THERMO-CHEMICAL LEACHING FOR EXTRACTION OF ALUMINA FROM BAYER’S PROCESS WASTE RESIDUE: RED MUD

Abstract

Red mud emerges as the major waste material during production of alumina from bauxite by the Bayer’s process. It comprises of elements oxides of iron, titanium, aluminium and silica along with some other minor & trace constituents. Based on economics as well as environmental related issues, enormous efforts have been directed worldwide towards red mud management issues i.e. of utilization, storage and disposal. Different avenues of red mud utilization are more or less known but none of them have so far proved to be economically viable or commercially feasible. During alumina refining process 16 % ~18 % of alumina loss as red mud, depends upon the quality of bauxite and process parameters used for extraction of alumina by Bayer’s process. In the alumina refinery, some phases like De-hydroxylated Gibbsite (Diaspore/Boehmite), Gibbsite co-existing with Boehmite, Alumo-Goethite, Goethite, Anatase, Ilmanite, Zircon, Quartz and Mica etc. do not dissolve during the industrial treatment of Gibbsite bauxite and get released as constituents of red mud and there by reduce the recovery of alumina significantly.

It is possible to extract valuable alumina from red mud by using a second stage digestion technology at normal atmospheric pressure at temperature of 95-105°C by using suitable diluted liquor of Bayer’s process by varying the leaching time from 60 minutes to 240 minutes. The double digestion process doesn’t effective because of poor extraction of alumina from red mud. The alumina extraction efficiency has been achieved ~ 43-45 % by only using Double Digestion process. Hence the sintering of red
mud is carried out using oxides of divalent alkaline earth metal and Soda Ash (Na₂CO₃) at high temperature around 900°C to 1100°C by varying sintering time from 1 to 4 hrs using high temperature Muffle furnace. During sintering method Alumina phases present in red mud as de-hydroxylated gibbsite (Diaspore / Boehmite), alu-goethite, sodalite reacted with soda ash and divalent alkaline earth metal oxides like MgO, CaO, BaO & converted to divalent Metal Silicates and Titanate and Soluble Sodium Aluminate. The resultant sodium aluminate was extracted by leaching the sintered products of red mud with fresh caustic (80 gpl) for 1 hour at 105°C. In the above process the formation of stable phases are responsible for maximum extraction of alumina and soda recovery from red mud. Where as, in this newly developed process: the extraction efficiency of alumina from red mud-soda ash sintering process using CaO shown 97.64 %, MgO shown 98.7 % and BaO shown 99.5 % followed by leaching with suitable concentration caustic concentration.

All the sintered products before and after leaching are characterized by using XRD and SEM. The Chemical composition and the impurities are estimated by using instruments like AAS and XRF as well as by classical method.