Journal of Environmental Science and Health, Part A

Synthesis of zeolite NaA membrane from fused fly ash extract

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Abstract

Zeolite-NaA membranes were synthesized from an extract of fused South African fly ash on a porous titanium support by a secondary growth method. The influence of the synthesis molar regime on the formation of zeolite NaA membrane layer was investigated. Two synthesis mixtures were generated by adding either aluminium hydroxide or sodium aluminate to the fused fly ash extract. The feedstock material and the synthesized membranes were characterized by X-diffraction (XRD), scanning electron microscopy (SEM) and X-ray fluorescence spectroscopy (XRF). It was found by XRD and SEM that the cubic crystals of a typical zeolite NaA with a dense intergrown layer was formed on the porous Ti support. The study shows that the source of Al used had an effect on the membrane integrity as sodium aluminate provided the appropriate amount of Na(sup+) to form a coherent membrane of zeolite NaA, whereas aluminium hydroxide did not. Morphological, the single hydrothermal stage seeded support formed an interlocked array of zeolite NaA particles with neighbouring crystals. Also, a robust, continuous and wellintergrown zeolite NaA membrane was formed with neighbouring crystals of zeolite fused to each other after the multiple stage synthesis. The synthesized membrane was permeable to He (6.0 x 10(sup6) L (m (sup-2)h(sup-1) atm(sup-1) and CO(sub2) (5.6 x 10(sup6) L m (sup-2)h(sup-1) atm(sup-1), which indicate that the layer of the membrane was firmly attached to the porous Ti support. Membrane selectivity was maintained showing membrane integrity with permselectivity of 1.1, showing that a waste feedstock, fly ash, could be utilized for preparing robust zeolite NaA membranes on Ti support.