

Suitability of using borrow pit soils collected from Southwestern Nigeria as landfill liners

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Abstract. Effective waste disposal system is essential in preventing the infiltration of leachate into the groundwater and in achieving the sustainable development goal of ensuring clean water. One of the ways to provide an adequate disposal system is through the provision and use of engineered landfills for waste containment instead of open dumps. Consequently, this study evaluates the suitability of using soils from six borrow pits collected from six states in Southwestern, Nigeria. To assess the suitability of the soils, laboratory tests were carried out to determine the index properties, mechanical and hydraulic properties of the collected soil samples. The results showed that the soil samples collected from the selected borrow pits in Ogun, Oyo and Ekiti States could be effectively employed for the containment of inert waste. In contrast, the soil samples collected from the selected borrow pits in Osun, Lagos and Ondo States needs to be improved such that their unconfined compressive strengths satisfy the standard requirement (≥ 200 kN/m²). This study provides readily accessible soil data for use by engineering professionals involved in selecting suitable soil for use as landfill liners in Southwestern, Nigeria.

Keywords: Engineered landfills; sustainable development; waste containment; waste disposal; waste management

1. Introduction

The rapid growth in population, industrialization and urban development has resulted in an increase in the generation of solid waste [1, 2]. According to Verisk Maplecroft [3], over 2.1 billion tonnes of municipal solid waste (MSW) is generated each year globally. This large volume of generated wastes is a global problem requiring prompt action [4]. In developing countries, the decline in environmental quality and potential loss of valuable resources have been ascribed to the rising rates of waste generation, ineffective waste handling and poor management quality of solid waste [5]. Babayemi and Dauda [6], Babayemi et al. [7] and Minh et al. [8] identified open waste dumping and burning, and landfilling in dug holes as the prevalent waste management types generally employed in developing nations. However, despite the use of these waste management types, Scarlat et al. [9] stated that in 2012, only 54.4% of solid waste generated gets collected, while the rest are indiscriminately discarded [10].

Engineered or sanitary landfills have been proposed in a bid to effectively dispose of this increasingly large volumes of solid waste that are being generated, [11, 12]. Engineered landfills

