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QUANTIFICATION OF HEAVY METALS PRESENT IN MINED *TRONA* (POTASH) SOLD IN KURE ULTRA-MODERN MARKET, MINNA

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ABSTRACT

The level of heavy metals concentration in mined *trona* (Potash) sold in Kure Ultra-Modern Market was determined. The heavy Metals such as lead (Pb), zinc (Zn), copper (Cu), Nikel (Ni) and manganese (Mn) were analyzed using Atomic Absorption spectrophotometer. The results shows that the heavy metals concentration in the mineral were in the range of 0.055g/gg/g for Pb, 4.000g/gg/g for Zn, 0.021g/gg/g for Cu, 1.571g/gg/g for Ni, 0.331g/gg/g for Cr, 0.542g/gg/g for Mn and 0.308g/gg/g for Cd. The results further shows that the level of concentrations compared with WHO (2004) IFEPA standard fall below the standards, but there could be bioaccumulation especially Zn and Ni. Therefore it can be concluded that the concentration of the heavy metals are within the acceptable limits set by international organizations.

Keywords: Bioaccumulation, trona, heavy metals, atomic absorption spectrometer.

INTRODUCTION

Trona $Na_3(C0_3).2H_2O$, otherwise known as potash (Kanwa), is a secondary mineral in gossans of metallic ore deposits as weathering product). It occurs in saltpans and dry lakebeds, ascending ground water may have deposited it. This mineral is dark in colour and occurs as aggregates in desert soils. It may be found with other secondary minerals. Kanwa is the local name in Hausa for dry lake salt (Kutshik *et al.*, 2018), also mistakenly referred to as potash, although it has a low potassium concentration compared to sodium. It is found mainly in the northern parts of Nigeria particularly in states like Kano and Borno and other neighbouring countries such as Chad and Niger (Imafidon *et al.*, 2016). Kanwa is widely used in West Africa and particularly in Cameroon, Ghana and Nigeria (Okoye *et al.,* 2016). In the gastro intestinal system, Kanwa is used as an antacid Stomachic for the relief of constipation and flatulence (Kutshik *et al.,* 2018). Kanwa is also a liver stimulant. In the renal system, Kanwa induces alkaline diuresis (i.e. increased urination) and expands blood vessels to enhance renal blood flow. In the respiratory system, Kanwa induces secretion of respiratory mucosa to act as a medicine. Generally, Kanwa induces diaphoresis by dilating blood vessels of the skin with subsequent cooling effect that may feel helpful in febrile situations. In traditional concoctions and for cooking purposes, Kanwa serves as tenderizer, thickener, seasoning, potentiating adjunct and preservative. Ancient Egyptians used Kanwa solutions as preservative in mummification (Kutshik*et al.,* 2018). Nigeria government revitalized concern in the exploration of solid minerals in the past, could perhaps explain the reason for the use of naturally occurring inorganic substances (salts) by the people for various purposes (Imafidon *et al.,* 2016). Kanwa is the second most commonly used salt in Nigeria. In animal tissues, free radicals can damage cells and are believed to accelerate the progression of cancer, cardiovascular disease, and age-related diseases; Kanwa is a high grade form of Bentonite Detox Clay, scientifically termed Calcium Montmorillonite. Chemical Analysis determines Kanwa contains 90 trace minerals in a uniquely balanced proportion, which is healthy for the body. Scientists are now discovering the superior healing properties contained in *Trona* to help fight infections, absorb harmful bacteria, stimulate cellular energy and help reverse bone decay. Kanwa is the next important table salt (Nielsen, 1999). There are basically two varieties of 'Kanwa' that are well known in Nigeria. The first contains sodium carbonate and it is red-white. The other type contains of sodium sulphate, which is whitish. Both varieties contain little or no potassium (Ekanem, 1977). The effects of 'Kanwa' on cooking time was determined by (Uzogara *et al.,*1988) as it is commonly used by most Nigerians in the rural areas for cooking vegetables and legumes. It was observed that it increases the green colour and texture of vegetables as well as reduces the cooking time of legumes. Cowpea which is noted for its prolonged cooking time of 40-65 minutes was reduced to 10-15 minutes when cooked with a high concentration of Kanwa (0.1 – 0.5%). Vadas, 2000, observed that 'Kanwa' can be administered as medicine

for all sorts of illnesses. As medicine, in its grounded form, it is mixed with tobacco and used as snuff. In the Northern part of Nigeria, it is also administered in large doses by the 'Hausa' majority in the form of porridge of guinea-corn and millet in what is popularly called 'Kunun Kanwa'. This is administered to their women immediately after delivery as a medicine to increase the quality and quantity of breast milk (Helleday *et al.,* 2000).

MATERIALS AND METHOD

This paper describes the materials and method used for heavy Metals assessment in mined *Trona* (Kanwa) sold in Kure ultra-modern market Minna. All samples were grinded into powder using pestle and molter. The grounded samples were sieved to remove impurities. The samples were collected into a 30ml plastic vial container, and then taken to laboratory for analysis. 1.0 g of each sample was measured using weighing balance, after that, 1.0 g of each sample was collected into a beaker and digested using HCl (hydrochloric acid). The samples were filtered into a conical flask using a funnel and a filter paper. Distilled water was then added to the filtered solution to increase the volume of the solution. Finally, the samples were analysed using atomic absorption spectrometer (AAS). The sampling procedure described by Nelson (1994) was adapted for the work.

SAMPLE COLLECTION AND SAMPLING SITE

Samples were purchased from Kure ultra-modern market Minna, Niger state (Figure 1). The samples which include Farar Kanwa (white potash), Ngurnu, Jan Kanwa (red potash) were collected and stored in a plastic polythene bag to avoid possible contamination. The samples were labelled; sample 1 (White potash); sample 2 (Ngurnu) and sample 3 (Red potash). All samples were collected in 30ml plastic vial bottle in the same day, and were immediately transported to National Cereals Research Institute, Badeggi for analysis.

RESULTS AND DISCUSSION

The result of Heavy metal content from three varieties of *Trona* analysed using atomic absorption spectrometer (AAS) is presented in Table 1.

Table 1 shows all the results and data obtained from atomic absorption spectrometer analysis. From the table, a graph of concentration against element was plotted for each sample using the data generated from the AAS analysis.

Table 1: Results of Heavy Metal Contents in Different Varieties of *Trona*

	Heavy Metals (µg/g)						
Samples	**Cd**	**Mn**	**Cr**	**Ni**	**Cu**	**Zn**	**Pb**
White Posh	0.028	0.542	0.331	1.571	0.021	4.000	0.055
Ngurnu	0.051	0.449	0.411	2.159	0.022	5.249	0.055
Red Potash	0.308	0.822	0.384	2.394	0.023	6.857	0.056

The table above show the concentration level of Cd, Mn, Cr, Ni, Cu, Zn and Pb from different varieties of *Trona* purchased from Kure ultra-modern Market Minna, Niger State. The level of Zn and Ni were higher when compared to those of Cd, Mn, Cr, Cu and Pb (see tables 2, 3, and 4). The high level of Zn obtain in this study could be primarily attributed to the use of Zn as galvanizing product (i.e. the use of Zn as an additive which might be deposited from the *Trona* ore) or the human activities taking place in the environment. The concentration level of Zn in the *trona* were; 4.00 µg/g in Farar Kanwa (White potash), 5.249 µg/g in Ngurnu, 6.857 µg/g in Jan Kanwa (Red potash). The sequential arrangement of the concentration in ascending order for the various samples *trona* are; Farar Kanwa (White potash) > Ngurnu > Jan Kanwa (Red potash).

The concentration of Cd in the *trona* were; 0.028 µg/g in Farar Kanwa (White potash), 0.051 µg/g in Ngurnu and 0.308 µg/g in Jan Kanwa (Red potash). Thus given an order of Farar Kanwa (White potash) > Ngurnu > Jan Kanwa (Red potash). The concentration of Cr in the *trona* were; 0.331 µg/g in Farar Kanwa (White potash), 0.411 µg/g in Ngurnu, 0.384 µg/g in Jan Kanwa (Red potash). The concentration level of Ni in the *trona* were; 1.571 µg/g in Farar Kanwa (White potash), 2.159 µg/g in Ngurnu and 3.394 µg/g in Jan Kanwa (Red potash), while Cu and Pb have the lowest concentration in this study when compared to other metal analysed. The concentration of Cu was; 0.021 µg/g in Farar Kanwa (White potash), 0.022 µg/g in Ngurnu, 0.023 µg/g in Jan Kanwa (Red potash), while that of Pb are; 0.055 µg/g in Farar Kanwa (White potash), 0.055 µg/g in Ngurnu and 0.056 µg/g in Jan Kanwa (Red potash). The low

concentration of Cu and Pb (particularly Pb) might attributed to the source of the mineral which is in low concentration and the geology of the mined area.

Table 2: Comparison of Mean concentration level obtained in this research compared with International standards

Heavy Metals	Concentration obtained in this research work in (µg/g)	Publish work WHO/FAO (µg/g)
Cd	0.028	60
Mn	0.449	400
Cr	0.331	50
Ni	1.571	6
Cu	0.021	3.0
Zn	4.000	60
Pb	0.055	10

In general, it can be seen from Table 2 that the concentration level obtained in this work is low as compare to international (WHO/FAO) recommend safety limit. Therefore, it indicates that the *Trona's* currently in market consumed by people is within the safe limit.

CONCLUSION

From the results obtained in this study, it can be concluded that the concentrations were found to be high even though not exceeding the permissible limits set by international organisation WHO.The presence of the Metals Pb and Zn in the mineral is dangerous. Since these salts are low when this Metals are consumed by animals. They enter the food chain and become bio-accumulated and later bio-transferred to Human, the ultimate consumers of animals. These Metals could be a threat to human life since *trona* is used locally as an ingredient in preparation of soup, cooking and as an additive in traditional medicine. However, their concentration levels (Pb and Zn, 0.055 µg/g and 4.000 µg/g) falls within the safety limit as proposed by international organisations.

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