Asian Journal of Research in Botany

4(4): 76-80, 2020; Article no.AJRIB.61675

Studies on Chemical Properties of Three Utilized Agrowastes in Nigeria

S. S. Agbagwa[1*], E. C. Chuku[1] and W. C. Worlu[1]

[1]Department of Plant Science and Biotechnology, Rivers State University, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author SSA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author ECC managed the analyses of the study. Author WCW managed the literature searches. All authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. K. S. Vinayaka, Kumadvathi First Grade College, India.
Reviewers:
(1) S. Gayatri Sri Ramachandra, Sri Ramachandra Institute of Higher Education and Research, India.
(2) A. Padma, Sri Krishna College of Engineering and Technology, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/61675

Original Research Article

Received 02 August 2020
Accepted 07 October 2020
Published 04 November 2020

ABSTRACT

Studies on chemical properties of three utilized agrowastes were conducted in the Department of Plant Science and Biotechnology, Rivers State University. The agrowastes investigated were sawdust, wood ash and cassava bran. Proximate composition of the assessed agro-wastes gave the following highest values for moisture (9.52±0.003), lipid (4.23±0.04) and carbohydrate (64.11±0.02) in cassava bran. Fibre and protein were highest in sawdust while ash content was highest for wood ash. Mineral assessment showed that sawdust had highest concentrations of iron (1.52±0.03), phosphorus (12.02±0.02) and potassium (11.01±0.02). Wood ash recorded highest values for calcium and magnesium. Highest value for sodium (0.70±0.00) was observed for cassava bran. Anti-nutrient screening revealed phytate, tannin and saponin with the highest values recorded in cassava bran. However, polyphenol and flavonoid recorded (2.81±0.02) and (4.21±0.01) for sawdust respectively. The cyanide concentration of the assessed cassava bran (2.52±0.03) was within the acceptable limit of FAO and WHO. In general, these agrowastes materials still possess essential nutrients and anti-nutrients that can be further utilized.

**Corresponding author: E-mail: samuelagbagwa@gmail.com;*

Keywords: Agrowastes; nutrient; anti-nutrient and utilization.

1. INTRODUCTION

Agro-wastes are commonly generated through the various agricultural activities in the environment. The waste products generated from cultivation processes, livestock production and aquaculture facilities do not only affect the aesthetics of the environment but also the health of the individuals living within the environment [1]. Agamuthu [2] reported the drastic increase in agro-wastes generation in developing countries, and stated that their underutilization for productive industrial and economic enterprises by the growing human population of the region would constitute an increasing nuisance to the public and the environment.

Nevertheless, several efforts have been put in place to maximize the potentials of these wastes [3]. Leng et al. [4] emphasized the use of agrowastes for the formulation of feeds for livestock. Saunders [5] showed that ash generated from burning of wood could also be reused for the stabilization of soil pH. Furthermore, the use of ash helps the assimilation of mineral element by plants [6].

Sawdust being a form of waste obtained from timber and lumber activities have also been reutilized for other production process. Several studies have shown the use of sawdust for the cultivation of edible mushrooms [7,8]. Liasu et al. [9] also outlined the use of palm press fibre waste for the cultivation of mushrooms.

In addition, agrowastes are known to be important in the paper industry as straws from wheat and rice, stalks of cotton and sugacane bagasse have been successfully used for the production of pulp [10,11,1]. Literatures have shown that the use of agrowastes in cultivation further supports the nutrient quality of produce [6,12,13].

However, there is little or no literature on the chemical compositions of these utilized agrowastes. It is on this basis that this research was embarked upon in order to assess the chemical compositions of three agrowastes (sawdust, wood ash and grounded cassava peels) in Rivers State, Nigeria.

2. MATERIALS AND METHODS

2.1 Sample Collection

Cassava peels were collected from Omagwa community in Ikwerre Local Government Area, Rivers state (LAT 4.99937/LON 6.90741; 4°59'57.7726"N/6°54'26.67"E). The peels were dried for one month and immediately ground into powder for further use. Sawdust and *Rhizophora racemosa* wood were both obtained from Timber market Mile II Diobu (LAT 4.78902/LON 6.98781; 4°47'20.49"N/6° 59'16.11"E). *R. racemosa* woods were later burnt to collect the ash.

2.2 Nutrient Composition Studies

The determination of proximate, mineral, vitamin and anti-nutrient contents of the agrowastes were done using the methods earlier described by AOAC [14,15].

3. RESULTS AND DISCUSSION

The result of proximate, mineral and anti-nutrient compositions of the utilized agrowastes viz: sawdust, wood ash and cassava bran presented in Tables 1, 2 and 3 respectively showed that cassava bran had highest values for moisture (9.52±0.003), lipid (4.23±0.04) and carbohydrate (64.11±0.02) while sawdust was highest for both fibre (72.12±0.03) and protein (5.38±0.01). Highest value for ash (8.51±0.1) was recorded for wood ash. Although, lowest values of 8.50±0.00, 0.00±0.00, 0.00±00, 5.12±0.02 and 1.41±0.01 was recorded for moisture, lipid, fibre, carbohydrate and protein respectively for wood ash while cassava bran had lowest value for ash (3.53±0.04).

Table 1. Mean proximate composition of utilized agrowastes (%)

Agrowastes	Moisture	Ash	Lipid	Fibre	CHO	Protein
cassava bran	9.52±0.03	3.53±0.04	4.23±0.04	16.21±0.01	64.11±0.02	2.52±0.02
Sawdust	9.21±0.02	6.52±0.03	0.52±0.01	72.12±0.03	6.31±0.02	5.38±0.01
wood ash	8.50±0.00	8.51±0.01	0.00±0.00	0.00±0.00	5.12±0.02	1.41±0.01

CHO= Carbohydrate

Table 2. Mean mineral composition of utilized agrowastes (mg/100g)

Agrowastes	Ca	Fe	Mg	P	K	Na
Cassava bran	17.04±0.06	1.41±0.02	2.82±0.02	11.21±0.01	10.51±0.02	0.70±0.00
Sawdust	5.21±0.02	1.52±0.03	1.60±0.00	12.02±0.02	11.01±0.02	0.51±0.01
Wood ash	18.02±0.03	1.23±0.04	11.04±0.06	9.43±0.04	8.82±0.03	0.62±0.02

Table 3. Mean anti-nutrient composition of utilized agrowastes (%)

Agrowastes	Phytate	Tannin	Polyphenol	Flavonoid	Saponin	Cyanide (mg/100)
Cassava bran	1.21±0.21	7.23±0.04	1.32±0.00	1.23±0.04	0.50±0.00	2.52±0.03
Sawdust	0.02±0.02	6.22±0.03	2.81±0.02	4.21±0.01	0.12±0.00	-
Wood ash	0.04±0.02	1.20±0.00	2.73±0.04	0.12±0.03	0.00±0.00	-

Furthermore, highest concentrations of iron (1.52±0.03), phosphorus (12.02±0.02) and potassium (11.01±0.02) were recorded for sawdust while calcium (18.02±0.03) and magnesium (11.04±0.06) were highest for wood ash. Cassava bran had the highest value for sodium (0.70±0.00). Sawdust had the lowest values for calcium (5.21±0.02), magnesium (1.60±0.00) and sodium (0.51±0.01). Wood ash also recorded lowest values for iron (1.23±0.04), phosphorus (9.43±0.04) and potassium (8.82±0.003).

In addition, highest values for phytate (1.21±0.21), tannin (7.23±0.04) and saponin (0.50±0.00) were recorded for cassava bran while sawdust revealed highest values for polyphenol (2.81±0.02) and flavonoid (4.21±0.01). Further observations showed that wood ash recorded lowest values for tannin (1.20±0.00), flavonoid (0.12±0.03) and saponin (0.00±0.00) while lowest values for phytate (0.02±0.02) and polyphenol (1.32±0.00) were seen for sawdust and cassava bran respectively. Cassava bran was found to contain minimal concentration of hydrogen cyanide (2.52±0.03 mg/100 g).

Results for the mineral and anti-nutrient composition of *R. racemosa* wood ash in this study are in agreement with the findings of Udeozo et al. [16] as the same mineral elements and anti-nutrients in *R. racemosa* wood were found. The high content of calcium in wood ash conforms to the report of Saunders [5] about wood ash being a good source of calcium, an important component of calcium carbonate. The study of Mandre [6] pointed out the influence of wood ash on mineral elements and how this relationship supports plant metabolic pathways, enzymatic reactions and biosynthesis such as photosynthesis. Baba et al. [17] also emphasized the usefulness of wood ash in Nigeria.

The result from the proximate composition of cassava reported by Afoakwa et al. [18] agrees with the current findings as they reported 7.48±0.50 to 9.660.48 moisture and 1.60±0.36 to 3.48±0.47 protein of dried cassava. However, the mineral contents in this study are higher than those they reported. Okpako et al. [19] also reported similar carbohydrate content of cassava peels (64.51±3.01). The variation could also be affected by the varieties of cassava used in their own studies. Cyanide which is a major health concern was also considered in this study.

The cyanide composition of cassava bran utilized in this study is in line with the standard recommendation of < 10 mg/kg [20]. The 2.52±0.03 mg/100 g cyanide content in this study disagrees with those reported by Okpako et al. [19] for fermented and unfermented peels of cassava as they implicated higher concentrations of cyanide.

The great deal of cyanide reduction in this study could be as a result of the drying process as Gomez & Valdivieso [21] reported that sun drying reduced 82-90% cyanide content. They further stated that sun drying reduces cyanide than oven drying which caused a reduction of only 60-77%.

The present study has shown that the utilized agrowastes still possess potential nutrients. Though these substances are considered as wastes, the current study has shown that they can be utilized for other purposes as they can serve as sources of nutrient. Several researches have further shown the positive possibilities attached to the usefulness of agrowastes [13]. Earlier studies have shown that these

agrowastes could further be converted to manure, anaerobic digestion, adsorbents in heavy metal elimination, pyrolysis and many others [3]. In general, cassava bran had more proximate and anti-nutrient quality than the other waste materials assessed. However, sawdust possessed more mineral contents than cassava bran and wood ash.

4. CONCLUSION

Sawdust, cassava bran and wood ash commonly found within the environments and considered as wastes still contain appreciable amounts of nutrient and anti-nutrient constituents that can be employed in various production processes. Their deliberate utilization should be encouraged as they not only support other production processes but reduce and recycle the waste materials.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Rout S, Sahoo PK. Utilization of agro-wastes for sustainability of environment: A short review. Int. J. of Engineering & Management Res. 2017;36-38.
2. Agamuthu P. Challenges and opportunities in agro-waste management: An Asian perspective. Inaugural meeting of first regional 3R forum in Asia, Tokyo, Japan. 2009;15-19.
3. Obi FO, Ugwishiwu BO, Nwakaire JN. Agricultural waste concept, generation, utilization and management. Nigerian Journal of Technology. 2016;35(4):957-964.
4. Leng RA, Choo BS, Arreaze C. Practical technologies to optimize feed utilization by ruminants. In: A speedy and P L Pulgliese (editors). Legume tress and other fodder trees as protein sources for livestock. Rome, Italy: FAO. 1992;145-120.
5. Saunders O. Guide to using wood ash as an agricultural soil amendment. University of New Hampshire Cooperative Extension. 2006;4.
   Accessed 13 July 2020.
   Available:http://extension.unh.edu
6. Mandre M. Influence of wood ash on soil chemical composition and biochemical parameters of young scot pine. Proceedings of the Estonian Academy of Science: Biology & Ecology. 2006;55(2): 91-107.
7. Onuoha CI, Uchechi U, Onuoha BC. Cultivation of *Pleurotus pulmonarius* (mushroom) using some agrowaste materials. Agricultural Journal. 2009;4(2): 109-112.
8. Agbagwa SS, Chuku EC, Nmom FW. Effect of different substrate compositions on mycelia ramification parameters of *Pleurotus ostreatus*. Int. J. Adv. in Engineering & Management. 2020a;2(5): 92-97.
9. Liasu MO, Adeeyo AO, Olaosun O, Oyedokun RO. *Pleurotus pulmonarius* cultivation on amended palm press fibre waste. African Journal of Biotechnology. 2015;14(19):1624- 1631.
10. Peng F, Simonson R. High yield chemimechanical pulping of bagasse. Part 4 bagasse CMP with sodium hydroxide/ hydrogen peroxide pretreatment. Appita J. 1995;45(2):104-108.
11. Lindgren GC, Lindstrom M. Kinetics of wheat straw delignification in soda and Kraft pulping. J. of Wood Chem. Technol. 1998;18(1):69-82.
12. Nwoko MC, Onyeizu UR, Okwulehie IC, Ukoima HN. Nutritional and bioactive compounds evaluation of *Pleurotus pulmonarius* (Freis) quell fruit bodies grown on different wood logs in Abia State, Nigeria. Journal of Petroleum & Environmental Biotechnology. 2017;7:325.
13. Agbagwa SS, Chuku EC, Emiri UN. (2020b). Determination of mineral and proximate compositions of *Pleurotus ostreatus* grown on three agrowastes. Int. J. of Res. in Agric., Biol., & Env. 2020b; 1(2):16-21.
14. AOAC. Official methods of analysis of AOAC international. 15th ed. Association of official analytical chemists, Washington, DC, USA; 1990.
15. AOAC. Official methods of analysis of AOAC international. 18th edition. Association of official analytical chemists, Washington, DC, USA; 2005.
16. Udeozo IP, Okafor GU, Ike OC, Eze EC. The efficacy of *Rhizophora racemosa* wood: An important study. Federal University Wukari Trends in Science & Technology Journal. 2018;(28):977-980.
17. Baba S, Chan HT, Aksornkoae S. Useful products from mangrove and other coastal plants. ISME mangrove educational book

series no. 3. International Society for Mangrove Ecosystem (ISME), Okinawa, Japan and Int. Tropical Timber Organization (ITTO), Yokohama, Japan. 2013;23.

18. Afoakwa EO, Asiedu C, Budu AS, Chiwonap-Karltun L, Nyirendah DB. Chemical composition and cyanogenic potential of raditional and high yielding CMD resistant cassava (*Manihot esculenta* Crantz) varieties. International Food Research Journal. 2012;19(1):173-181.
19. Okpako CE, Ntui VO, Osuagwa AN, Obasi FI. Proximate composition and cyanide content of cassava peels fermented with *Aspergillus niger* and *Lactobacillus rhamnosus*. Journal of Food Agriculture & Environment. 2008;6(2):251-255.
20. FAO/WHO. Joint FAO/WHO food standards programs. In: Codex Alimentarius Commision xii (suppl. 4) Rome, Italy: FAO; 1991.
21. Gomez G, Valdivieso M. Cassava foliage: Chemical composition, cyanide content and effect of drying on cyanide elimination. Journal Science Food & Agriculture. 1985; 36(6):172-183.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/61675