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Muhammad S.A
Nabda, Bioresource Center, Odi., Bayelsa, Nabda, Nigeria.

Magdaline Joseph Kwaji
Nabda, Bioresource Center, Odi., Bayelsa, Nabda, Nigeria.

Oje E.O
Nabda, Abuja, Nigeria.

D Babalola Ayoade
Department of Biochemistry, University of Ibadan, Ibadan, Nigeria

Correspondence:
Magdaline Joseph Kwaji
Nabda, Bioresource Center, Odi., Bayelsa, Nabda, Nigeria.

Disparities in Proximate Analysis and Screening of Substrate for Methanogenesis using Mixed Fruit and Vegetable Residue, Cow Dung from Slaughter House Lugbe, F.C.T, Abuja, and Saw Dust from ODI Saw Mill, Bayelsa Nigeria.

Muhammad S.A, Magdaline Joseph Kwaji, Oje E.O, D Babalola Ayoade

Abstract
The proximate composition of foods includes moisture, ash, lipids, protein and carbohydrate contents. This component may be of interest in product development, quality control, screening or regulatory purposes especially during fermentation. Methanogenesis was once considered a special type of fermentation. However, in some respect a very unique biochemistry is involved, which distinguish methanogenesis from fermentation as well as respiration. Analysis used may be rapid methods for screening and quality control or more accurate but time-consuming official methods. Sample collection must be considered carefully during this analysis to ensure analysis of a homogenous and representative sample, and to obtain accurate results. This is achieved by the breakdown of complex polymeric substances such as carbohydrate, protein, fatty acid to simple compounds like carbon dioxide (Co_2), methane (CH_4), hydrogen sulfide and other trace elements. The process is carried out by strict anaerobic bacteria all of which belong to the phylum Euryarchaeota. ATP synthesis during methanogenesis is based on electron transport linked phosphorylation not substrate linked phosphorylation. In view of the ever-increasing costs and the negative environmental impacts of petroleum-based fuels and enormous amount of sawdust generated yearly in Nigeria. This study was undertaken to assess the suitability of Sawdust, Cow dung and Mixed fruit and vegetable residue as source of energy by determining their chemical properties via proximate analysis carried out at the International Institute of Tropical Agriculture, Ibadan, Oyo state. The aim of this work is geared towards determining the chemical constituents of these substrates and to ascertain its usability in biomethenation, to be added to the substrate biomethane potential (BMP) database of these substrates for referral purposes in scientific findings and research. This is because optimum methanization (biogas production) is only possible with the optimum range of pH, Carbon, Nitrogen, Carbon Nitrogen ratio, ash content, sulfur and others of these factors and macro nutrients.

Keywords: Biomethanation, substrate, physicochemical parameters, Saw dust, Cow dung, mixed fruit & vegetable residues, disparities, proximate.

Introduction
India is found as 4th largest petroleum consuming country with USA preceding (N. Sonnichsen 2021), China and Japan, with high impact on grown economy of 6–8% per year which can create further strong dependency on various type of petroleum products (petrol, kerosene or natural gases) with more environmental causing health problems, risks and challenges like global warming and climate change. Biogas and biomass-based energy (bioethanol and biohydrogen) production can be provided good option for replacing fossil fuel energy via developing and enhancing cost-effectiveness bioprocess for bioenergy opportunity in rural communities worldwide. Third-generation biofuels from microalgae, wood sawdust species can be suitably synthesized with environmental, economic and social benefits for the worldwide population with reflection of high energy efficiency for road map of individual to industry level consumption (R.K Srivastava 2019). Rutiaga-Quinones

described the chemical compositio of six wood species. The result obtained varied from pH (4.5-5.19), Ash (0.08-10.23%) total extractives (6.9-49.5). Dry wood is primarily composed of cellulose, lignin, hemicelluloses, and minor amounts (5–10%) of extraneous substances (Horisawa et al., 1999).

Methodology

Source of Sample

Saw dust,Mixed fruit and vegetable residues samples were collected from the Saw mill located at Tipper garage, federal Housing, airport road, Ahmadu Bello way, Lugbe, Abuja.

Sample collection

Sterile polyethylene bags were used to collect the sample (50kg) and was transported to the International Institute of Tropical Agriculture, Ibadan, Ibadan, Oyo state, Nigeria.

Study Design

For each of the three substrate which include cow dung, mixed fruit and vegetable residue, proximate analysis was carried out. The parameters analysed include Nitrogen, Moisture content, Ash, Organic matter, Carbon, Carbon nitrogen ratio, Calcium, Potassium, Magnesium, Sodium, Manganese, Ion, Copper.

Study Location

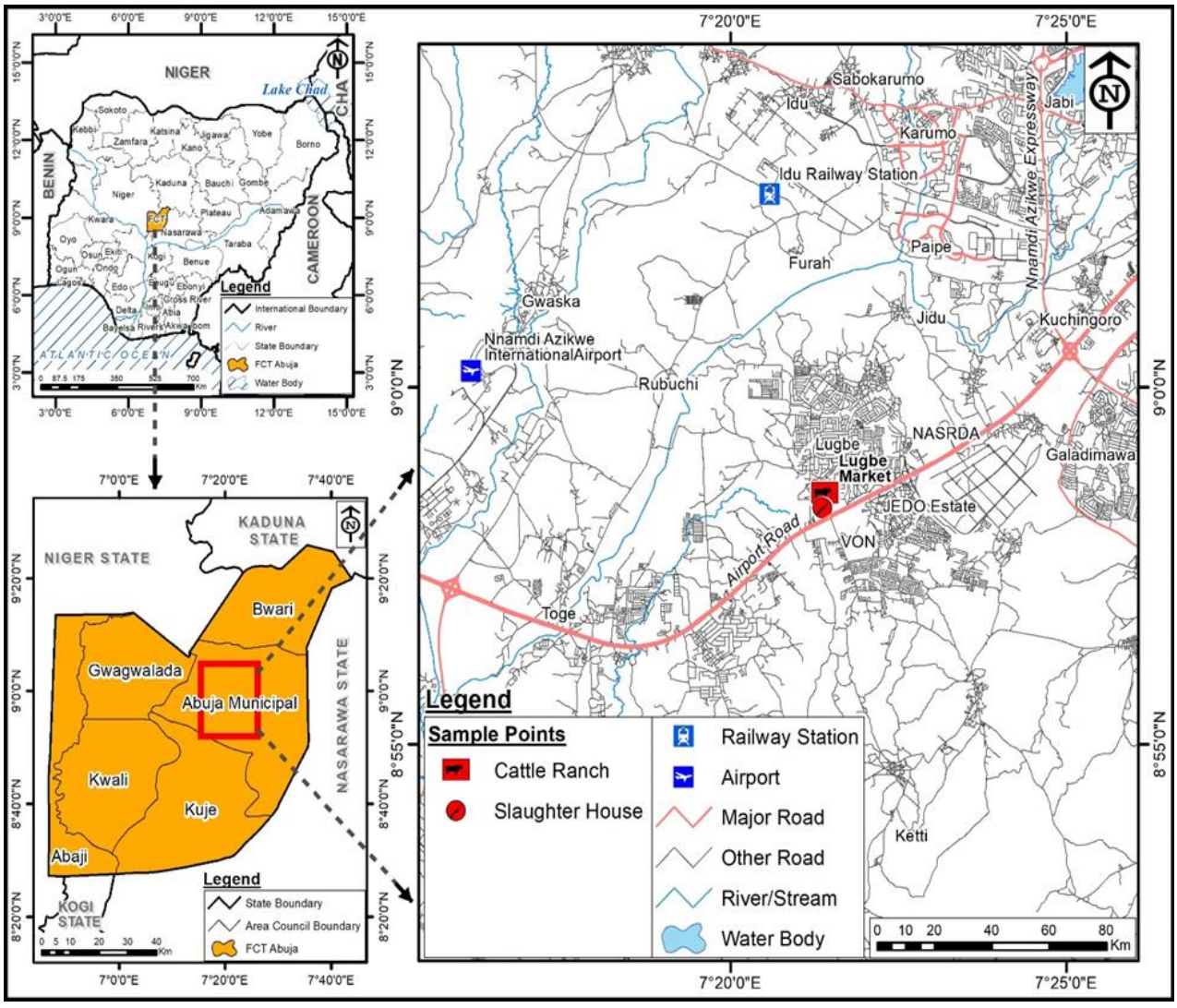

Plate 3.1: Map of Abuja Municipal Area Council showing Sample Points (Cattle Ranch and Slaughter House, Lugbe Market), Abuja. Source: Map Gallery, Geography Department, ABU Zaria.

Results

Lab ID	My ID	N (%)	MC (%)	Ash (%)	OM (%)	(C)LOI (%)	C/N (%)
	SAWDUST	0.2	9.08	2.8	88.10	51.0	0.2:51.1

Table 4.1: Proximate Analysis of Saw Dust from Tipper Garage, Abuja.

KEY:
N = Nitrogen
MC = Moisture content
OM = Organic matter
C (loi) = Carbon (by loss of ignition)

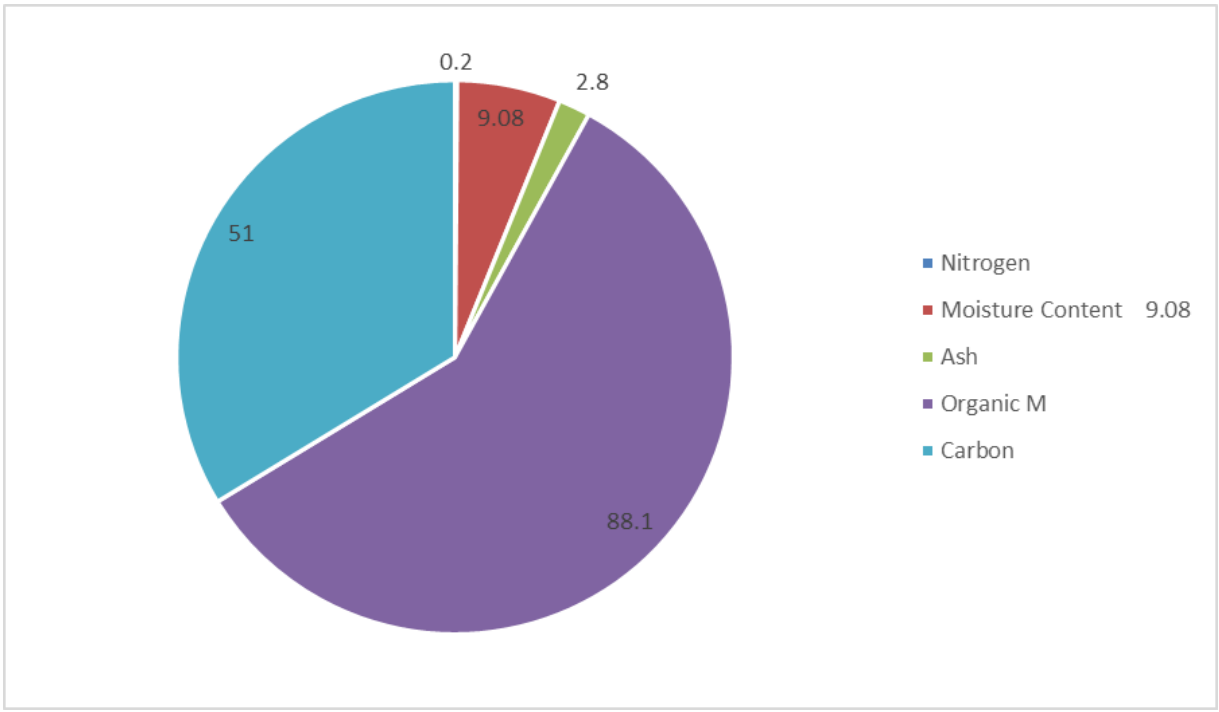

Fig 4.1: Graphical presentation from table 4.1: Proximate Analysis of Sawdust.

	Calcium	Magnesium	Potassium	Sodium	Manganese	Ion	Copper
ID	%	%	%	%	%	%	%
FRUITS	0.77	0.34	2.32	17.36	43.10	77.99	9.80
DUNG	1.02	0.15	0.67	70.80	194.56	198.86	6.49

	Nitrogen	Protein	Phosphorus	Moisture Content	Ash	Fat	Zn
ID	%	%	%	%	%	%	%
FRUITS	3.31	20.69	0.39	5.83	7.91	0.21	35.96
DUNG	1.29	8.04	0.26	3.85	23.54	0.00	23.35

Table 4.2: Proximate analysis of mixed Fruit and Cow Dung.

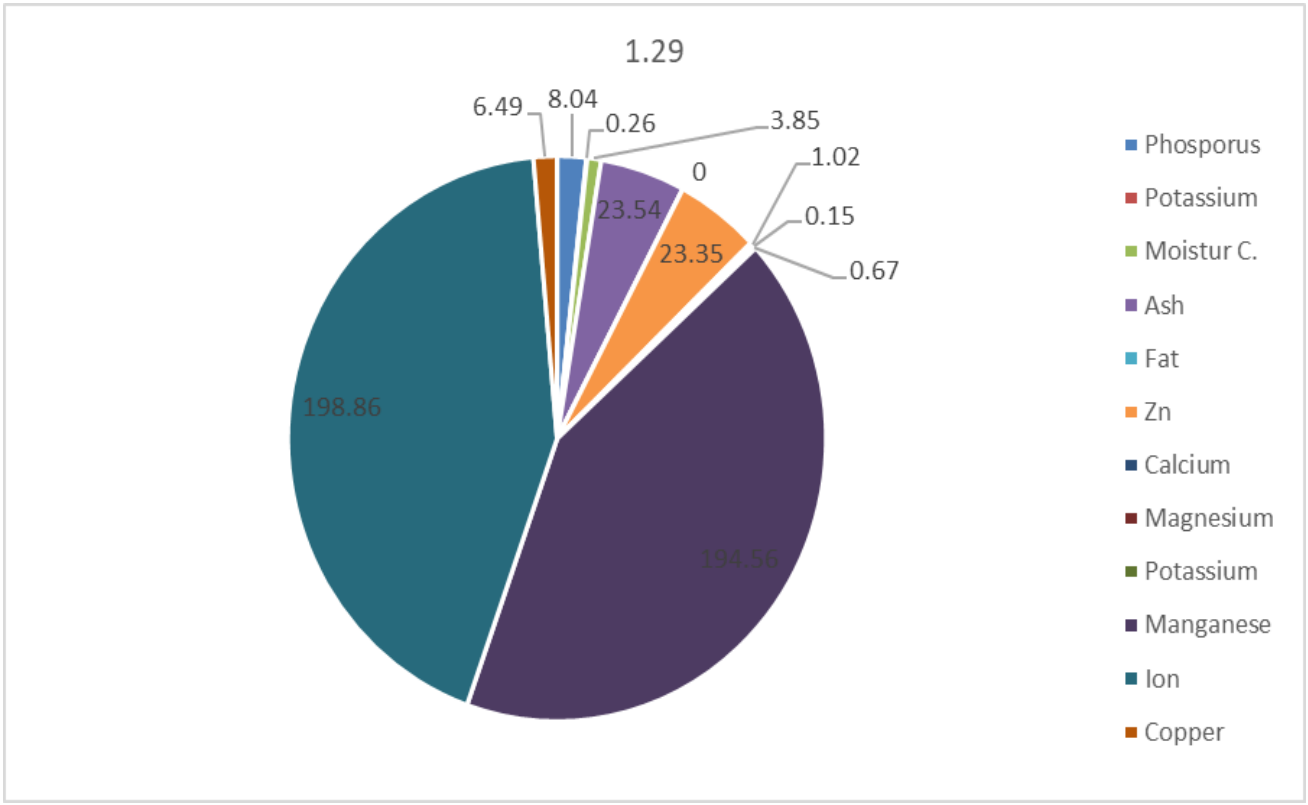

Fig 4.2: Proximate analysis of cow dung from table 4.2 and 4.3.

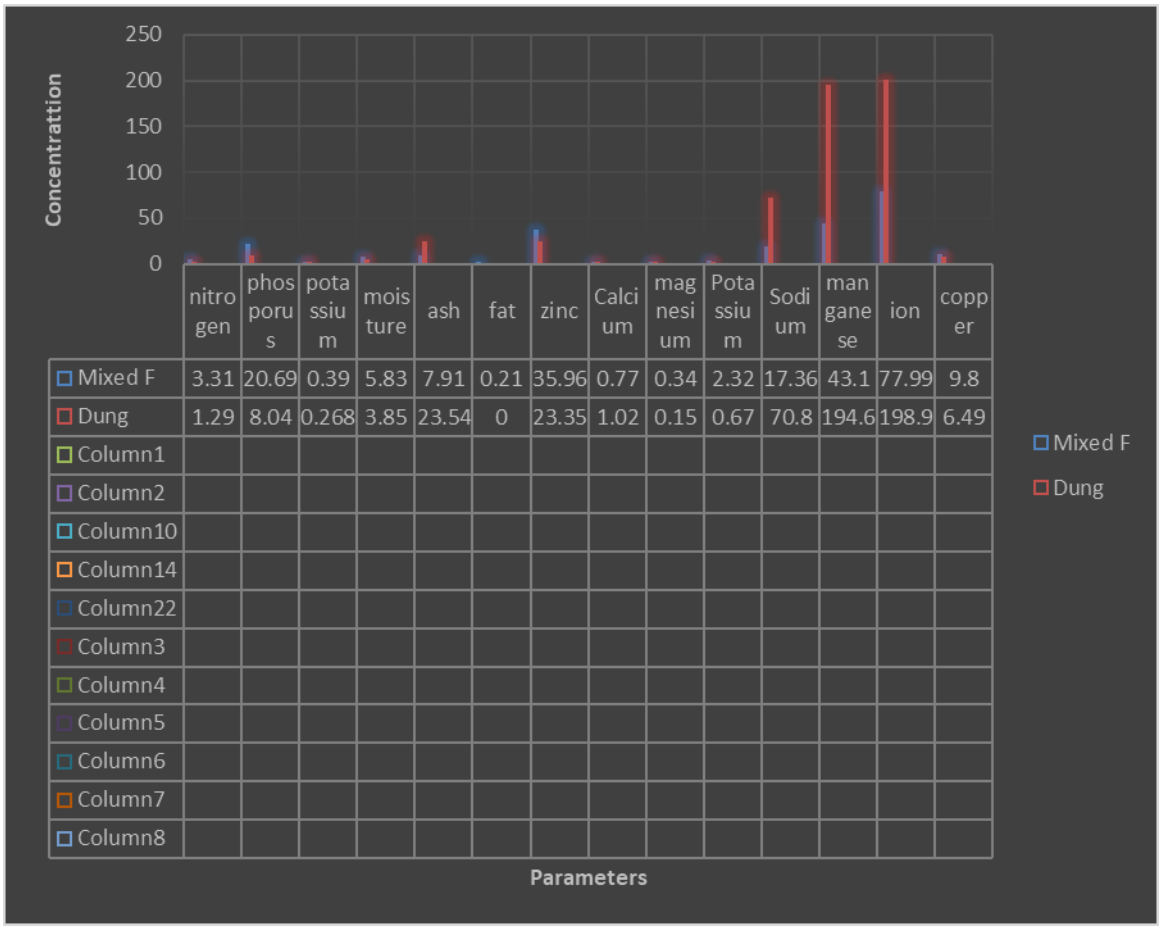

Fig 4.3 Proximate analysis of cow dung and mixed fruit and vegetable residue.

Results and Discussion

The results depict a high concentration of organic matter and carbon in sawdust from Bayelsa as shown in table 4.1 and figure 4.1, the carbon nitrogen ratio was not balanced and did not meet up to the requirement for a stress free methanation process. The required [C:N] ratio for optimum biogas production in organic matter ranges from 20:1 and 30:1. The [C:N] ratio obtained in this work is 50:0.1 which implies that the substrate or wood have a very high concentration of carbon and is deficient in Nitrogen. Therefore, if this wood substrate must be used for biomethenation, nitrogen should be augmented by using supplements rich in nitrogen such as tannery effluent, corn, soya bean milk, ground nut cake, gram flour, ammonium sulfate and urea during pretreatment of substrates, and also, the concentration of carbon must be regulated to meet up with the bio methane potential (BMP) requirement for this substrate. Optimum concentrations of organic matter increase the speed and rate of biomethanation. Cow dung on the other hand had higher concentrations of Sodium (70.8), Manganese (194.56) and Ion (198.86) compared to other parameters while potassium, magnesium, nitrogen, Calcium, Fats and ash were very low in both cow dung and mixed fruits. Potassium triggers the activation of important biochemical enzymes for the activation of Adenosine tryphosphate (ATP), therefore the need for potassium rich supplement while using this substrate cannot be over emphasized. The effects of different potassium and nitrogen pretreatment strategies on the anaerobic digestion (AD) performance of rice straw were investigated by Juan Luo *et al*, 2020. The result showed that potassium hydroxide, ammonia and water combined pretreatment achieved the highest bio methane production. Manganese is a metal essential cofactor for oxygen-evolving complex (OEC) of the polysynthetic machinery, catalyzing the water splitting reaction in photosystem ii (PSII) of the electron transport chain. Since cow dung recorded a high concentration of manganeses, this depicts its suitability in biomethanation on its ability to facilitate the systems of energy pathways in microbial metabolysis. On the same note, Cow dung should be supplemented during methanation with substrate rich in potassium, magnesium, nitrogen, calcium and fats since it has them in low concentrations. A high concentration of manganese and ion was also recorded in cowdung as shown in figure 4.3. This information is very crucial and must be checked for supplementing and optimum performance during biomethanation (Biomethanepottensial)(BMP).

Reference

1. Juan Luo *et al.,* 2020. Effects of different potassium and nitrogen pretreatment strategies on anaerobic digestion performance of rice straw. Department of environmental science and engineering, Beijing University of chemical technology, 15 Beisanhuan East Road, Chaoyang District, Beijing 1000029**. 10**, 25547525556**.**