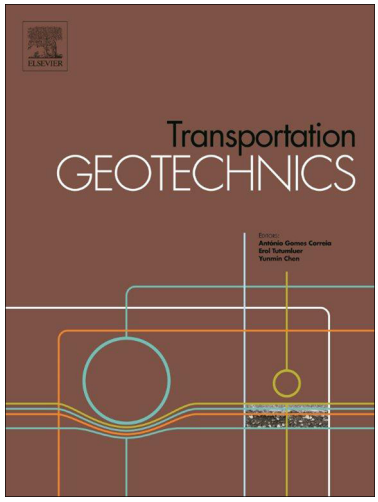

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GEOTECHNICAL AND ENVIRONMENTAL EVALUATION OF LIME-CEMENT STABILIZED SOIL-MINE TAILING MIXTURES FOR HIGHWAY CONSTRUCTION

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ABSTRACT

Lime-cement was used as a stabilizing binder in a ratio of 1:2 to treat Lateritic Soil-Mine Tailings (LMT) mixtures. Strength characteristics and environmental impact of the Lateritic Soil-Mine Tailings Binder Mix in highway construction was evaluated using a series of laboratory tests. Results of the geotechnical tests showed that the properties of the soil sample improved with the addition of mine tailings and binder. There was an increase in the maximum dry density with a decrease in the optimum moisture content. There was also an increase in the strength of the lateritic soil, this was evident from the California Bearing Ratio and the unconfined compressive strength values. The environmental performance evaluation was determined by the Leaching test, conducted on the LMT sample to determine the capability of the binder in retaining heavy metals. The results of the leaching test show that the binder was able to reduce the heavy metals in the leachate below the regulatory level, with the exception of barium and chromium. Mineralogical analysis done on the leached samples revealed that the binder was able to immobilise the mine tailing minerals that could adversely affect the environment in the soil matrix.

Keywords: Highway Construction, Lateritic soil, Leaching, Mine tailings, Stabilizing binder

Introduction

Among the many threats that affect the environment, wastes generated in mining/production processes or discarded after a specific material has served its purpose or intended use are a major concern. These wastes include solid, liquid and gaseous wastes. Studies on how to dispose some of these solid wastes such as mine tailings in the most beneficial ways are not yet fully exhausted. An estimated 1150 million tons of heavy metals have been mined since the Stone Age with estimates of contemporary mine tailings production ranging between 5 and 7 billion tonnes per year worldwide (Lu and Wang, 2012; Mudd and Boger, 2013). Tailings are mixtures of crushed rock and processing fluids from mills, washeries or concentrators that remain after the extraction of economic metals, minerals, mineral fuels or coal from the mine resource (Hudson-Edwards *et al*., 2001; Younger and Wolkersdorfer, 2004; Lottermoser, 2007). The ratio of tailings to concentrate is commonly very high, generally around 200:1 (Lottermoser, 2007). According to Lottermoser (2011) reuse of mine wastes is defined as the process that involves the new use or application of the total mine waste in its original form for a specific purpose directly without any reprocessing. Current research emphasis is more on the utilization of materials that are considered as waste (mine waste). In recent years there is an increase in trend to utilize the mine tailings for geotechnical applications, provided they are treated with some admixtures (Ramesh *et al*., 2012). Mine tailings can be safely utilized for civil engineering constructions which will minimize the disposal problems and reduce the environmental hazards (Pebble Project, 2005). Surendra