

A suite of four CKDs with different chemical and physical characteristics were used in the study. The amount of free lime, which is expected to play a major role in the stabilization, was high in two of the CKDs and was low in the remaining two CKDs. The clays selected for this study was relatively pure, commercially available clay minerals and included kaolinite, Na-montmorillonite and Ca-montmorillonite.

The dry clays, dry CKD powders and the hydration products of compacted CKDs (at constant water content) were characterized in details using X-ray fluorescent spectroscopy (XRF), X-ray diffraction analysis (XRD), thermogravimetric analysis (TGA) and scanning electron microscopy (SEM) energy dispersive X-ray spectrometry (EDX). The physical properties such as particle size distribution and the surface areas were also determined using various techniques. The evaluation of the hydration products of the high free-lime CKDs revealed that they consisted mainly of calcium hydroxide (CH), Syngenite, ettringite (E) and gypsum (G). The content of the same components in the hydration products of the low-free lime CKDs was significantly lower. The compressive strength of the two CKDs with high free-lime content was significantly higher compared to the remaining two CKDs.

The engineering properties of CKDs-treated clays were determined and compared with that of the untreated and lime-treated clays. The engineering properties studied included the Atterberg limits, pH values and unconfined compressive strength (UCS) as a function of CKD content and curing period. It was found that the effectiveness of a particular CKD in stabilizing clay is mainly a function of its chemical composition, specifically, the free-lime content. In each case, the CKD with higher free-lime content was found to be more effective in improving various engineering properties.

Finally, a chemical interaction study of the CKDs-model clays systems was conducted. The presence of ettringite, gypsum (using XRD, TGA and SEM) and C-S-H (using TGA and SEM) was confirmed and the amounts of these products were a function of chemical characteristics of the particular CKD. Irrespective of the type of the clay mineral, the main mechanism of stabilization was confirmed to be the pozzolanic reaction between the clay and the calcium hydroxide produced due to the hydration of the CKD. The SEM examination gave conclusive evidence of the adsorption of the calcium hydroxide on to the surfaces of kaolinite clay flakes treated with CKDs, a process that may promote formation of C-S-H in this systems. In addition to the evidences of the adsorption of the CH by the Na-montmorillonite clay, extensive C-S-H formation was also documented in this clay using the SEM and EDX analysis. Although CH adsorption was also observed for Ca-montmorillonite clay no extensive formation of C-S-H took place. Other hydration products that contributed to the improvement of the properties of CKDs-treated compacted clays were ettringite and gypsum.