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Investigation into the Degree of Salinity in Some Rivers in Bayelsa State

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ABSTRACT

This study is an investigation into the degree of salinity of rivers in Bayelsa State. The rivers chosen were Brass, Nembe, Sangana and Ukubie all in Bayelsa State. Rivers samples were collected and their Salinity levels determined using the total dissolved solids methods in which the water samples were evaporated to dryness and the residual salt weighed. Their results in g/l was converted to parts per million (ppm). The result of the analysis showed that Brass river water at 22,000 ppm, Sangana River had a salinity level of 13,700 ppm, Ukubie Creek River had a salinity level of 20,000 ppm and Nembe River 13,000 ppm. The density of the various water samples obtained are given as 1.25g/cm3, 1.28g/cm3, 1.41g/cm3 and 1.45g/cm3 for Nember, Sangana, Ukubie and Brass river water as well as the pH values are within the range of 7.21 to 7.51. The research demonstrates the usefulness of these rivers in the production of local salt within the Niger Delta of Nigeria.

Keywords: Investigation, Degree, Salinity, Some Rivers, Bayelsa State, Nigeria.

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1. INTRODUCTION

Salinity is the measure of all the salts dissolved in water and is usually measured in part per million (ppm) or parts per thousand (ppt). In most researchers conducted, results obtained revealed that high percentages of salt contents are obtained in salt water media; that is, in most cases, 1.0 kilogram (1000grams) of seawater may yield salt concentration of 35grams or less (Ukpaka 2004; Ukpaka & Ikenyiri 2004; Ukpaka, Ogoni & Ikenyiri 2004; Ukpaka, Ogoni & Ikenyiri 2004; Ogoni & Ukpaka 2004; Ukpaka 2004; Ukpaka 2004; Ogoni & Ukpaka 2004; Ukpaka, Ogoni, Amadi & Ikenyiri 2004; Ukpaka, Ogoni & Ben 2005). Investigation conducted revealed that the bottom water always contains more salt than surface waters due to sedimentation processes that has taking in spreading and diffusion of these substance in river. The salt in the ocean is mostly made up of the elements sodium (Na) and chlorine (Cl), and accounts for 85.7% of the total dissolved salt in the ocean.

The other major components of seawater are the presence of some substance such as magnesium (Mg), calcium (Ca), Potassium (K) and sulfate (SO_4) etc. The research carried out revealed that the concentration of chlorine and sodium make up 99.4% of the salt in the ocean. Salinity is the degree of saltiness or dissolved salt content water body of a river. Salinity is an important factor in determining many aspects of the chemistry of natural waters and biological process within it, and its thermodynamic state variable that, alongside with temperature and pressure, which governs the physical characteristics of the system such as: the density and heat capacity of the water; rive ions (Ogoni & Ukpaka 2004; Ukpaka 2004; Ukpaka 2004; Ogoni & Ukpaka 2004; Ukpaka, Ogoni, Amadi & Ikenyiri 2004). Salinity can be expressed in the form of a mass fraction, i.e. the mass of the dissolved material in a unit mass of solution.

Seawater typically has a salinity of around 35g/kg, although lower values are found near coasts where rivers enter the ocean. Rivers and lakes can have a wide range of salinities, from less than 0.01 g/kg (Ukpaka, Ogoni & Ikenyiri 2004) to a few g/kg, although there are many places where higher salinities are found. The Dead Sea has a salinity of more than 200g/kg (Ukpaka, Ogoni & Ikenyiri 2004).

Whatever pore size is used in the definition, the resulting salinity value of a given sample of natural water will not vary by more than a few percent (%).

Salinity is an ecological factor of considerable importance, influencing the types of organisms that live in a body of water. As well, salinity influences the kinds of plants that will grow either in a water body, or on land fed by water (or by a groundwater) (Ukpaka 2005).

Changes in the salinity of the oceans are thought to contribute to global changes in the physicochemical properties of the river as saline waters are less soluble to carbon dioxide. In addition, during glacial periods, the hydrography is such that a possible cause of reduced circulation is the production of stratified oceans. However, too much salt can have a negative impact on the plant's appearance, hydration and growth. Many plants cannot tolerate the presence of saltwater and there are those that can endure the effects of saltwater in their system. Each plant differs in their tolerance level for sodium. Although, they need salt to perform their chemical procedure, too much of it can be fatal to terrestrial plants (Ukpaka, Ogoni & Fetepigi 2005; Ukpaka, Ogoni, Amadi & Njobuenwu 2005; Ukpaka 2005; Ukpaka 2005; Ukpaka 2005; Ukpaka, Ogoni & Ikenyiri 2005; Derrick Njobuenwu, Stephen Amadi & Ukpaka 2005; Ukpaka 2006; Ukpaka 2006; Ukpaka 2006; Ukpaka 2006; Ukpaka & Oboho 2006).

Osmosis is the procedure in which water absorption through semi permeable membrane happens at high concentration levels. Semi permeable membranes pertain to tissues found in the plant roots; from these tissues will be transported to an area with much lower concentration levels. Fresh water, along with vitamins and minerals found in the soil flow freely to the roots and up to the stem, leaves and other parts of the plants distributing the nutrients effectively. When salt is present in the water, it tends to play tug of war with the roots. The roots pull in the available water while the salt pulls out the water. After regular exposure to too much sodium, plants will shrivel and die (Ukpaka, Ogoni & Ujile 2006; Ukpaka 2006; Jacbo, Amadi & Ukpaka 2006; Ukpaka 2007; Ukpaka, Ene & Dune 2007; Ukpaka, Ikenyiri & Adebayo 2007; Ukpaka 2009; Ukpaka 2007; Amadi, Ukpaka & Fakrogha 2007; Amadi & Ukpaka 2007; Amadi, Ukpaka, Akpa & Dune 2007; Ukpaka, Amadi & Akpila 2007; Amadi, Ukpaka & Neeka 2007; Ukpaka, Akpa, Ikenyiri & Farrow 2007; Umesi, Mbah & Ukpaka 2007; Ukpaka, Ogoni, Gumus & Farrow 2008; Ukpaka & Nnadi 2008; Ukpaka, Amadi & Njobuenwu 2008;

Ukpaka 2012; Ukpaka, Amadi & Umesi 2009; Ukpaka, Amadi & Gumus 2009; Ukpaka & Musa 2009; Ukpaka & Umesi 2009; Ukpaka & Nnadi 2009; Ukpaka 2009; Ukpaka, Ogoni, Amadi & Akor 2009; Ukpaka, Abowei & Okerie 2009; Ukpaka 2009; Ukpaka, Nnadi & Umesi 2009; Ukpaka 2009; Ukpaka, Ogoni, Amadi & Akor 2009; Ukpaka, Ogoni, Amadi & Akor 2009; Ukpaka 2009; Ukpaka & Farrow 2009).

While most living things need some salt, too much of it can be toxic. This is true in plants, although some can withstand sodium and are more salt tolerant than others are. Salt is a nutrient that can be absorbed by the plant. When an accumulation of sodium happens, it can severely alter the chemical composition, thus resulting to nutritional imbalance (Ukpaka, Ogoni, Amadi & Akor 2009; Ukpaka 2009; Ukpaka & Farrow 2009; Ukpaka, Amadi & Umesi 2009; Ukpaka 2011; Ukpaka 2011; Ukpaka, Umesi & Gumus 2009; Ukpaka & Amadi 2009; Ukpaka, Eno, Okon & Farrow 2010; Ukpaka 2010; Ukpaka & Davis 2010). When plants are exposed to too much salty water, they have a hard time completing the osmosis process. They spend too much energy playing tug of war with the salt, pulling in as much water as they can. In other words, they have to fight for moisture and because of this, they put in lesser energy into making leaves formation and flowering, which makes them not to produce or grow well.

The study covers the whole of Bayelsa State. The river to be studied will be gotten from any four rivers in Bayelsa State. This study will focus on the measurement and evaluation of the salinity levels of any four rivers in Bayelsa State while outlining their effects on plants, animals and the people living in the communities where the rivers are located.

The general objectives are as follows: to investigate the salinity of four river samples in Bayelsa State, to determine the direct and indirect causes of their salinity, and to evaluate and compare the amount of salt (in parts per million) of the different water samples collected thereby giving a near accurate result on the amount of salt present in the four rivers studied in Bayelsa State.

2. MATERIALS AND METHODS

2.1. Materials

The materials used for this study includes: electric heater, heating bowl, electronic weighing balance and four river water samples

2.2. Method of Sample Collection

1 litre of each of the samples was collected at a distance away from the edge of the river bank to prevent sample contamination by mud and soil residue and to ensure homogeneous samples. The samples were then stored in an air tight container and sent to the separation processes laboratory of the department of Chemical/Petroleum engineering, Niger Delta University, Wilberforce Island, Bayelsa state for salinity determination. The map showing the area where the samples were collected is illustrated in figure 1. The methodology employed in this study is the application of a furnace to heat off the river into dryness. In this method, the river water sample was evaporated at boiling temperature (100°c) to dryness. The residual salt is then weighed and recorded. Samples were dried and recorded in duplicates. The results were a mean of the duplicate measurement.

Sample 1- - Nembe River Water

This water sample was gotten from the river in Nembe Local Government Area of Bayelsa State.

2.3. Determination of Salinity

100ml of the sample was put into the heating bowl and heated with an electric heater at a temperature of 100°c to dryness. The residue was weighed using an electronic weighing balance and recorded. This procedure was run in duplicates and the value gotten was the average weight of the duplicate measurement.

Weight of pan = 65.00g

Weight of sample + pan = 66.30g

Weight of residue = I .30g

Salt content of sample 1 = 1.30g/ 100ml of the water sample.

To determine the approximate amount of salt present in the river water (in parts per million), the following equation was applied:

lg/ ml = 1ppm

1.30g/100ml = 13.00g/l

2.4. Determination of Density

100ml of the sample was put into a beaker and weighed. The density was gotten as the mass of the sample divided by its volume. Readings were done in duplicates.

2.5. Determination of the pH

10ml of the sample was put into a beaker, stirred gently for five minutes and was measured using a pH meter. Reading was done in duplicates.

Sample 2-- Sangana River Water

This water sample where collected in a community known as Santana in Brass local government area of Bayelsa state. 100m1 of the sample was put into the heating bowl and heated with an electric heater at a temperature of 100°c to dryness. The residue was weighed using an electronic weighing balance and recorded. This procedure was run in triplicates and the value gotten was the average weight of the duplicate measurement.

2.6. Determination of Salinity

Weight of pan = 65.00g

Weight of sample + pan = 66.70g

Weight of residue = 1 .70g

Salt content of sample 2 = 1.37g/l00ml of the water sample.

To determine the approximate amount of salt present in the river water (in parts per million), the following equation was applied:

lg/ml = lppm

1.37g/l00ml = 13.70g/l

2.7. Determination of Density

100ml of the sample was put into a beaker and weighed. The density was gotten as the mass of the sample divided by its volume. Readings were done in duplicates.

2.8. Determination of pH

100ml of the sample was put into a beaker, stirred gently for five minutes and was measured using a pH meter. Reading was done in duplicates.

Sample 3- - Ukubie River Water

This water sample where collected from Ukubie community in Brass local government area of Bayelsa State. 100ml of the sample was put into the heating bowl and heated with an electric heater at a temperature of 100°c to dryness. The residue was weighed using an electronic weighing balance and recorded. This procedure was run in triplicates and the value gotten was the average weight of the triplicate measurement.

2.9. Determination of Salinity

Weight of pan = 65.00g

Weight of sample + pan = 67.00g Weight of residue = 2.00g

Salt content of sample3 = 2.00g/l00ml of the water sample.

To determine the approximate amount of salt present in the river water (in parts per million), the following equation was applied:

lg/ ml=1 ppm

2.00g/100ml = 20.00g/l

2.10. Determination of Density

100ml of the sample was put into a beaker and weighed. The density was divided by its volume. Readings were gotten as the mass of the sample divided by its volume. Readings were done in duplicates.

2.11. Determination of pH

100ml of the sample was put into a beaker, stirred gently for five minutes and was measured using a pH meter. Reading was done in duplicates.

Sample 4 --- Brass River Water

The water sample was collected from Ukubie community in Brass local government area in Bayelsa State.

2.12. Determination of Salinity

100ml of sample was put into the heating bowl and heated in an electric heater at a temperature of 100°c to dryness. The residue was weighed using an electronic weighing balance and recorded. This procedure was run in triplicates and the value gotten was the average weight of the triplicate measurement.

Weight of pan = 65.00g

Weight of sample + pan = 67.20g

Weight of residue = 2.20g

Salt content of sample 4 = 2.20g/lml of the water sample.

To determine the approximate amount of salt present in the river water (in parts per million), the following equation was applied:

lg/ ml = lppm

2.20g/l00ml = 22.00g/l

2.13. Determination of Density

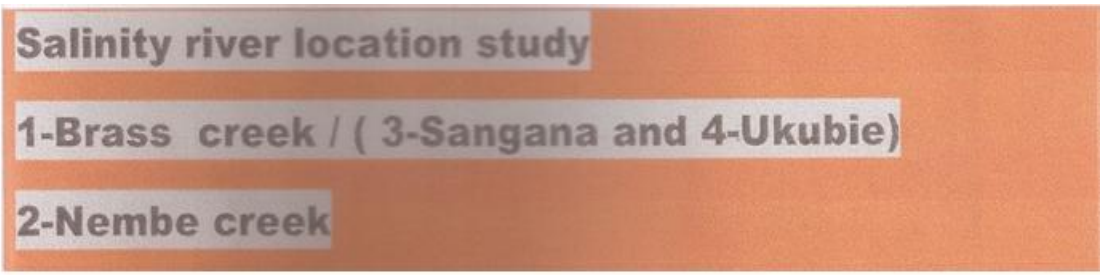
100ml of the sample was put into a beaker and weighed. The density was gotten as the mass of the sample divided by its volume. Readings were done in duplicates.

2.14. Determination of pH

100ml of the sample was put into a beaker, stirred gently for five minutes and was measured using a pH meter. Reading was done in duplicates.

Figure-1. Map Showing the Regions of Sample Collection

Source: (Tamaran, 2015)



Figures-2. Brass Creek River Sample Collected

Source: investigated area (photograph)

Figure-3. Nembe Creek River Sample Collected

Source: investigated area (photograph)

Figure-4. Sangana Creek River Sample Collected

Source: investigated area (photograph)

Figure-5. Ukubie Creek River Sample Collected

Source: investigated area (photograph)

3. RESULTS AND DISCUSSION

The results obtained from the experiment investigation of salinity concentration in for different rivers in Bayelsa State are presented in Tables and Figures. The various salts obtained from the research work are presented in Figure 5 to 10. Figure 11 depicts the equipment used or salt extraction from the various Rivers water samples.

Table-1. Characteristics of River water sampled

Sample	Salinity (g/l)	Salinity (ppm)	Density (g/cm^3)	pH	Colour
Nembe River water	13.00	13,000	1.25	7.21	White in colour
Sangana River water	13.70	13,700	1.28	7.25	Brackish a little
Ukubie River water	20.00	20,000	1.41	7.46	Brackish a little
Brass River water	22.00	22,000	1.45	7.51	Brackish a little

Source: result obtained from the investigation

From the results in the table above, salinity rates between 13,000ppm and 22,000ppm falls within an acceptable range for river waters. Three of the four water samples: Santana, Ukubie, Nembe and Brass- were gotten from the same local government area but different communities. They show a steady increase in salinity levels, density and pH. These salinity levels are relatively low and may have no short term effects on plants and animals alike. However, plants and animals that consume such waters may develop certain ailment in the long run. Density of pure Density levels of the range of 1.25-1.45 (glcm3) for the river water occurs as a result of the dissolved solids and other impurities the river. As a consequence, these rivers have higher densities than that of pure water. pH is the degree of acidity or alkalinity of any substance. pH of pure water tends to be neither acidic nor basic. This therefore means pure water is neutral with a pH of 7.00. pH values of the analyzed river samples show that they are slightly basic. These may be due to the potash and lime present in the rocks of the river beds.

Figure-6. Salt Content Obtained from Brass Resources

Source: result obtained from the investigation (photograph)

Figure-7. Salt Content Obtained from Nembe River Sources

Source: result obtained from the investigation (photograph)

Figure-8. Salt Content Obtained from Sangana River Sources

Source: result obtained from the investigation (photograph)

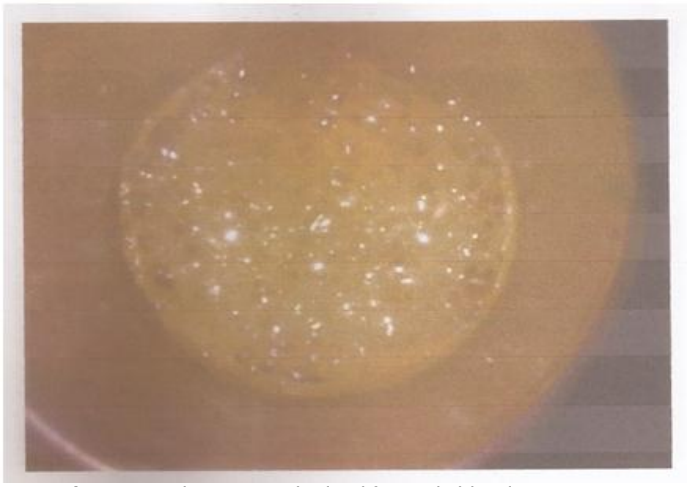


Figure-9. Salt Content Obtained from Ukubie River Sources

Source: result obtained from the investigation (photograph)

Figure-10. Beakers showing the four (4) Salinity Waters

Source: result obtained from the investigation (photograph)

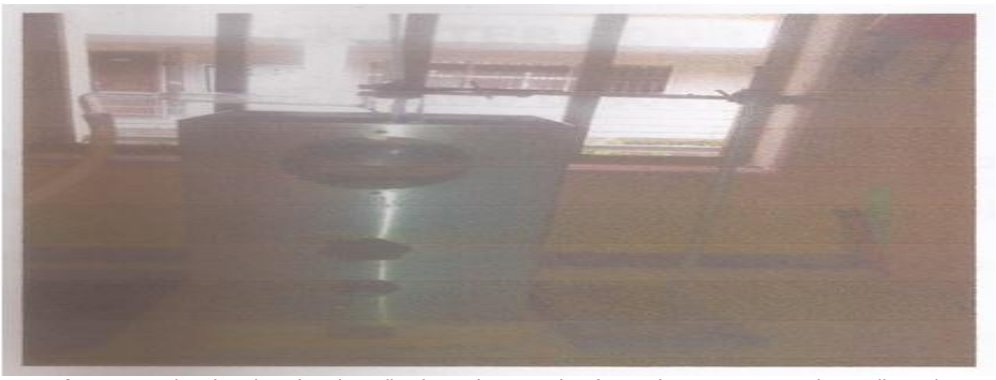


Figure-11. Showing the Electric Boiler for Salt Extraction from River Water Samples Collected

Source: photograph on equipment installed in the Department of Chemical/Petroleum Engineering Laboratory , Niger Delta University, was in carrying out the experimental investigation.

4. CONCLUSION

From the research work, the following conclusion was drawn such as:

1. All the river water samples contain high percentage of salinity, meaning that the NaCl concentration is very high.
2. High increase in salinity influence human health hereby causes disease such as stomach cancer, edema skin disease, blood pressure.
3. Rivers in Bayelsa State there samples are useful in salt production.
4. The separation process requires high energy utilization for effective/efficiency in product quantity.

This study is an investigation into the degree of salinity of rivers in Bayelsa State. The rivers chosen were Brass, Nembe, Sangana and Ukubie all in Bayelsa State. River samples were collected and their Salinity levels determined using the total dissolved solids methods in which the water samples were evaporated to dryness and the residual salt weighed. The result of the analysis showed that Brass river water had the highest salinity levels of 22,000 ppm followed by Ukubie river water at 20,000 ppm. Sangana river water had a salinity level of 13,700 ppm and Nembe River 13,000 ppm. Their densities were slightly higher than that of water owing t the various solids, sediments and impurities present.

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