Environmental Engineering and Management Journal March 2015, Vol.14, No. 3, 541-549
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

EQUILIBRIUM PERFORMANCES OF *CRYSTAL-RIGHT^{TM} CR100* ZEOLITE USED IN WATER SOFTENING PROCESS

Liliana Lazar[1*], Bogdan Bandrabur[2], Ramona-Elena Tataru-Fărmuş[1], Mioara Drobota[3], Silviu-Gabriel Stroe[4], Gheorghe Gutt[4]

[1] "Gheorghe Asachi" Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, Department of Chemical Engineering, 73 Prof. dr. docent Dimitrie Mangeron Str., 700050 Iasi, Romania
[2] Hach Lange SRL, 3 Căminului Str., 021741 Bucharest, Romania
[3] "Petru Poni" Institute of Macromolecular Chemistry, Department of Polymer Materials Physics, 41A Gr. Ghica Voda Alley, 700487 Iasi, Romania
[4] "Stefan cel Mare" University of Suceava, Faculty of Food Engineering, 13 University Str., 720229 Suceava, Romania

Abstract

The present work investigates the performance of *Cristal-Right^{TM} CR100* zeolite based on the equilibrium and thermodynamics water softening process. The commercial zeolite was characterized by scanning electron microscopy combined with energy dispersive X-ray spectroscopy and FT-IR spectroscopy. The equilibrium performances of zeolite were evaluated by the sorption capacity of calcium cations from calcium chloride solutions varying the calcium concentrations corresponding to moderate, hard and very hard waters. Experiments were carried in batch mode out as a function of temperature (278, 298, 318 and 338 K) and in fixed optimum conditions for soption process (pH, zeolite dose and contact time). Equilibrium sorption data were analysed using Langmuir, Freundlich and Dubinin-Radushkevich isotherm models to obtain the characteristic parameters of each model. Sorption equilibrium data fitted very well to the Langmuir model that confirmed the monolayer sorption with high correlation coefficients. According to the evaluation using the Langmuir isotherm, the maximum sorption capacities of calcium cations onto *Cristal-Right^{TM} CR100* zeolite were 31.45 mg/g for 298 K. The thermodynamic parameters values indicate the spontaneous and endothermic nature of the sorption process by ambient temperature. The sorption energy fell in the range of physisorption.

Key words: isotherms, permanent hard water softening, sodium-zeolite, sorption capacity, thermodynamics

Received: November, 2014; Revised final: March, 2015; Accepted: March, 2015

∗ Author to whom all correspondence should be addressed: e-mail: lillazar@ch.tuiasi.ro