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Proximate Analysis Of Metallic Composition Of Different Trona (Kanwa) Types In Use In Northern Nigeria: Implications For Classroom Instruction.

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Abstract
This study assesses the composition of seven trona (Kanwa) types used as food additives and other local practices in northern Nigeria. The study employed Atomic Absorption spectrophotometry to determine the elemental compositions of the tronas. The study established that the various trona contain Sodium, Potassium, Magnesium and calcium in various quantities. Sodium is found to be the predominant. The implication of these variations particularly to classroom instructions is that the salts could have a lot of benefits in the introduction of several concepts regarding the nature of matter; demonstration of the properties of metals; the reactivity of different metal species; rate of reaction; hydrogen gas and Carbon (IV) Oxide gas production; Solubility of gases etc. study concludes that this substances if effectively used could learner participation and influence learner performance. It could also expose the learner on the potentials of the resources around them for educational and economic advancements.

Keywords: *Trona, metallic Composition, Classroom instruction*

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I. Introduction

Trona locally known as '*Kaun*' in *Yoruba* and '*Kanwa*' in *Hausa* or *Akanwu* in *Igbo* (the three major Nigerian languages) is a dried lake salt that is presumed to be mainly hydrated sodium carbonate. They are a local Nigerian name for some Alkali substances used in most or all African societies as food and/or for leather processing. *Kanwa* are a very important substance in use among Nigerians. Studies have shown that it has good effect in enhancement of sexual desire (Rabi'u and Abubakar, 2020); it is used as food additive and is effective in softening food during cooking (Ojo, 2013). It has also been established that they are good for the treatment of various fungal ailments (Nata'ala, Mormoni, Isah, Ibrahim, Zauro, and Halilu 2018)

In Nigeria, the Kanwa exists in about 7 different types. These are *Bakar kanwa* (gray trona), *Jar kanwa* (red trona), *Balma, Ngurnu, Sumbu – sumbu, Mangul and Manda* (Peni, et al. 2023). Although people do not distinguish between them in terms of chemical composition, yet they are used in different ways or as substitutes to one another. Such uses are limited to the kitchen and are seldom brought to the classroom to teach concepts.

Science teaching in developing nations is bedevilled by lack of resources. This forces teachers to adopt methods that encouraged rote learning (Badmus & Omosewo, 2018)! This problem is prominent in all topics in science and science education. By this, students are forced to learn by rote! The basic reason why teachers adopt the method is because the required reagents are not available (Ogbu, 2015). Providing substitute reagent therefore could enhance the students participation (Badmus & Omosewo, 2018). Hence, this study analyses the alkali metal elemental components of the seven different *Kanwa* types and made reference to their implications in the classroom instructions.

Objectives of the Study

i. To determine the metal elemental composition of seven trona (*Kanwa) types used in northern Nigeria;*
ii. To draw the implications of the composition on classroom instruction.

II. Materials And Methods

The chemicals employed in this research work were of analytical grades and purity (98-99.9%). Major equipment's used were flame spectrophotometer and atomic absorption spectrometer (AAS).

Collection and Preparation of Samples

The Kanwa samples were obtained from the Bichi Central market in Kano State Nigeria. They were identified as These are *Bakar kanwa* (gray trona), *Jar kanwa* (red trona), *Balma, Ngurnu, Sumbu – sumbu, Mangul and Manda*.

The samples were digested using concentrated Nitiric acid. 1g of each *Kanwa* type was measured and added into a 100ml beaker. 10ml of the concentrated HNO_3 was added to the beaker. The mixture was heated at 200^oC for 1 hour and was thereafter allowed to cool. On cooling, 50ml of deionised water was added to each sample. The mixture was hence filtered. The filtrate was subjected to Atomic Absorption Spectroscopy (AAS) to determine the elements present in the trona as well as their concentrations. The results of the analysis is as follows.

III. Results

Table 1: Concentrations of the different metals in the seven trona types

Trona type	Analyte	Conc (mg/L)	STDEV (mg/L)	%RSD
Balma	Ca	10.01	0.093	0.93
	K	71.23	0.0876	1.23
	Mg	70.08	0.0202	2.88
	Na	2274	0.472	2.08
Jar Kanwa	Ca	8.869	0.0474	0.53
	K	136.3	0.2531	18.57
	Mg	18.89	0.0664	3.51
	Na	2799	0.354	1.26
Kanwa	Ca	23.59	0.085	0.36
	K	73.37	0.0709	0.97
	Mg	127.1	0.0586	4.61
	Na	780.4	0.3054	3.91
Manda	Ca	107.2	0.857	7.99
	K	74.07	0.1054	1.42
	Mg	330.3	0.0304	1.84
	Na	160.4	0.1365	8.51
Mangul	Ca	24.25	0.231	0.95
	K	138.9	0.1463	10.54
	Mg	82.56	0.0263	3.19
	Na	1885	0.418	2.22
Sumbu - sumbu	Ca	0.274	0.0195	7,13
	K	132.8	0.308	2.23
	Mg	1.731	0.0144	0.83
	Na	1824	0.276	1.52
Ungurnu	Ca	1.746	0.0162	0.93
	K	100.4	0.3018	30.04
	Mg	10.69	0.0214	2.00
	Na	2377	0.241	1.01

Summary of findings

From the result above it could be traced that:

i. The salts contain significant quantities of Sodium, Potassium, Magnesium and Calcium;
ii. All the salts have predominantly Sodium as the major elements except *Manda* that has more Potassium;
iii. Potassium concentrations comes next to sodium in *Balma, Jarkanwa, Mangul* and *Sumbu-sumbu;*
iv. The varying compositions of these elements could affect their reactive behaviour since the component elements reacts differently.

IV. Discussion And Implication To Basic Science Classroom Instruction

The analysis of the seven trona types has proven that the different salts in their crude form have different compositions of the metals Sodium, Potassium, Magnesium and Calcium. The results shows that Sodium is the most prevalent. This finding agrees with that of Saidou, Hamzaoui. and Mnif (2015) who discovered that sodium is more prevalent in most trona (evaporates) from Niger republic. The salts compositions of the other elements varies from one another.

The implication of these variations particularly to classroom instructions is that the salts could have a lot of benefits in the introduction of several concepts regarding the nature of matter. First, the establishment of the metals implies that the materials could be used to demonstrate the properties of metals such as reactivity and Hydrogen gas production.

The variation in composition could be used to show the differences in the reactivity of different metal species. Substances with more Potassium could react faster than others with less potassium. This can be used to explain the effect of concentration as well as the reactivity of substances due to their position on the electrochemical series.

It is a fact than when acids react with metals, they could generate hydrogen gas. However, in this situation that the salt could be a carbonate salt, the gas to be produced could either be hydrogen and/or Carbon (IV) oxide. This possibility of multiple gas production provides with teachers the opportunity to explore whether the gas generated is CO_2 of H_2. The use of appropriate method could show the exact gas generated and that would give a basic science teacher a way to demonstrate the solubility of the gases, test for the CO_2 by passing the gas through lime water.

V. Conclusion

This study assessed the metallic composition Sodium, Potassium, Calcium and magnesium in seven different trona types/samples. The study established that the metals are available in the samples in significant quantities. Although the compositions were determined in two different trona types, they could be used in reactions that does not require analytical grade reagents. The use of these local materials will not only influence learner participation and influence learner performance. It could also expose the learner on the potentials of the resources around them for educational and economic advancements.

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