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Preparation of Faujasite-Type Zeolite (13X) from Angren Kaolin for Hydrogen Sulfide Adsorptive Purification of Natural Gas

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The extraction of hydrogen sulfide (H2S) from gases is essential in numerous industrial applications to safeguard human safety, preserve equipment, and mitigate environmental harm. In these circumstances, zeolites are crucial for the extraction of H2S from these gases. This study reports, for the first time, the synthesis of 13X zeolite from Angren kaolin using an optimized, fully autoclave-free fusion/hydrothermal route. This method enables 13X crystallization under atmospheric pressure, greatly improving process safety, cost-efficiency, and scalability. The impact of the NaOH ratio on kaolin synthesis was investigated. Thereafter, these samples were analyzed utilizing XRD, SEM, EDS, and BET techniques to evaluate their crystalline structures, surface morphologies, and textural properties. The adsorption of H2S from natural gas was performed using both synthetic and commercial samples in a custom-designed laboratory-scale adsorption machine. The results demonstrated that the synthesized zeolite designated as 13X-III, with a high NaOH ratio, displayed an adsorption capacity higher than that of commercially available 13X molecular sieves (C13X). The synthesized 13X efficiently removed H2S from various gases containing H2S, such as biogas, refinery gases, and natural gas.

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