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Determination of Trace Elements in Organic Manure Derived from Yobe State Municipal Solid Waste

Mustapha Usman Nasir
Department of Chemistry, Yobe State University Damaturu, Nigeria.

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ABSTRACT: The study was carried out to assess the level of trace elements in organic manure collected from five major local government of Yobe State. Potiskum, Gashua, Geidam Damaturu and Nguru were the local government selected in the study. The concentration of Cd, Cr and Pb in all the sampling sites were found to be above the recommended limits sets by Fertilizer Control Order (FCO), while Cu and Zn fells within the recommended limits. The findings of this study proved that the samples used in the study were polluted with Cd, Cr and Pb.

KEYWORDS: Municipal Solid Waste, Trace Elements, Organic Manure.

I. INTRODUCTION

Waste is any unwanted material intentionally thrown away for disposal [1]. However, certain wastes may eventually become resources valuable to others once they are removed from the waste stream [2]. Waste products arise from our ways of life and they are generated at every stage of process of production and development.The knowledge of the sources and types of waste in an area is required in order to design and operate appropriate solid waste management systems [3].Increasing in population, industrialization, urbanization, economic growth and improved standard of living have resulted to an increase in solid waste generation [4]. Management of these huge quantities of municipal solid waste has become a serious concern for government departments, environmental protection agencies, regulatory bodies and the general public at large. Municipal solid waste (MSW) management has become a serious environmental problem and one of the major growing concerns in urban areas all over the world. However, composting technology seems to be an excellent alternative method for managing MSW [5]. If the waste is not managed correctly, the time is not far when our planet will be filled up with the waste [6]. Waste composition is influenced by external factors, such as geographical location, the population's standard of living, energy source, and weather [7].

[8]Solid waste is a by-product of human and animal activities. According to WHO solid waste can be defined as useless, unwanted or discarded materials arising from domestic, trade, commercial, industrial and agricultural as well as from public services.

Municipal solid waste includes wastes generated from residential, commercial, industrial, institutional, construction, demolition, process, and municipal services. Residential Single and multifamily dwellings generate food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods,batteries, oil, tires), and household hazardous wastes [3].

The high rate of urbanisation, the rising standard of living and rapid development accompanied by population growth have resulted in the increased generation of solid waste in urban areas in Nigeria.

[9] saidshortage of organic fertilizers necessitates the use of wastes as unconventional fertilizers in agriculture. Municipal wastes contain great amounts of organic matter placing them among unconventional fertilizers, which can play an essential role in soil humus balance. Composting municipal solid waste is seen as a method of diverting organic waste materials from landfills while creating a product, at a relatively low cost that is suitable for agricultural purposes [10].

In many countries, a significant proportion of municipal waste is not disposed of properly, posing a potential environmental threat due to the presence of pathogens and toxic pollutants [11].

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[12] revealed that dumpsites, especially in most developing countries, comprise a higher proportion (50–90%) of organic materials, however, considerable proportions of plastic, paper, metal rubbish and batteries which are known to be sources of heavy metals which may be hazardous to man and his environment are also present [13].
However, there is concern regarding the presence of organic and inorganic contaminants, visual impurities and pathogens in compost. The primary concern is the presence of toxic heavy metals in the composted manure [14].

Therefore, compost manure quality testing is necessary to determine the quality of the compost in order to protect the environment and humans from any harmful substances it may contain [15]. Quality testing must be carried out on parameters such as heavy metals, maturity, foreign matter and pathogens, physicochemical parameters, etc.

II. STUDY AREA

The study was conducted in Yobe State, Nigeria and the study covers only five (5) out of the seventeen (17) local government of state. Potiskum, Gashua, Geidam, Damaturu and Nguruwere the local government used in the study and they are the major local governments in the State. Yobe State lies around (lat. 10.578-13.377^{0}N; Long. 9.654-12.689^{0}E) and covers about 47,153Km^2. Yobe State has about 2,321,339 million people as of 2006 census [16].

III. SAMPLES COLLECTION

The samples organic manure were collected by systematic random sampling techniques using hand augur technique. the manure samaples were obtained from three different location across the local goverments and the samples were collected in triplicates.

IV. SAMPLE ANALYSIS

The trace metals were analysed with an atomic absorption spectrophotometer (BUCK scientific AAS, Model 210VGP).

V. DATA ANALYSIS

The data obtained from the study were analyzed using Microsoft Excel 2013 and the results obtained were compared with the international standards.

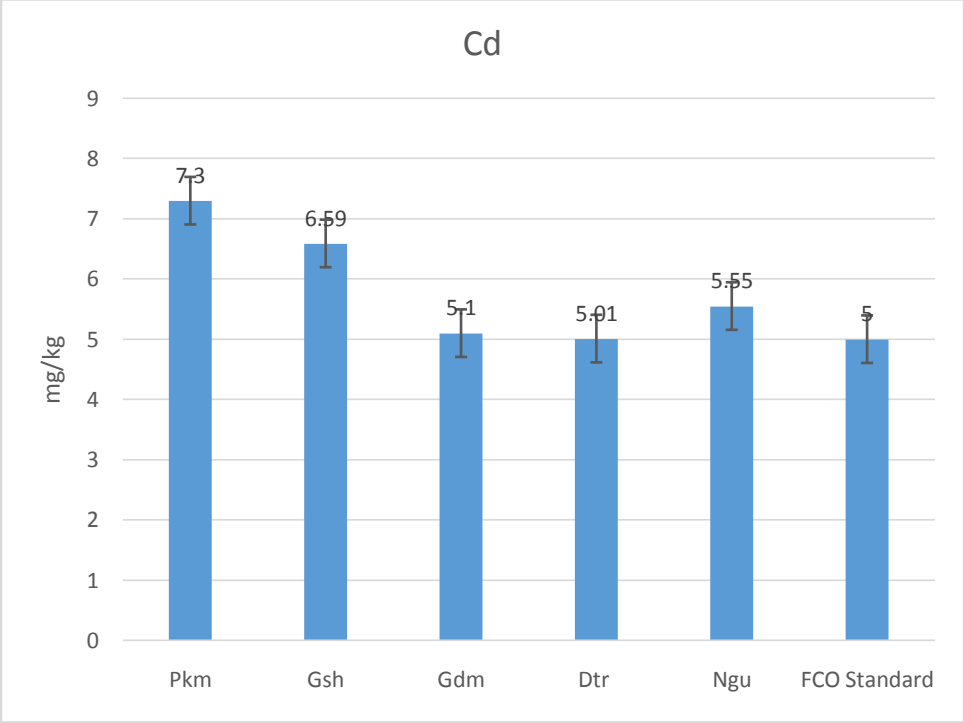

Fig. 1: Cadmium concentrations obtained from the manure samples

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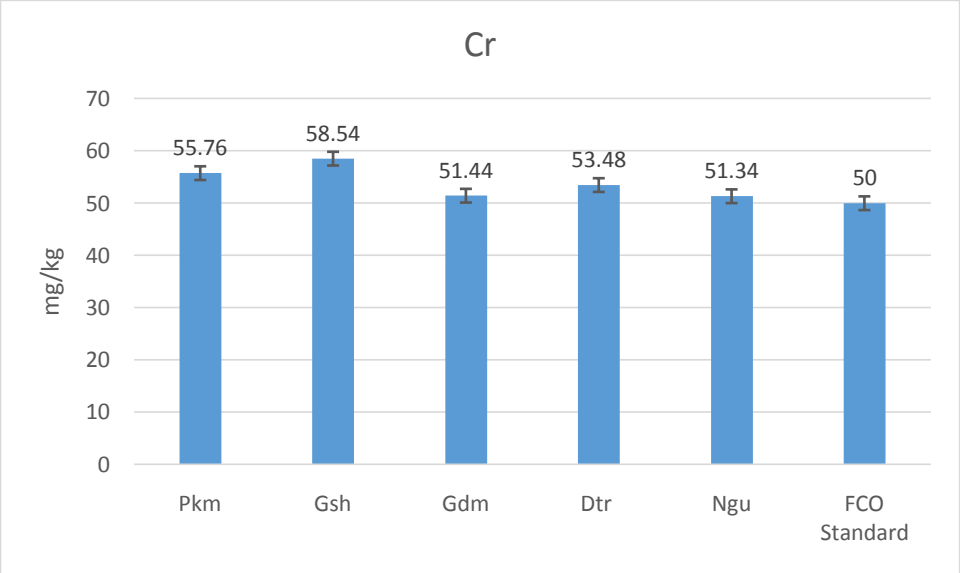

Fig. 2: Chromium concentrations obtained from the manure samples

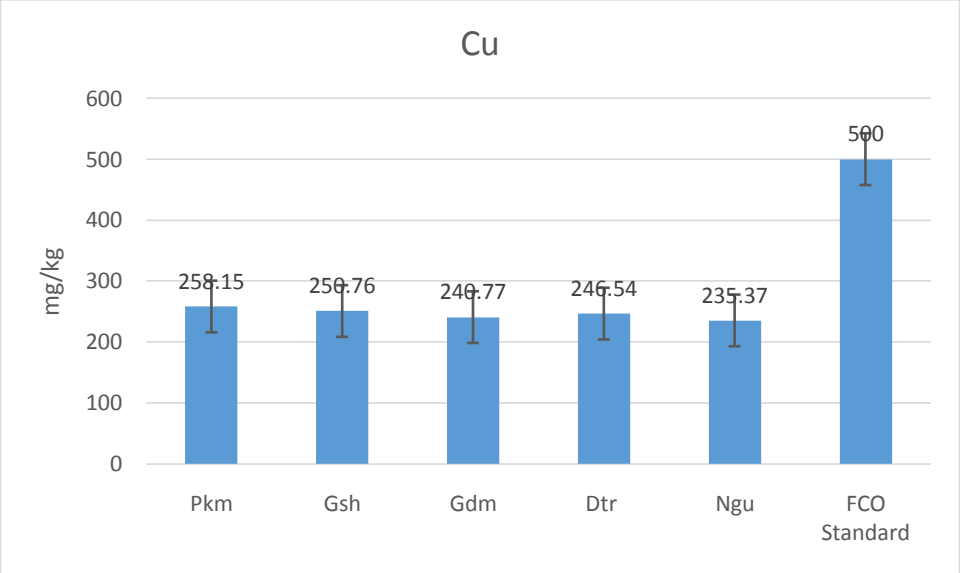

Fig. 3: Copper concentrations obtained from the manure samples

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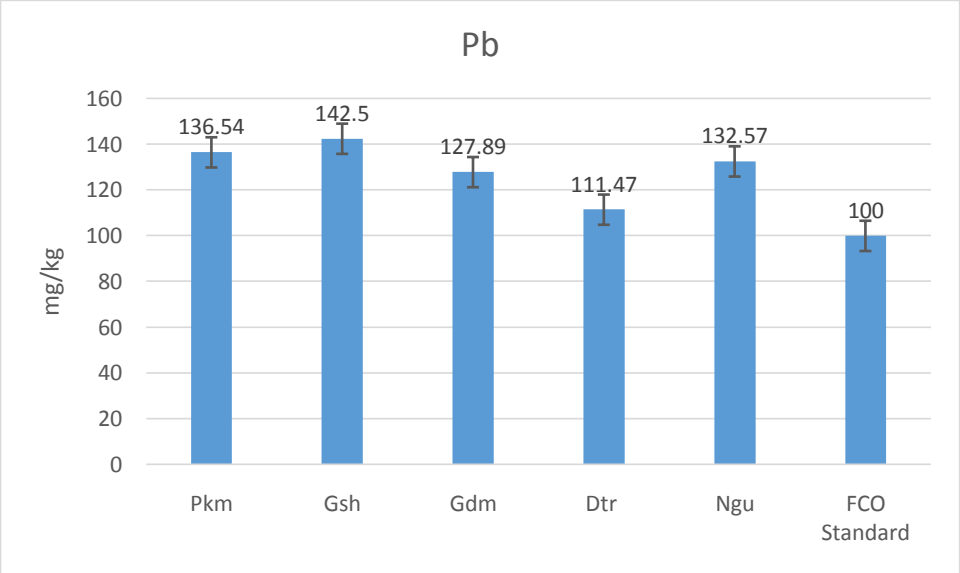

Fig. 4: Lead concentrations obtained from the manure samples

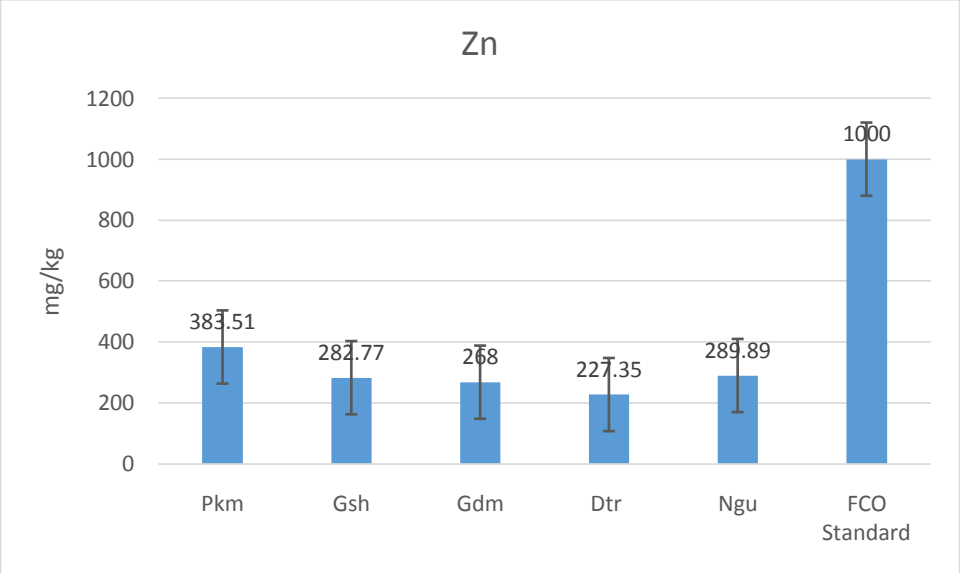

Fig. 5: Zinc concentrations obtained from the manure samples

Figure 1-5 showed the results of trace elements in manure samples. The concentration of cadmium ranges from 5.01 to 7.30 mg/kg. In all manure samples collected, the cadmium level were above the recommended permissible limits of 5.00 mg/kg set by [17]. PKM had the highest value of cadmium concentrationof 7.30 mg/kg and DTR had the lowest of 5.01 mg/kg, while GSH, GDM and NGU had 6.59±0.25, 5.10±0.20 and 5.55±0.30 mg/kg respectively.

The chromium concentration in the manure samples were recorded to be between 58.54±1.30 to 51.34±1.53 mg/kg, with GSH having the highest and NGU having the lowest, GDM had 51.44±2.35, DTR had 53.48±1.26 and PKM had 55.76±2.56 mg/kg. In all the obtained chromium concentrations exceeded the permissible limit of 50 mg/kg set by FCO.

Copper concentration in this study were found to be within the permissible limit recommended byFCO of 300 mg/kg as PKM had the highest value of 258.15±7.53 and NGU obtained the lowestvalue of 235.37±2.84 mg/kg. GSH, GDM and DTR had the concentrations of 250.76±6.10, 240.77±3.74 and 246.54±3.33 mg/kg respectively. The findings of these results is in concordance with that of [4].

All the obtained results from the manure showed that the values of lead were above the FCO standard of 100 mg/kg, with GSH having the highest concentration of 142.50±3.72 and DTR with the lowest concentration of 111.47±2.35 mg/kg, while PKM, GDM and NGU had the values of 136.54±3.62, 127.89±2.68 and 132.57±0.98 mg/kg respectively.

Zinc concentrations ranged from 383.51±3.44 to 227.35±1.35 mg/kg. GSH, GDM and NGU had the concentrations of zinc 282.77±2.55, 268.00±3.45 and 289.89±2.38 mg/kg respectively. Zinc concentration were found to be within the permissible limit set by FCO of 1000 mg/kg.[18]in their research titled Spectral characterization and quality assessment of organic compost for agricultural purposes

VI. CONCLUSIONS

The study was designed to ascertain and compare the levels of some trace elements in organic manure derived from five major towns of Yobe state and that of Fertilizer Control Order (FCO) standard. Five local government were used in the research. The concentrations of Cd, Cr and Pb in samples were tends to be above the recommended level set by FCO while the concentration of Cu and Zn were found within the recommended limit. The results obtained also showed that all the samples collected and tested were polluted by Cd, Cr and Pb. Therefore this research work concludes that farmers should be very careful in using such kind of manures and government should take necessary action in addressing the problem.

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