ASSESSMENT OF CASSAVA WASTEWATER ON GEOTECHNICAL PROPERTIES OF A LATERITIC SOIL

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ABSTRACT

Assessment of cassava waste water as effluent on the geotechnical properties of lateritic soil form along Falegan in Ado-Ekiti, Southwestern Nigeria was investigated. Soil samples were collected and laboratory soil tests were carried out on the contaminated and non contaminated samples as control. Grain Size Distribution analysis, Atterberg Limits, Compaction Test and California Bearing Ratio in accordance with Standard Methods, after the soil was contaminated with cassava water and left for 7 days for saturation. The result indicates that cassava wastewater affects geochemical properties of the soil especially Atterberg Limits with the value of Plastic Index less than 10%, thereby renders the contaminated soil unfit as sub-grade, sub-base and base materials.

Keywords: *Cassava waste water, Lateritic soil, Contamination.*

1.0 INTRODUCTION

Soil is a natural gift of nature, consisting different layers (soils horizon) of materials constituents of variables thickness which is different from the parent materials in their morphological, chemical and mineralogical characteristics. Laterites are constituents of the soil rich in iron, aluminium, quartz, kaolinite, found in hot and wet tropical areas which are derived from a wide variety of rocks, weathering under strongly oxidizing and leaching conditions. (Gidigasu, 1973 and 1976)

Most of lateritic soil falls within the A-2, A-6, and A-7 groups of American Association of State Highway and Transportation officials, AASHTO (1986) classification. Adebisi et al (2013) observed that the Engineering formations of lateritic soil are controlled by clay-sized particles or clay soil. In the filed of Civil Engineering nearly all projects are built unto or into the ground whether the project is a structural, roadway, a tunnel or a bridge, the type and nature of the soil at that location is of great importance. Soil contamination is one of the largest environmental challenges facing developing country like Nigeria. It is a problem because of sustainable eco-system in which soil is a contributing agent.

Soil contamination is composed of either solid or liquid hazardous substances mixed with the naturally occurring soil. Usually contamination in the soil is physically or chemically attached to soil particles or if they are attached, are trapped in the small spaces between soil particles.

In Nigeria, different researchers like Agbede (1992), Agbede and Osuolale, 2005, Bello 2007, Bello and Adegoke 2010 have worked on geotechnical properties of soil in different part of the country. Hence, there is need to evaluate the effect of cassava waste water on the geotechnical properties of soil. The result generated will contribute to the understanding and identifying the effect of cassava waste water on the geotechnical properties of lateritic soil.

2.0 METHODOLOGY

The soil samples were collected and subjected to various tests; these samples were collected along Falegan in Ado-Ekiti in Ekiti-State which lies within the geographical coordinate of $29^{0}59^{I}59{\cdot}9^{II}$N and $30^{0}0^{I}0^{II}$E. Geologically, the study area falls within the basement complex of South-Western Nigeria which consists predominantly of magmatised and undifferentiated gneisses and quartisite (Akintola 1982 and Areola, 1982, Bello and Adegoke 2010)

The samples were taken to the laboratory when the deleterious materials such as roots were removed. The samples were air dried, broken down with mortal and pestles. Fresh cassava water was collected at cassava processing site at Aisegba-Ekiti. The cassava water was used to contaminate the sample by pouring 7 liters on it, which is then allowed to soak for a period of seven days. The contaminated sample was sundried and passed through a set of sieve

All test specimens started as possible after the completion of identification. All tests were performed according to standard methods contained in BS 1377. The tests carried out on the selected samples for classification purposes are Particles Size Distribution, Atterberg Limits, and Compaction Test. The classification for the soil samples is in accordance with AASHTO (1986)

3.0 RESULT AND DISCUSSION

The summary of result of test performed on the soil samples is presented on Table 1 and 2. It indicated that the percentage of soil sample passing through BS sieve(No 9.5mm to O.075mm) for uncontaminated soil and contaminated soil is 27.94 and 52.5. Hence, it can be deduced that the soil sample for contaminated soil is coarse grain soil according to USC system.

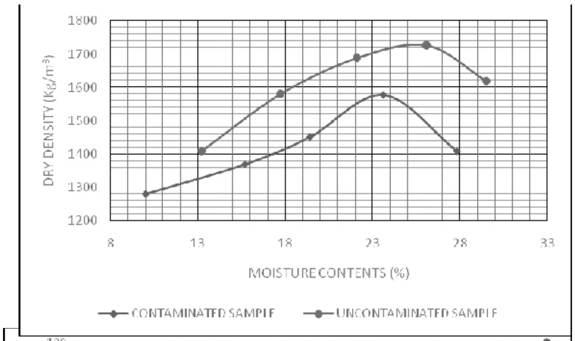
The liquid limit for uncontaminated and contaminated soil samples was between 24% and 18.2%, plastic limit 17.5% and 8.45, plasticity index between 6.5% and 9.8%. The soil samples fall within this specification except plasticity index for contaminated soil which is 9.8% and is less than 10% maximum recommended. This shows that contamination increases the plasticity of soil. The result also indicates the early effects of contamination on the Atterberg limit properties.

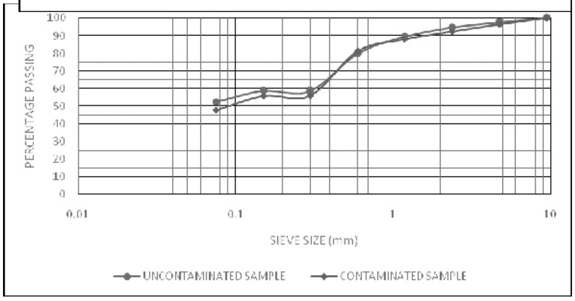
The (MDD) was between 1824kg/m^3 and 1931kgm3 for contaminated and uncontaminated soil samples, OMC ranges between 11% and 24.3% this shows that cassava waste contamination reduces the MDD and reduces OMC of the soil. Also, it was observed that the CBR values for uncontaminated and contaminated soil sample are 6% and 6.2% respectively. The value does not satisfy 30% for sub-base and 80% for base materials.

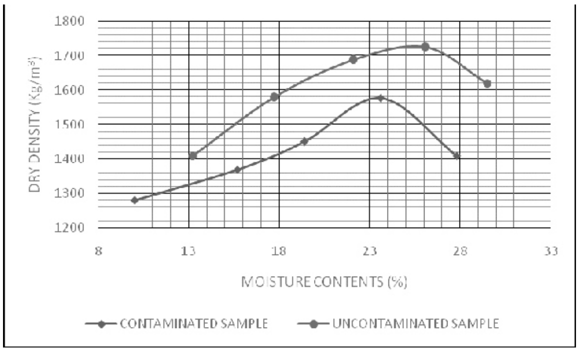
Table 1: Summary of test result on Grain size distribution, Atterberg limit, Compaction test and CBR

Soil Sample	Grain size	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	OMC %	MDD (kg/m^3)	CBR %
Uncontaminated Sample	27.94	24	17.5	6.5	24.3	1931	6
Contaminated Sample	52.5	18.2	8.4	9.8	11	1824	6.2

Note: OMC mean optimum moisture content, MDD means maximum Dry Density and CBR is California bearing ratio.







4.0 CONCLUSION

The study indicates that contamination has early effect on the Atterberg limit but soil regains its strength after biodegradation as volatilization. Contamination increases only the plasticity of the soil while the Atterberg limits meet their standard requirement. Also, cassava waste contamination reduces the MDD and reducesOMC of the soil. Based on this study, it is clear that contaminations has severe effects on the plasticity and thereby render the soil unfit as base and sub-based materials.

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