

## Accepted Manuscript

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PII: S0032-5910(15)00298-3  
DOI: doi: [10.1016/j.powtec.2015.04.024](https://doi.org/10.1016/j.powtec.2015.04.024)  
Reference: PTEC 10934

To appear in: *Powder Technology*

Received date: 10 November 2014  
Revised date: 5 April 2015  
Accepted date: 11 April 2015



Please cite this article as: Nurudeen Salahudeen, Abdulkarim S. Ahmed, Ala'a H. Al-Muhtaseb, Muhammad Dauda, Saidu M. Waziri, Baba Y. Jibril, Jamal Al-Sabahi, Synthesis, characterization and adsorption study of nano-sized activated alumina synthesized from kaolin using novel method, *Powder Technology* (2015), doi: [10.1016/j.powtec.2015.04.024](https://doi.org/10.1016/j.powtec.2015.04.024)

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## Synthesis, characterization and adsorption study of nano-sized activated alumina synthesized from kaolin using novel method

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### Abstract

Synthesis and characterization of nano-sized activated alumina from kaolin using an innovative three-step method is presented. Adsorption study of the as-synthesized activated alumina using phenol solution as absorbate was carried out. The Brunauer-Emmett-Teller (BET) specific surface area, pore diameter and pore volume of the as-synthesized activated alumina were 202.3 m<sup>2</sup>/g, 1.212 nm and 0.0613 cm<sup>3</sup>/g respectively. Chemical, mineralogical, morphological and thermal analyses of the as-synthesized activated alumina were carried out using X-ray fluorescence (XRF), Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and thermogravimetric analysis (TGA). The as-synthesized activated alumina possessed 83.47 wt% Al<sub>2</sub>O<sub>3</sub>. Its XRD pattern possessed characteristic peaks gamma phase of alumina. The as-synthesized activated alumina possessed nano-size morphology; having crystal size value of 12.5 nm. It was thermally stable; the differential thermogravimetric (DTG) analysis showed that only 17 wt% mass depletion was observed for heating from 30 - 900°C. Adsorption isotherm of the as-synthesized activated alumina using Freundlich, Langmuir and Dubinin–Radushkevich (D–R) models, gave coefficients of determination of 0.948, 0.962 and 0.867 respectively. The K<sub>f</sub>, b, and

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