Optimization of Acid Activation Conditions for Athi River Bentonite Clay and Application of the Treated Clay in Palm Oil Bleaching

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Abstract: Athi River bentonite clay was activated using sulphuric acid at various acid concentrations, clay-acid ratio, temperature and contact times. Optimization was based on palm oil bleaching performance. The chemical compositions of the raw clay and clay activated at different acid concentrations were analysed to investigate the extent of cation dissolution and exchange. From the results, the clay was classified as calcium bentonite. Both cation exchange capacity (CEC) and the apparent bulk density were found to decrease with increase in acid concentration. When palm oil was bleached at 90°C for 30 minutes using 1% and 4% clay activated with 2M sulphuric acid, the bleaching performances obtained were 94,5 and 98% respectively. These results compared well with those of a commercial bleaching clay which was used as standard. The equilibrium data was analysed using Freundlich and Langmuir adsorption isotherms and the former was found to provide a better fit for the data. The calculated heat of adsorption indicated that palm oil bleaching by the activated clay was an exothermic reaction and a physico-chemical process. Sulphuric acid activation was found to be an effective method of improving adsorption performance of Athi River bentonite clay and the activated product is a viable alternative to imported commercial bleaching earth.

Keywords: Acid activation, Bentonite clay, Oil bleaching, Adsorption isotherm