Synthesis of zeolites by alkali-thermal treatment of illite clay

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Zeolite synthesis from clay minerals offers potential for production of efficient, low cost microporous material for use as ion exchangers, molecular sieves, sorbents and catalysts. Most synthetic zeolites are produced from sodium alumosilicate gels, which is expensive method. Clay minerals as a source of both aluminium and silicon offers cheaper alternatives for raw materials that can be used for zeolite synthesis using different alkaline treatment methods (Mezni et al., 2011).

This study investigates possibility of producing zeolites form natural illite clays using alkali activation with concentrated NaOH solutions and incorporating different thermal processes for zeolite synthesis.

Source of illite was fractioned clay from Kuprava clay pit in northeastern Latvia. Alkaline treatment was conducted on calcined illite (at 600°C) using NaOH solutions with concentrations of 6M and 10M, with following curing processes: 1) at 120°C for 24h; 2) at 600°C in air atmosphere; 3) at 600°C in nitrogen atmosphere; 4) hydrothermally at 180°C for 24h. Structure and morphology of raw and syntesized materials was investigated by SEM (Nova NanoSEM 650, The Netherlands) and XRD (model D8 Advance, Bruker, with CuKα radiation in a scanning interval of 2θ =10–60° at a speed of 4°/ min).

Hydrosodalite type zeolites form in all tried curing conditions, most effective being hydrothermal treatment. Curing at 600°C show reduced amounts of hydrosodalite compared to curing at 120°C or in hydrothermal conditions due to its thermal degradation and formation of nepheline phase, most notably when cured in nitrogen atmosphere.

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References:

Mezni, M., Hamzaoui, A., Hamdi, N., & Srasra, E. (2011). Synthesis of zeolites from the low-grade Tunisian natural illite by two different methods. *Applied Clay Science*, *52*(3), 209–218. https://doi.org/10.1016/j.clay.2011.02.017