DETERMINATION OF PHYSICOCHEMICAL PARAMETERS OF DRAIN SEDIMENTS IN OGONI, RIVERS STATE, NIGERIA.

Lucky.G.B.[1] & Akatah, B.M.[2]
[1]Department of Science Laboratory Technology, *Kenule Beesor Saaro Wiwa Polytechnic, Bori, Rivers State, Nigeria*
[21]Department of *Civil Engineering, Kenule Beesor Saaro Wiwa Polytechnic, Bori, Rivers State, Nigeria*
Corresponding Email: lucky.gift@kenpoly.edu.ng

Abstract:
***Background**: This study was designed to investigate the status of drains using drain sediment. Thirty-five drain sediment samples were collected from thirty-five communities across the four local government areas of (Eleme, Tai, Gokana and Khana) in Ogoni land. **Material and Methods:** The samples were evaluated using Glass Electrode for pH, Macro Kjeldahl for Nitrogen, Flame Photometer for Phosphorus and Potassium. **Results:** pH ranged between 7.243 and 8.105, Available Nitrogen (N) ranged from 0.022 to 0.115 mg/kg. Available Phosphorus (P) ranged from 0.227 to 0.377 mg/kg. Available Potassium (K) ranged from 16.440 to 77.447 mg/kg. **Conclusion:** The drain sediments in the study areas are alkaline. The presence of Available Nitrogen, Available phosphorus and Available Potassium in the drain sediment from the study areas indicate that nutrients are leached from surrounding farm lands and run off from the fertilizer plant located in Aleto, Eleme.*

Key Word: Physicochemical Parameters, Drain Sediments, Nutrients, Ogoni

INTRODUCTION

Sediments can be defined as any settle-able particulate material found in storm water or wastewater that are able to form bed deposits in pipes and hydraulic structures [1]. These solids contain a wide range of very small to large particles, i.e. ranging from clays with a mean diameter of 0.0001 to 60 mm gravels and may originate from a variety of sources, such as large fecal and organic matter, atmospheric fall-out and grit from abrasion of road surface, among others. These

particles move in the drainage catchment during storm events and, eventually, enter into the ecosystem [2][3].

Drainage is the natural or artificial removal of a surface's water and sub-surface water from an area with excess of water. The internal drainage of most agricultural soils is good enough to prevent severe water logging (anaerobic conditions that harm root growth), but many soils need artificial drainage to improve production or to manage water supplies.

Nitrogen concentration has an important effect on soil microbial community structure and function with further consequences for ecosystem processes. In the last several decades, human activities of deforestation, fossil fuel and fertilizer uses have affected the nitrogen (N) cycling and changed N deposition rate, resulting in increased emissions of N at least fourfold over the last century. Elevated atmospheric N deposition is generally considered to significantly alter species composition, nutrient imbalance, nitrate leaching, loss of biodiversity [4].

Phosphorus (P) is one of the major macronutrients for plant growth and production. It plays an important role in physiological processes that occur within the developing and maturing plants. It is an essential element for cell division as it is a constituent element of nucleoproteins, carbohydrate synthesis and degradation. The main element involved in energy transfer for cellular metabolism. It is structural component of cell membranes and nucleic acids. After nitrogen, P as a constituent of chemical fertilizers has made substantial contributions to increase yields and food nutrition. Food production has been estimated increase about 30-50% since 1950 as a result of P fertilizers application and the globally consumption of P fertilizers had been estimated more than 30 million tons yearly. Soil is a complex ecosystem. Its maintenance for productivity is very important in order to maintain and stimulate the growth of plants. In fact, P is present in soils in organic or inorganic forms and supplied as a phosphate such as diammonium phosphate $(NH_4)_2HPO_4$ or as calcium dihydrogen phosphate Ca $(H_2PO_4)_2$. The phosphorus content of fertilizer is specified as the amount of P_2O_5 as it is the anhydrous form of phosphoric acid which considered the most concentrated form of phosphate. However, phosphorus in organic form is the most stable form in the soil, whereas the inorganic form, it is stable and readily absorbed and used by plants if it is not fixed. P applied to the plants or soils depends mainly on the available reservation of this element in the soil. Therefore, negative or positive results may be due to the quantity or sources stored in the soil; and also due to its high capacity of soil in absorbing P whereas sometimes it is low in soil so that all used phosphorus fertilizers in soil cannot be available in plants. Therefore, phosphorus exists in soil solution must be continuously decomposed. In most soils, P content is very low in

the surface layer. It represents less than 1% of total P. However, the total P content of any soil may vary widely and depend on some factors such as organic matter content, climatic conditions, parent materials and degree of fertilization. Over 80% of P becomes immobile and unavailable for plants uptake because of adsorption, fixation, conversion of P to organic form and precipitation, inorganic forms of P are usually existing in virgin soils which are derived from the parent rocks, inorganic P form can be converted to organic form by soil age, microbial populations animals and plants [5].

Soil potassium (K) directly affects crop yield since K is responsible for the maintenance of osmotic pressure and cell size, which in turn influences photosynthesis and the energy production along with stomatal opening and carbon dioxide supply. Except nitrogen, K is a mineral nutrient plant require in largest amounts. Potassium is assimilated in relatively large quantities by the growing crop as the yield and quality are closely related to soil K. Plants require soil K for ATP production, translocation of sugars, starch production in grains, nitrogen fixation in legumes and protein synthesis. The concentration and availability of K in the soil is primarily controlled by inorganic processes. Though K does not pose the potential environmental concerns that nitrogen and phosphorus do, an understanding of K cycling and availability is important for the management of profitable long-term cropping systems. Soil K has, however, not been given much attention by researchers as it deserves in the tropics.

Forms of soil K

Based on availability to plants, K can be categorized into three major forms:

i) Relatively unavailable K; this is contained within the crystalline structure of micas, feldspars and clay minerals. Plants cannot use the K in these insoluble forms and therefore mineral weathering must take place. Because feldspars and micas are resistant to weathering they release only small quantities of K during a single cropping season.

ii) Slowly available (fixed) K; this form of K is trapped between the layers or plates of certain kinds of clay minerals as illite, vermiculite and chlorite. Potassium held in this manner cannot be used much by plants during a single growing season. However, the supply of fixed K largely determines the soil's ability to supply K over extended periods of time.

iii) Readily available K; is that which is dissolved in soil water or held on the surface of clay particles. Plants absorb dissolved K readily, and as soon as the concentration in the soil solution drops, more is released into the solution from the exchangeable forms. Potassium in the soil solution, which represents a very small fraction of total soil K, is an important indicator of K availability [6].

I. STUDY SITE

The Ogonis settles on this territory as farmers and fishermen before the British colonialists invaded them in 1901. The Ogoni ethnic minorities are made up of six clans, which comprises of four local government areas known as: Eleme (Eleme Local Government Area), Tai (Tai Local Government Area), Gokana (Gokana Local Government Area), Babbe, Ken-khana and Nyokhana (Khana Local Government Area), and Bori as the traditional headquater [7].

Codes
Bodo = Bd

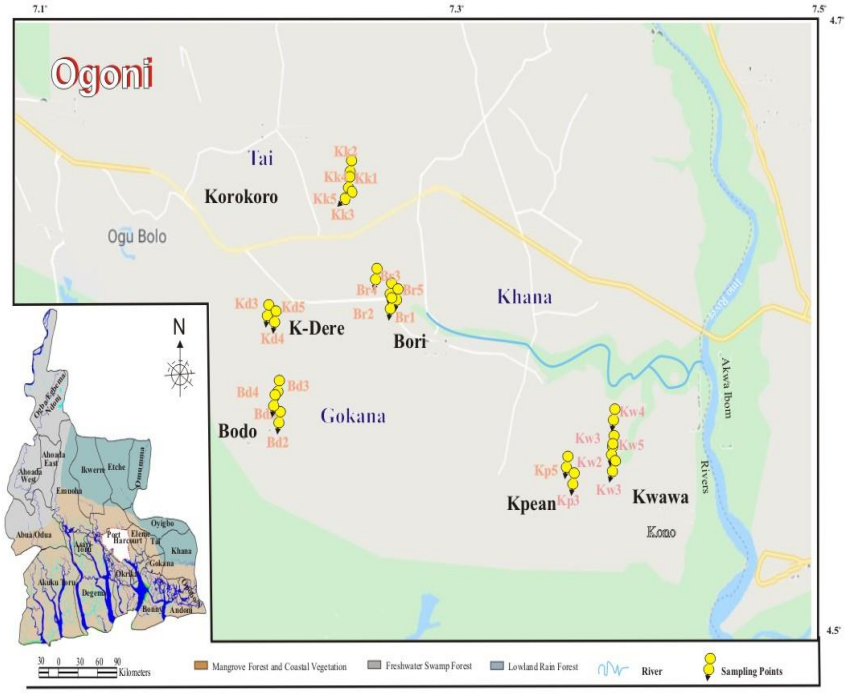
Bori = Br

K-dere = Kd

Kpean = Kp

Korokoro = Kk

Kwawa = Kw



II. SAMPLE COLLECTION AND PRE-TREATMENT

Composite Samples from drains were collected from thirty-five (35) communities from the above Local Government Areas, given a total of thirty-five (35) samples. The samples were air dried, sieved, weighed and stored in clean sample containers in the laboratories.

III. SAMPLE ANALYSIS AND METHODS

pH

For the measurement of pH, 1.0g of the dust sample was weighed with analytical balance, 100ml distilled water was added and stirred for homogenation.
Thereafter the pH metre was calibrated and the pH electrode inserted into the solutions and the pH value was read and recorded [8].

Available Phosphorus

Bray No. 1 method, as modified by [9] was used in the extracting solution was added. The percentage transmittance was measured at 660nm wavelength. The optical density of standard solutions was placed against the concentration P and the content of the extractable P in soil was obtained from the calibration curve.

Available Potassium

To 5g of the soil sample, 30ml of 1M ammonium acetate (NH_4OAC) solution was added and shaken for two hours on a mechanical shaker as previously reported [10]. Potassium concentration was determined using a flame photometer.

Available Nitrogen

Total nitrogen concentration was determined using the regular Macro-Kjeldahl. 5g sample was digested and distilled. The distillate was titrated with 0.01M standard sulphuric acid. The percent total nitrogen was then determined by calculation [11].

IV. RESULTS AND DISCUSSION

pH

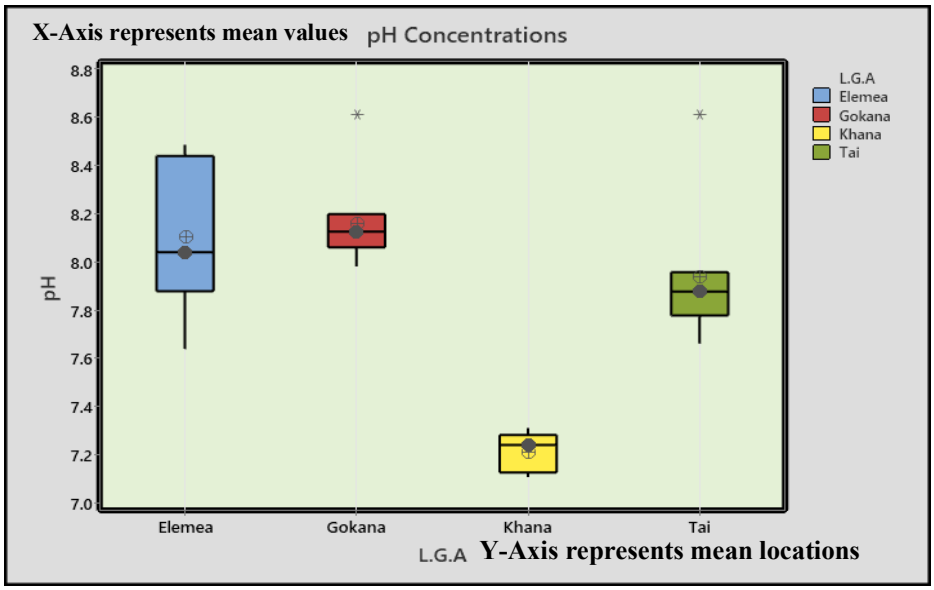
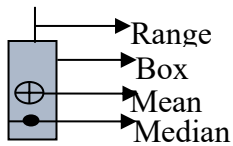


Figure 2 shows that Eleme Local Government had the highest pH concentration of 8.105 ± 0.209, Gokana Local Government 8.162 ± 0.129, Tami Local Government 7.941 ± 0.092 and Khana Local Government 7.243 ± 0.092.



Available Nitrogen (N)

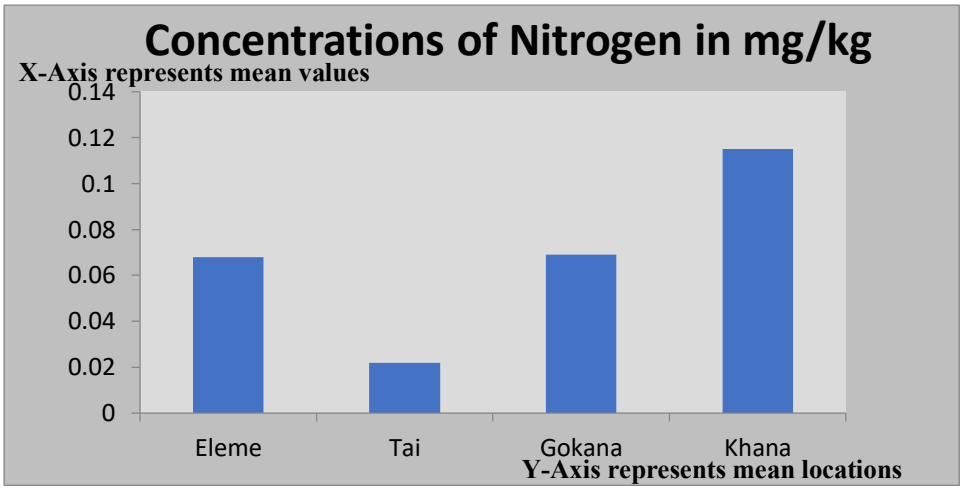


Figure 3 shows that Khana Local Government had the highest Nitrogen concentration of 0.115 mg/kg ± 0.005 mg/kg, Gokana Local Government 0.069 mg/kg ± 0.0.006 mg/kg, Eleme Local Government 0.068 mg/kg ± 0.0001 mg/kg and Tai Local Government 0.022 mg/kg ± 0.001mg/kg.

Available Phosphorus (P)

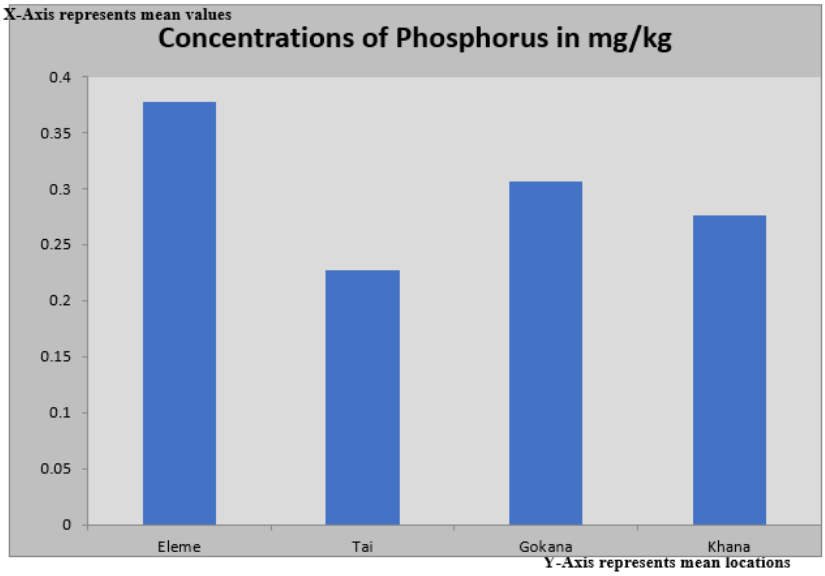


Figure 4 indicated that Eleme Local Government had the highest Phosphorus concentration value
of 0.377 mg/kg ± 0.005 mg/kg, Gokana Local Government 0.306 mg/kg

± 0.005 mg/kg, Khana Local Government 0.276 mg/kg ± 0.004 mg/kg and Tai Local Government 0.227 mg/kg ± 0.005 mg/kg.

Available Potassium (K)

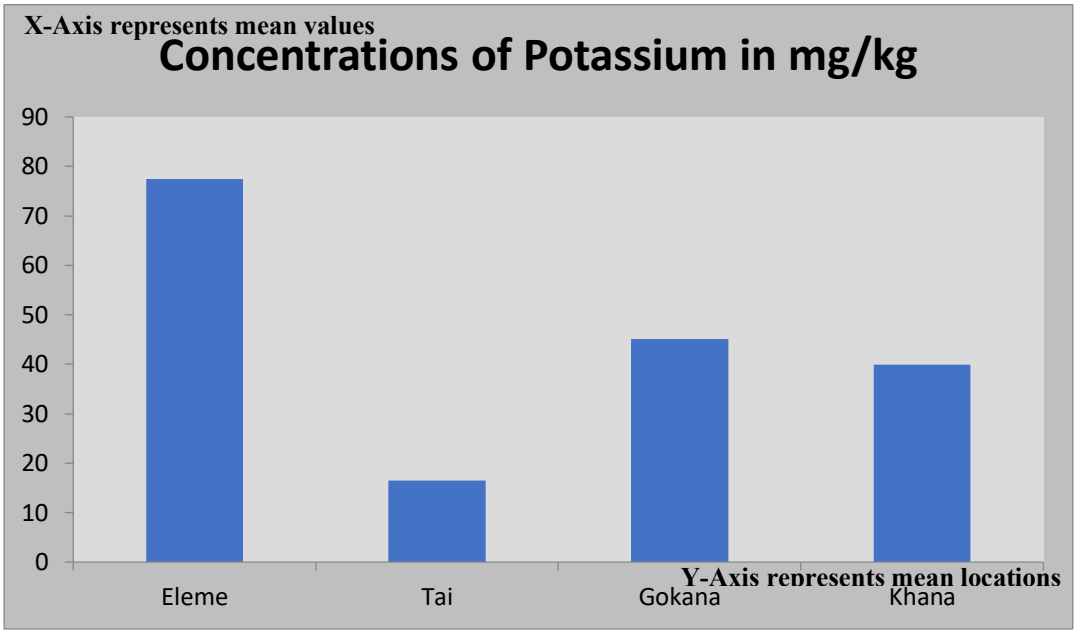


Figure 5 indicated that Eleme Local Government had the highest Phosphorus concentration value of 77.447 mg/kg ± 0.005 mg/kg, Gokana Local Government 45.066 mg/kg ± 0.004 mg/kg, Khana Local Government 39.893 mg/kg ± 0.079 mg/kg and Tai Local Government 16.440 mg/kg ± 0.636 mg/kg.

CONCLUSION

The drain sediments in the study areas are alkaline.

The presence of Available Nitrogen, Available phosphorus and Available Potassium in the drain sediment from the study areas indicate that nutrients are leached from surrounding farm lands and run off from the fertilizer plant located in Aleto, Eleme.

RECOMMENDATIONS

Ministry of Environment and other Agencies involved in the on-going clean-up exercise in Ogoni should consider the built or residential environment also and not just their farm lands, rivers etc. Local population or the people should be enlightened about these findings and encouraged to engage in regular cleaning of homes to reduce possible exposure to indoor dust.

References

[1]. Ackers, G., Dorsch, T., and Kusel, K. (2000). Clostridium scatologenes strain SL1 isolated as an acetogenic bacterium from acid sediments. *Microbiologyresearch.org.* 50 (2), 537-546.

[2]. Blackburn, W.H., Dennen, W.H. (1988). Principles of Mineralogy. (1st edition), Wm.C. Brown Publishers, ISBN 069715078X, Dubuque, Iowa.

[3]. Ashley, G.M., Maitina, J.M., Muasya, M.A., Richard, B.O., Driese, S.G., and Hover, V.C. (2004). Sedimentation and recent history of a freshwater wetland in a semi-arid environment: Loboi Swamp, Kenya, East Africa. *Sedimentology* 51 (6), 1301-1321.

[4]. Ashley, G.M., Maitina, J.M., Muasya, M.A., Richard, B.O., Driese, S.G., and Hover, V.C. (2004). Sedimentation and recent history of a freshwater wetland in a semi-arid environment: Loboi Swamp, Kenya, East Africa. *Sedimentology* 51 (6), 1301-1321.

[5]. Mansour, A. S., Latif, A. A., Zaho, S. M. E. and Abdullah, I. N. (2014). A Case Study of the Total and Available Phosphorus Concentration in Libyan Agricultural Soils in Different Depths and Seasons in Long-term Chemical and Animal Manure Fertilization. *International Joburnal of Research Studies in Biosciences (IJRSB)*. 2(2) 1-9.

[6]. Victor Afari-Sefa, P. K. K., Daniel, O-A., and Nyamiah, M. (2004). POTASSIUM AVAILABILITY IN SOILS – FORMS AND SPATIAL DISTRIBUTION. *Research gate*, 1-18.

[7]. Amanyie, V. The Agony of the Ogoni in the Niger Delta. PH, *Horizon concept* 2001;18, 19.

[8]. Loganathan, G. V. and Delleur, J. W. (1984). Effects of Urbanization on Frequencies of Overflows and pollutant Loadings from Storm Sewer Overlows: A Derived distribution approach. *Water Resources Research. 20 (7) 857-865.*

[9]. Oslen, S. R. and Sommers, L. E. (1982). Phosphorus. Method of soil analysis part 2, Chemical and Microbiological properties, American Society of Agronomy, Soil Science Society of America. Madison, 403-430.

[10]. Knudsen, T. and Geiker, M. (1982). Chemical shrinkage of Portland cement pastes. *Cement and Concrete Research. 12 (5): 603-610.*

[11]. Loganathan, G. V. and Delleur, J. W. (1984). Effects of Urbanization on Frequencies of Overflows and pollutant Loadings from Storm Sewer Overlows: A Derived distribution approach. *Water Resources Research. 20 (7) 857-865.*