

ABSTRACT

The discrepancy between a stoichiometrically calculated and analytically derived soda loss mass balance in two Jamaican alumina plants was found to owe its origin to adsorption of soda on red mud. This phenomenon accounts for about 15% of the total washable soda being discharged to the mud lakes. Its magnitude depends on the concentration of soda in the dispersion medium of red mud slurry, retention time, temperature and agitation.

A study of the fundamental parameters of the mud washing circuit showed that viscosity and density varies with total soda concentration, whereas surface tension does not. The latter depends on the concentration of causticised flour in each wash thickener.

Data derived from a systematic adsorption study of model systems of red mud slurry components were fitted to the Freundlich, Langmuir and B.E.T. adsorption isotherms. This revealed that sodium hydroxide is adsorbed on red mud as a monolayer, sodium aluminate and sodium carbonate do not obey any of these simple isotherms whereas sodium oxalate showed best agreement with the B.E.T. equation.

The adsorbability of NaOH , $\text{NaAl}(\text{OH})_4$ and $\text{Na}_2\text{C}_2\text{O}_4$ shows marked variation with the composition and surface area of the red muds investigated and indicates that the non-siliceous minerals are the most active adsorbents in Jamaican red mud for Bayer solutes.

The results suggest that adsorption of the anions of the sodium compounds occurring in Bayer liquor involves formation of surface complexes with the metal atoms of the minerals in red mud, with Na^+ adsorbing as the counter-ion.

Red mud shows little adsorptivity for the aluminate anion and suggests the existence of residual alumina on the red mud surface. The latter is favoured by the genesis of bauxite/red mud and in particular the mineralogy of red mud.

The pH dependence of oxalate adsorption on red mud has been demonstrated. Oxalate adsorption on red mud is a major outlet for this impurity in the Bayer process.

Adsorbed OH^- and Na^+ on the red mud surface are exchangeable for Cl^- and K^+ respectively.

Correction factors need to be applied for adsorption of Bayer solutes and water when the efficiency of the counter-current decantation mud washing system is calculated via the Scandrett equations.