

Evaluation of Some Physical Properties of Soils as Factors Influencing Movement of Contaminants through Porous Soils Media of Gwari market Dumpsites, Yola, Nigeria

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Abstract - Pollution is a bad thing, no matter how you look at it. We can smell it when the air gets polluted and taste it when the water has gone bad, but soil is also another element that may be susceptible to different types of pollution. The present study evaluated some physical properties of soils such as bulk density, moisture content, particles size distribution, and textural classification as parameters that affect transport of pollutants through soils of the research area. Field in-situ and laboratory studies were conducted to characterize these properties using scientific calibrated equipment. Major results showed that bulk density was 3.1215kg/cm² at mean moisture content of 22.5% and temperature of 38.6°C. There was correlation coefficient of 0.26 between bulk density and distance of points taken. Permeability rate was found to be 1.55cm/min and strength of relationship between points X and Y (0.9776) was positively strong while Bouyoucos hydrometer analysis produced sandy loam as textural classification of the site. This implies that the research area has low resistance to the flow of contaminants and therefore susceptible to pollution. It was recommended that before sitting any human activity/facility on an environment, there should be proper assessment of the physical properties of soils of that area.

Keywords: Permeability, transport, textural classification, bulk density, soil contamination.

1. INTRODUCTION

For a proper assessment of the hydrodynamic mechanism of contaminants in soils, a thorough understanding of the physical properties of soils is quite essential; especially that soil is a natural resource which is beneficial to humans, plants and animals. Soil is a mixture of sand, silt and clay in varying proportions and its basic characteristics is by its particle size distribution. The soils at the study site where waste vegetables were co-disposed on directly underneath the dumpsites on which decay metabolism takes place were collected and tested for textural classification, particle size distribution (soil texture), bulk density, porosity, moisture content, and permeability because these are parameters that affect the movement of contaminated leachate into soils which results into pollution [1]. Its pollution occurs when chemicals are released by spill, leachate from dumpsites, industries, sewage or underground leakage. Among the most significant soil contaminants are: hydrocarbons, heavy metals, herbicides, pesticides and chlorinated hydrocarbons, which reduce the productive capacity of soils [2]. The toxic substances from these dumpsites are leached out and percolate through the soil layer to contaminate the surface and groundwater [3] creating huge health issues. If soil is polluted with heavy metals such as chromium and lead, this can lead to higher incidence of cancer and leukemia in people. Permeability of a soil refers to its ability to transform hydraulic forces into fluid flow and it is a function of the total volume and structure of the pore space; it also depends on soil bulk density and moisture content [4]. If the pore space is saturated as in the bottom sediment, the permeability of the medium is at a maximum. Where the fluid only fills a portion of the pore space as in the upper layers of soil, the permeability of the fluid decreases and wettability becomes important because they consist not only of solid particles, but a network of interconnected pores. Furthermore [5] reported that the degree to which soils are permeable depends on a number of factors, such as soil type, grain size distribution, and water content, degree of compaction and stress history. The ability to transmit water is characterized by coefficient of permeability which is a product of Darcy's Law [6] that established the relationship for flow through saturated porous media. Previously, [7] indicated that nature takes thousands of years to form the soil to support food crops, but man can destroy it in a few years. This study is focused on stable soils, which are soils that