperature. Was neutralized with solid sodium carbonate until the effervescence cease. The volume was made up to 100mL and centrifuged, the supernatant was collected, 0.5 and 1mL aliquots was taken for analysis. The working standards were prepared. The volume was made up to 1mL in all the tubes, including the sample tubes by adding distilled water. 4mL of anthrone reagent was added and allow to be heated for 8 minutes in a boiling water bath. Cool rapidly and the green dark color was read at 630nm. A standard graph was drawn by plotting concentration of the standard on the X-axis versus absorbance on the Y-axis. The amount of carbohydrate present in the sample tube was calculated from the graph.

Calculation:

Amount of carbohydrates present in 100mg of the sample = x 100

Determination of Nitrogen

Procedure:

20g of sieved soil was transferred into 1lit. round bottom flask, a little distilled water was added in the bottom flask to ensure the soil don't remain stuck to the side of the flask. 100ml of potassium permanganates and 100ml of sodium hydroxide was added to the flask. Distillate was distilled and collected in a beaker containing 20ml of boric acid working solution. Approximately 150ml of distillate was collected. The distillate was titrated with H_2SO_4 0.02N till the colour change from green to red and the reading was recorded. Blank was carried out without soil.

NOTE: Crude protein (CP) sample,

CP= MX F

M = nitrogen content in sample.

F = factor (6.25 for feed samples)

Crude Fiber

Procedure:

Approximately 2g of the sample was weighed and transferred into a dry conical flask. 200ml of H_2SO_4 was measured and poured into the conical flask to mix the sample with the acid solution. The conical flask was placed on a hot plate and boiled for 30 minutes. The flask was shaking periodically to ensure proper boiling of the sample. After 30 minutes, it was filtered and the filtrate washed with hot water to remove the acid solution completely. Plus the filtrate was transferred into a beaker and 200ml of NaOH was added and boil for another 30 minutes. Was Filtered and wash with hot water to remove the base residue completely. The filtrate was transferred into a platinum crucible and placed in an oven to dry off the excess water. After removing the excess water, it was transferred into an electric furnace and burned to ash at 550ºc. Reweighed and calculated as followed.

Calculation:

Crude fiber % = x 100

Lipid Content

Procedure:

The sample was extracted with petroleum ether. The solvent was distilled off and the residue dried and weighed. 2-3 g of the sample was weighed to the nearest 1 mg, transferred into an extraction thimble covered with a fat wad of cotton wool. Clean and dry extraction flask was weighed to the nearest 1 mg. The thimble was placed in an extractor and extracted for 80 min with light petroleum. The residue was dried, maintaining the flask for one hour in the drying oven at 98ºC, and was allowed to cool in a desiccator and reweighed.

Calculation of results

$$CF = \frac{(b-a)}{C} \times 100$$

b – Weight of dried and cooled flask and extract after extraction

a – weight of dried and cooled flask

c – Weight of sample

RESULTS AND DISCUSSION

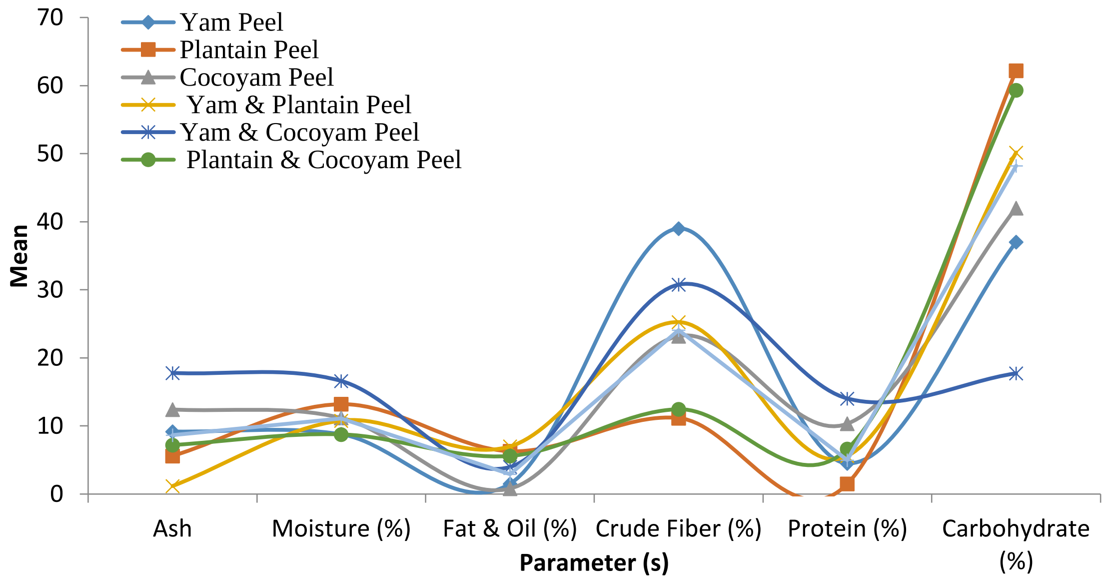

Figure 1: Scatter Plot for the Proximate Results of the Samples

DISCUSSION

Figure 1, the findings provide a comprehensive breakdown of the proximate analysis of numerous parameters derived from single and mixed yam, cocoyam, and plantain peels of plant waste samples. This research sheds light on the possible uses and relevance of these parameters in agricultural and environmental settings. According to the findings, a detailed examination of the nutritional makeup of a variety of plant waste samples was performed, which revealed the many possible uses of these materials in the development of soil. Notable discoveries include the high ash content of Yam and Cocoyam Peel, which contributes to mineral

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enrichment; the enhanced moisture content of Plantain Peel, which has implications for water retention; and the low fat and oil content of Cocoyam Peel, which suggests that it is appropriate for use as a low-fat organic material. Yam Peel has a high crude fiber level, which indicates that it can improve the structure of the soil. On the other hand, Yam and Cocoyam Peel stand out because it has the largest protein content, which is essential for the development of plants. Plantain and cocoyam peel have the largest carbohydrate content, making it an excellent source of energy for the bacteria and plants that live in the soil below it. The results is line with those reported by Onuguh *et al*. (2022). The rationality of the observed distinctions is highlighted by the fact that there are significant differences between the samples, as shown by F-statistics with p-values that are less than 0.05. Taking everything into consideration, these results highlight the potential of plant waste products as significant resources for sustainable agricultural operations. This has consequences for the fertility of the soil, the structure of the soil, and the water retention capacity of the soil. The health of the soil, it is necessary to do further research and field tests in order to convert the findings of the laboratory into practical applications.

CONCLUSION

In conclusion, the findings show various treatments significantly affects the yam, plantain, and cocoyam development factors. Highlighting the potential advantages of diversified and integrated agricultural approaches for maximizing crop yields, certain combinations of plant species have a favorable effect on plant development. Notable discoveries include the high ash content of Yam and Cocoyam Peel, which contributes to mineral enrichment; the enhanced moisture content of Plantain Peel, which has implications for water retention; and the low fat and oil content of Cocoyam Peel, which suggests that it is appropriate for use as a low-fat organic material. Yam Peel has a high crude fiber level, which indicates that it has the capacity to improve the structure of the soil. On the other hand, Yam and Cocoyam Peel stand out because it has the largest protein content, which is essential for the development of plants. Plantain and cocoyam peel have the largest carbohydrate content, making it an excellent source of energy for the bacteria and plants that live in the soil below it.

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