Original
Received November 29, 2017
Accepted for Publication January 18, 2018

Alkali Conversion of Waste Clay into Zeolitic Materials using NaOH and KOH solution

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Alkali conversion from waste clay in a NaOH and KOH solution was attempted to synthesize the zeolitic materials. Waste clay was added into 2 mol/L NaOH or KOH solution, then heated at 90, 120, 150 and 180 °C for 20 h to obtain the product. Waste clay mainly comprised three crystalline phases, quartz (SiO_2), albite ($NaAlSi_3O_8$) and clinochlore ($(Mg, Fe)_5Al(Si_3Al)O_{10}(OH)_8$), and one amorphous phase. In NaOH solution, zeolite-P ($Na_6Si_{10}Al_6O_{32}\cdot 12H_2O$) was formed at 90° C and 120° C, whereas the three mineral phases in raw waste clay remained, and analcime ($NaAlSi_2O_6\cdot H_2O$) was formed above 150° C. In KOH solution, chabazite ($K_2Al_2Si_4O_{12}\cdot 6H_2O$) and zeolite K-H ($K_2Al_2Si_4O_{12}\cdot xH_2O$) were formed at 90-150° C and 150-180 °C, respectively. With increasing reaction temperature from 90° C to 180° C, the cation exchange capacity (CEC) of the product using KOH increases, while that of the product using NaOH decreases. Waste clay was added into 0-8 mol/L KOH solution, and then heated at 80, 130 and 180° C for 12 h to obtain the product. The product synthesized in 3 M KOH at 180° C indicates the maximum CEC, 1.29 mmol/g. The concentrations of Si and Al in the solution and crystallization in the product during the reaction explain the CEC of the product.

Keywords : Waste clay, Alkali reaction, Analcime, Chabazite, Zeolite K-H