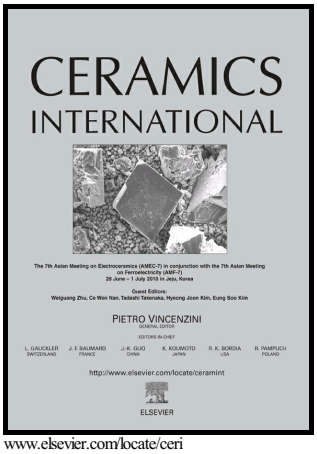

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PII: S0272-8842(17)31742-X
DOI: http://dx.doi.org/10.1016/j.ceramint.2017.08.045
Reference: CERI15999

To appear in: *Ceramics International*

Received date: 4 May 2017
Revised date: 29 July 2017
Accepted date: 6 August 2017

Cite this article as: S. Foorginezhad and M.M. Zerafat, Microfiltration o Cationic Dyes using Nano-clay Membranes, *Ceramics Internationa* http://dx.doi.org/10.1016/j.ceramint.2017.08.045

Microfiltration of Cationic Dyes using Nano-clay Membranes

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Abstract

Water resources cover 70% of earth surface with only 3% as fresh and the remaining frozen or unavailable. As a result, water and wastewater treatment have attracted a great deal of attention during last decades. Among various pollutants, dyes in textile wastewaters can have serious impacts on the environment. In the present study, low-cost ceramic nano-clay microfiltration membranes with low sintering temperature were fabricated via dry pressing, with natural zeolite as pore former. Flat disks were fabricated by sintering a mixture with various proportions of clay, zeolite and polyethylene glycol at 900 °C and characterized using FE-SEM, open porosity test, zeta potential, water permeability and acid-base treatment. Also, Membrane porosity was enhanced by increasing the zeolite content reaching 30.2% at 30 wt. % and then decreased. The 30% zeolite membrane was selected for microfiltration of methylene blue, crystal violet and methyl orange from aqueous solutions. Initial and time filtered solution concentrations for each dye were measured using a UV-Visible spectrophotometer. Methylene blue and crystal violet are cationic dyes due to the presence of $NC(CH)_3^+$ while SO_3^- makes methyl orange anionic. The membrane had negative charge at pH=6, suggesting adsorption of cationic dyes as the removal mechanism. 95.55% removal of crystal violet was obtained for the 54 mg. L^{-1} solution at 1 bar and 90.23% removal of methylene blue was obtained at optimal conditions with a 35.76 mg. L^{-1} concentration and 1.5 bar transmembrane pressure. However, less than 10% methyl orange removal was obtained, due to its negative charge. Membranes can be recovered completely by eliminating the adsorbed dyes via heat treatment at 300 °C for 1 h. The results approve the as-fabricated clay membranes cost-effective with high rejection of cationic dyes.

Keywords; NanoClay; Zeolite; Microfiltration; Cationic dyes; Wastewater treatment