

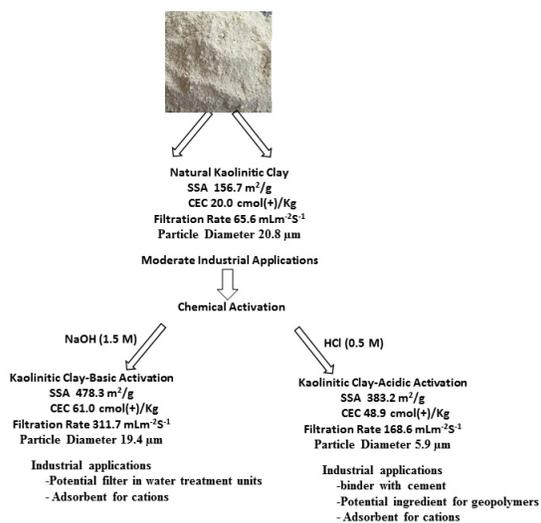
Industrial Applications of Chemically Modified Natural Kaolinitic Clay

YAHYA S. AL-DEGS *, AYMAN A. ISSA, MUNA S. AL-HENDI

Chemistry Department, The Hashemite University, P.O. Box 150459, Zarqa, Jordan

Abstract: This research aims to increase the industrial applications of kaolinitic clay by improving physico-chemical properties through chemical treatment. Chemical treatment using HCl and NaOH (0.5-1.5 M) created structural changes, and improved cation exchange capacity, specific surface area and filtration quality of the original clay sample. The surfaces were characterized by different analytical techniques to explore practical applications. Stability of the major mineral (kaolinite) was assessed by measuring Hinckley index and the results indicated structure changes with no phase transformation under alkali treatment. XRF and leaching tests indicated that alkali treatment ended up with enrichment of toxic metals (like Cr) while acid treatment accelerated metals leaching from the sample. For example, Cr was 2.5-fold more in the sample after alkali treatment. Leachability test showed that large fractions of heavy metals (53-88%) were eluted after acid treatment. Measurement of particle size by laser technology revealed the high reduction of particle size upon acid treatment, the acid treated kaolinite with an average size 4.8 μm is a potential binder (or pozzolane material after heat treatment) to be used with construction materials. In light of the results of the analysis, there are a number of proposed industrial applications for treated kaolinite including water adsorbent, filter, and ingredient for geopolymers.

Graphical Abstract



Keywords: Acidactivation; adsorbent; alkaliactivation; catalyst; electron microscopic characterization; filter; kaolin; natural clay; physicochemical characteristics; surface activation; XRF characterization.