PHYSICOCHEMICAL AND ELEMENTAL ANALYSIS OF POTASH (MANGUL) SOLD IN DAMATURU SUNDAY MARKET, YOBE STATE.

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ABSTRACT

The term "potash" include various mined and manufactured salts that contain potassium in water soluble form. The physicochemical parameters (solubility, density, pH, moisture content) was conducted using standard procedures and elemental analysis were carried out using Atomic Absorption Spectrometer (AAS), Digital Colorimeter and Flame Photometer. The solubility values for potash is 6.82 mg/L, the density of 2.50 (g/cm^3), the pH of 12.83 and the moisture content for the sample was 3.17mg/L. The sodium content was 32.50±1.62 *g/100g which is higher than all the concentration of the analytes hence, the concentration is within the acceptable permissible limit.The amount of Chloride detected in the sample* 46.04±1.25 *g/100g. Potassium and Sulphate were found to have the concentration of* 14.70±0.73 *g/100g and* 1.95±0.10 *g/100g respectively. The results indicated the presence of Aluminium, Calcium, Magnesium, Iron, and Copper in the potash sample.While Barium, Boron, Cadmium, Nickel, Manganese, Lead, Chromium, Zinc, Arsenic, Selenium and Cobalt were not detected in the potash sample. The result of this study indicates that potash is essential source of elements required for growth and development. Therefore, it is recommended that potash due to its several industrial application can be used in production of material such as glass, soap and ceramics also potash is used as a source of potassium in production of potassium fertilizer which can boost agricultural productions.*

Keywords: *physicochemical, potash, fertilizer, analysis, boost, solubility.*

INTRODUCTION

The term "potash" originally referred to impure form of potassium salt (mostly potassium carbonate, K_2CO_3) that was obtained from wood ashes. Potash composed of 85.4% K_2CO_3, 5% NaCl, 1.5% $MgCl_2$, 2.5% $CaCl_2$, 0.15% H_2O and 5.45% silicate *(Uba et al,, 2016).* Potash has been described as a white crystalline residue that remains after the evaporation of aqueous extract from ashes *(Kevin, 2003).* Potash denotes a variety of mined and manufactured salts, which contain the element potassium in water soluble form such as potassium chloride KCl, potassium oxide K_2O and potassium hydroxide, KOH. The name potash is derives from "Pot – ash", which refers to plant ashes soaked in water in a pot *(Onyegbado et al., 2002).* A number of chemical compounds containing potassium use the word potash in their traditional names this includes potash fertilizer (potassium oxide, K_2O), caustic potash or potash lye (potassium hydroxide, KOH), carbonate of potash, salt of tartar or pearl ash (potassium carbonate, K_2CO_3), chlorate of potash (potassium chloride, $KClO_3$), nitrate of potash or salt peter (potassium nitrate, K_2NO_3) and sulphate of potash (potassium sulphate, K_2SO_4) *(Alawa et al., 2000).*

When potash is dissolve in water only the carbonate and perhaps chlorides and sulphates of alkali metals go into solution including minute fraction of other metals which are not or sparingly soluble. In geological past, large inland seas existed for a time, which were separated from the ocean by straits and bars. These bars hindered or completely halted the influx of salt bearing sea water in the Inland seas evaporate. As a result of the salt concentration of the water increased and dissolved salt crystallized, which where them deposited in the order of their solubility, first rock salt and later potassium and magnesium salt *(Iman et al, 2019).* The geology within the drainage basin impacts chemistry of run off and spring waters and the resulting brine and thus controls which constituent and the ease with which given potash can be extracted as reported by ***(****Kutshik et al, 2006).* Studies have found a positive correlation between potassium, lithium and boron in brines which is probably indicative of their common origin in vocaniclastic terranes that typically are associated with convergent plate boundaries. Elevated levels of magnesium are also typical of many of the closed – basine brines ***(****Babayemi et al, 2010).* The old method of

making potassium carbonate (K_2CO_3) was by collecting or producing wood ash (an occupation carried out by ash burners), leaching the ashes and then evaporating the resulting solution in large iron pots, (*Omotayo at al, 2018)* leaving a white residue called pot ash. The naturally occurring natron mineral varieties usually contain several impurities such as sand, clay, and metals like silicon, calcium, iron, magnesium, aluminium, and titanium (Ibeme,2015).

Potash was one of the most important industrial chemicals. It was refined from the ashes of broadleaved trees and produced primarily in the forested areas of Europe, Russia, and North America. The first U.S. patent of any kind was issued in 1790 to Samuel Hopkins for an improvement "in the making of Pot ash and Pearl ash by a new Apparatus and Process (Robert, 2007). All commercial potash deposits come originally from evaporite deposits and are often buried deep below the earth's surface. Potash ores are typically rich in potassium chloride (KCl), sodium chloride (NaCl) and other salts and clays, and are typically obtained by conventional shaft mining with the extracted ore ground into a powder (Wikipedia, 2007).

Most of the world's potash production is used in agriculture. Over 95% -97% of it is sold to improve the world food, fibre and other from output. Potassium is one of the three major plant nutrients and as such must be added to all intensive farming soils as it becomes depleted. Some potassium-containing minerals such as clay, feldspar, and mica are found naturally in soils and the potassium slowly becomes available with weathering (Birnin-Yauri and Abubakar, 1999*)*. It then goes into solution or is in an ion exchanged with clays or organic matter near the surface and thus not is very mobile; therefore, the placement is important in many soils. Finally, the function of potassium in plant metabolism is different from that of the other major nutrients *(Abubakar and birni, 2009)*. The other nutrients become part of the plant structure, but potassium largely remains as an ion in the cells and sap. The function of potassium is to help control the plant's water intake and metabolism. Potash is as vital to the plant as the other fertilizers and is removed from the soil in the same manner, even though its action in the plant is different. For these reasons fertilization with potash is somewhat more complex than with the other nutrients. Some of the specific effects potash are to increase root growth; improve drought resistance by reducing water loss, wilting, and respiration (maintaining "turgor") and also lower the plant's energy losses *(Kevin, 2003).*

Potash helps form cellulose and reduce lodging, enhances many enzyme actions aids in photosynthesis and food formation, helps in the translation of sugar and starch, helps increase the starch and/or protein content of plant, and helps retard crop diseases. It is sometimes called the "quality" nutrient because of these many beneficial functions *(Van, 2001).*

The major aims and objectives of this work are to determine the essential elements composition in potash and to enlighten the public on its importance. This study will help in knowing the chemical elements and the physical properties of potash. It is important to know the physicochemical and elemental properties of potash since people consumed it every day.

SAMPLES COLLECTION:

Samples Potash were obtained from the Damaturu Sunday Market, Yobe, Nigeria

SAMPLE ANALYSIS:

Atomic absorption spectrophotometer Buck scientific model 210 VGP USA were used to determine the following elements *Aluminum, Zinc, Arsenic, Selenium, Barium, Boron, Cadmium, Nickel, Manganese, Calcium, Magnesium, Lead, Iron, Copper, Cobalt and Chromium.* Flame Photometer: PFP7 Jenway flame Photometer were used for *Sodium and Potassium* while Digital Colorimeter: Lamotte Samrt3 Colorimeter were to determine the presence of *Barium, Chloride and Sulphate.*

DETERMINATION OF SOLUBILITY:

Fifty gram (50 g) of sample was separately added to 100 cm^3 of boiling water and stirred for some time till no more salt can dissolve. The solutions were allowed to cool at room temperature and filtered. 20 cm^3 of the saturated solution of each sample was evaporated to find the amount of salt that is dissolved in it.

DETERMINATION OF DENSITY:

Principle of Archimedes was used. 5 g of dried sample was carefully placed into 10 cm^3 measuring cylinder containing 5 cm^3 of Water and the differences in volume was recorded.

DETERMINATION OF pH:

One gram (1g) of the sample was weighed and dissolved in $10cm^3$ distilled water. The solution was properly mixed to allow complete dissolution and pH meter was used to determine the pH, after proper calibration of the electrode. The result obtained was the average of duplicate determination.

DETERMINATION OF MOISTURE CONTENT:

Moisture content was determined using oven dries method. Four grams (4g) of sample was placed into a weighed petri dish and it was dried in an oven at 105^0C for 4 hours. The weight loss expressed as a percentage was taken as per cent moisture.

RESULTS:

The results of physicochemical parameters and elemental analysis of potash are presented in figures below:

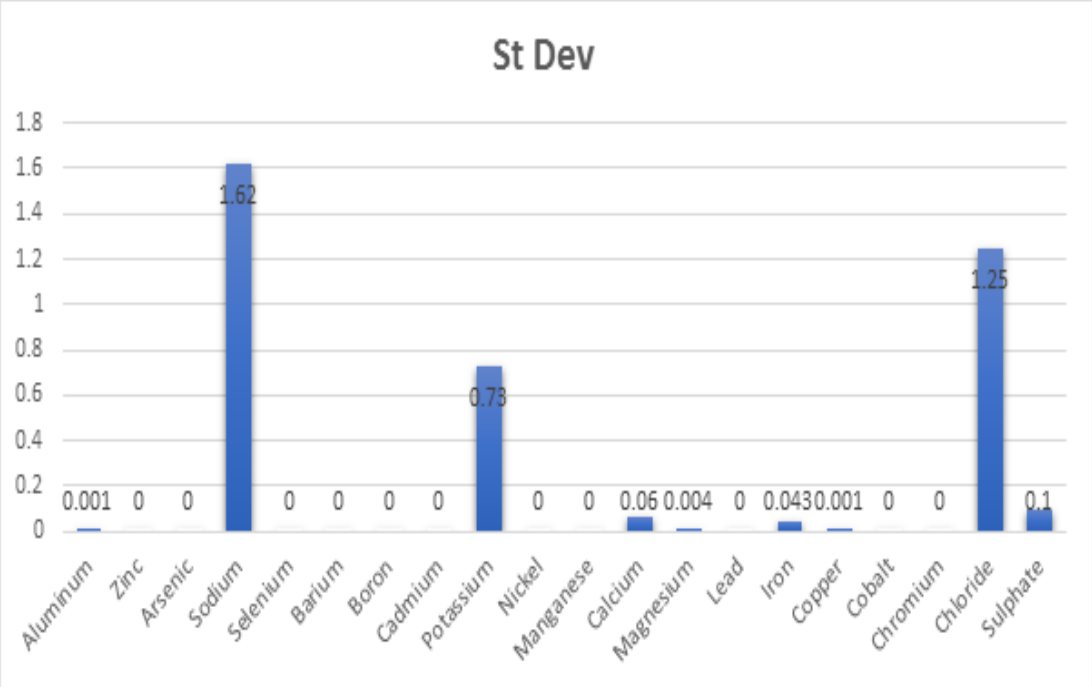

Figure: 1 shows Variation in the concentration of Analyte (g/100g) in the Potash sample

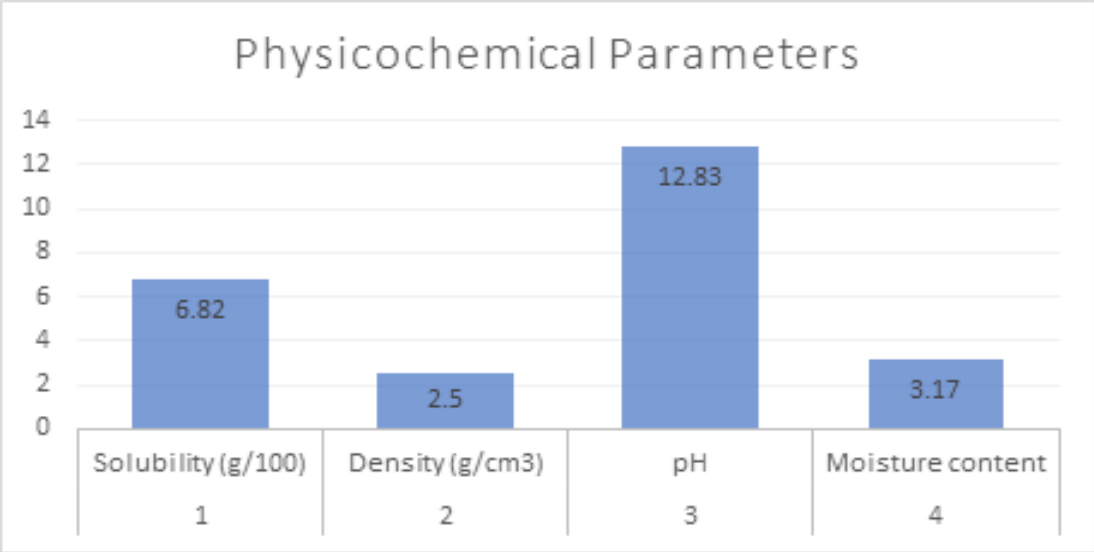

Figure: 2 shows Variation in the physicochemical analysis in the Potash sample

DISCUSSION:

The result from the physicochemical analysis of the sample potash shows the solubility value of the potash was 6.8mg/L in 100g of water. The solubility value may probably be due to the absence of particles with weak intermolecular bonds that can easily be broken by water molecule *(Ferrar and Coleman, 2001)*. The density range 2.50 g/cm^3 for the potash samples. The results obtained indicated the pH of the samples was 12.83 which indicates the sample to be basic in nature. The moisture content for potash was 3.17mg/L and these might be linked to the high percentage of water content absorbing molecules present within the sample *(Nielsin, 2008).*

The results of the analysis were treated using different statistical tools such as the mean and standard deviation to analyse the data. The sodium content was high in the sample which is 32.50±1.62 g/100g which was higher than the other analyte hence, the concentration is within the permissible limit of 100mg/kg. The amount of Chloride detected in the sample 46.04±1.25 g/100g. Potassium and Sulphate were detected in moderate concentration 14.70±0.73 g/100g and 1.95±0.10 g/100g. The results indicated the presence of Aluminium, Calcium, Magnesium, Iron, and Copper in the potash sample. While Barium, Boron, Cadmium, Nickel, Manganese, Lead, Chromium, Zinc, Arsenic, Selenium and Cobalt were not detected in the potash sample. The concentrations of all the

analytes detected in the sample were within the permissible limit. *(WHO and FOA guidelines 2012, 2017)*

CONCLUSION

In conclusion the result of the potash sample employed in this study were shown with acceptable degree of solubility, Density, pH and Moisture content. The samples have the higher Sodium (Na) content which falls within the limit as giving by *(WHO and FOA guidelines 2012, 2017)*. Therefore, potash can serve as a potential source of essential elements required for growth and development.

RECOMMENDATION

Base on the result obtained from the analysis the following recommendations were made;

- The use of potash (mangul) should be in courage due to its high concentration of sodium (Na) which will helps in proper growth, development and human physiology.
- Potash (mangul) should also be used as a source of potassium in manufacturing potassium fertilizer which can boost agricultural production.
- Similar studies of physicochemical and toxicity evaluation should be conducted on other varieties of potash which are sold in our various markets in Yobe State.

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