



Evaluation of Bentonite Mixed Indigenous Clays for Development of Clay Liners

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Abstract

This study presents experimental investigation of indigenous clays mixed with Bentonite to assess their suitability in potential use as clay liners. Soil samples with 0, 4, 8, and 12% Bentonite content from three different sites in Peshawar region were tested for various geotechnical properties. Grain size distribution, specific gravity, Atterberg limits and free swell were found through laboratory tests using appropriate ASTM procedures. Maximum dry density and optimum moisture content were calculated using Atterberg limits in available relationships. Finally, one dimensional consolidation tests were conducted to find relevant parameters for calculating hydraulic conductivity. A decrease in specific gravity, increase in free swell, and in optimum moisture content, decline in maximum dry density and hydraulic conductivity was observed with increase in Bentonite content across all three soil samples. During free swell, the soil clusters become larger leading to formation of floccules resulting in the narrowing of inter-particle space and thus blocking of permeable paths. It is concluded that 8% Bentonite content by weight yields a suitable mixture for a clay liner that has hydraulic conductivity in the range of recommended limits.

Keywords: Bentonite; Clay Liners; Hydraulic Conductivity; Atterberg Limits.

1. Introduction

The safe and efficient disposal of solid waste is indispensable as it poses a hazard to the environment, and is an emergent problem in developing countries. Environmental degradation is mainly associated with the malpractices of solid waste dumping that has become an emerging issue for many urban centres around the world. The phenomenon of urbanization influx coupled with escalated population growth in developing countries has exacerbated the situation. Pakistan is no exception where solid waste is a growing problem. The absence of engineered methods of disposal and open dump approach is creating major environmental and social issues within most of the cities. Solid waste is disposed haphazardly in open dumps and they are subsequently subjected to burning. Growth rate of waste generation in Pakistan is 2.4 percent per year and solid waste production lies in the range of 0.283 to 0.612 kg (0.624 to 1.349 lbs.) per person per day [1]. At present, only 50% of waste quantities generated in Pakistan is collected by government owned and privately operated services, though, for cities to be comparatively clean at least 75% of these quantities should be disposed properly [2].

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