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Received on: 09/03/2017

Accepted on: 12/10/2017

Studying the Efficiency of Lime-Soda Sinter Process to Extract Alumina from Colored Kaolinite Ores Using Factorial Technique of Design of Experiments

Abstract- As the increasing demand for alumina in recent years with the result diminishing reserve of bauxite, the need to secure a domestic raw material base is driving research in new technologies to process low grade ores into alumina, with the intention that these technologies will lead to a significant reduction of bauxite and alumina transportation costs, allow the extraction of more valuable components from the ore and reduce environmental impact. Clays are types of the low-grade aluminum ores, they're also well abundant which make them a potential substitutes for Bauxite. In this work, lime soda sinter process was adopted for extracting alumina from kaolinitic claystone from Al-Ga'ara formation (Duekhla) quarry in western Iraq. The operation efficiency of sintering was studied in which the whole process has been done with three stages: the sintering process for the raw materials, leaching and carbonizing processes to precipitate and separate the alumina from the leach pregnant solution . Factorial technique of Design of Experiments (DOE) module in Minitab was used as a principal methodology to examine the sintering efficiency over alumina extraction. The results obtained showed that the optimum parameters for the sintering operation were CaO/SiO₂ molar ratio of 2.2, Na₂O/Al₂O₃ molar ratio of 1.2, sintering temperature at 1213 °C for 90 min. The sintered materials were leached with sodium carbonate solution, and sodium aluminate solution was obtained. By bubbling carbon dioxide gas into this extract solution aluminum hydroxide [Al(OH)₃] has been precipitated and on calcination at 1200 °C for 2 hrs, alpha alumina (α -Al₂O₃) was obtained with purity of 98.5 %.

Keywords- Lime-soda, Kaolin, Extract Alumina, DOE, Factorial Technique

How to cite this article :H.Z. Toama, A.A. Al-Ajeel and A.H. Jumaah, "Studying The Efficiency of Lime-Soda Sinter Process to Extract Alumina from Colored Kaolinite Ores Using Factorial Technique of Design of Experiments," *Engineering and Technology Journal*, Vol. 36, Part A, No. 5, pp. 500-508, 2018.
