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Hydrotermalna synteza materiału zeolitowego na bazie popiołu lotnego ze spalania węgla kamiennego

Rozprawa doktorska

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Hydrothermal synthesis of zeolite material on the basis of fly-ash from combustion of hard coal

Summary

On the basis of fixed chemical and mineralogical composition of fly ashes originating from combustion of hard coal, co-incineration of hard coal and biomass and combustion of lignite in pulverized-fuel and fluidal boilers, it was chosen fly-ash for hydrothermal synthesis of zeolite material.

From among 20 fly-ashes coming from 11 Polish power plants and heating plants, the optimal usefulness for hydrothermal synthesis of zeolite material showed fly-ashes originating from combustion of hard coal and co-incineration of hard coal and biomass from Rybnik Power Plant.

Hydrothermal synthesis was conducted during 6 h, by variable weighed amount of fly-ash (25, 50, 100, 200g), and by variable concentration of NaOH activating solution (0,0M; 0,5M; 1,0M; 2,0M; 3,0M NaOH).

As a result of conducted hydrothermal synthesis of zeolite material from Ely-ashes from Rybnik Power Plant there were obtained two types of zeolite material – monomineral and polimineral.

Approved process of synthesis of zeolite material on the basis of fly-ash from Rybnik Power Plant indicates its high efficiency because the share of zeolites in obtained materials is very high and counts average 90% of mass.

Concentration of majority of elements in post-reaction solutions originating due to the synthesis usually increases within the increase of concentration of NaOH activating solution and the amount of ash applied in synthesis.

Textural parameters obtained zeolite materials indicate that they are in each case mesoporous materials. Specific surface of pores and surface of micropores of these materials are several times higher than raw fly-ash, what by high values of total volume of pores and mean diameter of pores make possible its applying as sorption materials.

Received zeolite materials show sorption possibilities for lead, nickel, zinc, and manganese. Reduction of concentrations in solutions of these metals was achieved over 96% in a short time – 0,5h.

Due to the conducted experiments in determined conditions of the process, it is possible producing of specified zeolite material (type of zeolite, textural parameters, sorption possibilities of Pb, Ni, Zn and Mn).