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Characterization and Suitability of Nigerian Barites for Different Industrial Applications

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Abstract: This work aimed to characterize barite samples from selected different locations in Nigeria and determine their suitability for various industrial applications. The properties determined include mineralogy, chemical composition, morphology, functional groups, and specific gravity. Samples were obtained from ten locations in Nasarawa and Taraba states as well as a standard working sample (WS) obtained from a drilling site. The samples were characterized using scanning electron microscope and energy dispersive X-ray (SEM-EDX), Fourier infrared analysis (FTIR), and X-ray diffraction (XRD). Specific gravity (SG) was determined using the pycnometer method. Results of SEM-EDX analysis show that the WS has a Ba-S-O empirical composition of 66.5% whereas these of the ten samples investigated vary between 59.36% and 98.86%. The FTIR analysis shows that the functional groups of S-O, SO_4^{2-}, Ba-S-O, OH of the ten samples match that of the WS. Results of XRD show that the ten samples have the same mineralogical composition as the WS and all meet American Petroleum Institute (API) standards for industrial barite. Similar matching results are shown from EDXRF spectra intensity, position, and composition analysis of the ten samples compared to the WS. Specific gravity (SG) results show that six out of the ten samples have SG above 4.2 which is the recommended minimum for the American Petroleum Institute (API) standard. The other four samples will require beneficiation to meet the standard for drilling mud application. Using all the parameters of the assessment together, results show that while some (6) of the samples can be used for drilling fluid application, some (4) require beneficiation but all ten samples can be used for other industrial applications including healthcare, construction, plastic, cosmetics, paper, and rubber industries. The results of the study can be used for value addition in developing beneficiation procedures, processes, and technology for purification along with new materials for the industries.

Keywords: barite; mineralogy; industrial application; beneficiation; specific gravity

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1. Introduction

The Federal Government of Nigeria is currently implementing the National Economic Recovery and Growth Plan (ERGP) aimed at re-directing the economy back to the path of recovery [1]. A major aspect of the plan is diversification of the economy away from oil and increasing the local content in operations of the oil industry. One way of diversifying the economy is by developing the mining sector, including adding value to extracted minerals. Approximately 85% of barite goes into the oil industry, about 10% into the chemical industry, 5% into the filler market. Barite is used as a weight density agent in drilling mud for gas and oil exploration to avoid the high-pressure formation and prevent blowouts. This is compressing the high pressure created by the drill bit as it passes through various formations with different characteristics. The deeper the drilling hole, the more