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Cation exchange in RHO Zeolite for CO_2 adsorption

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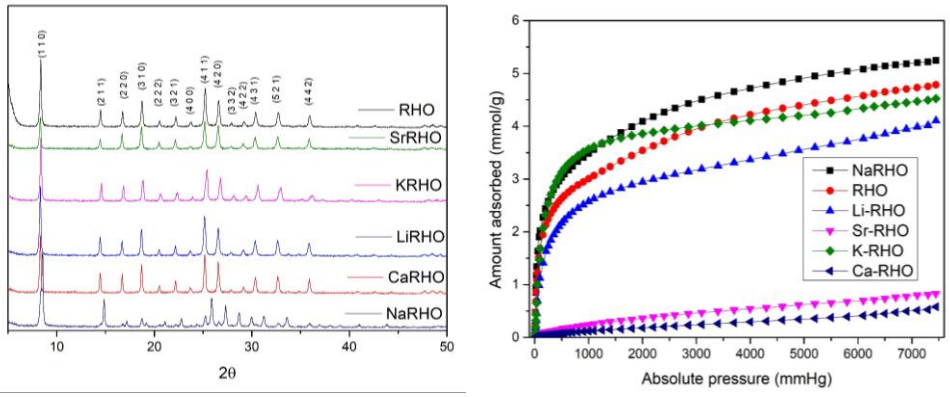
Abstract

Zeolites are being used as solid catalysts with the aim of reducing the environmental impact generated by the accumulation of waste, as they reduce the volume of effluents, as well as gas adsorbent material [1]. In this sense, the objective of the work is to investigate how cation exchange interferes with the adsorption of CO_2 from the RHO zeolite. The synthesis of RHO zeolite was carried out using the method of T. Chatelain, et al, [2]. The procedure used to perform cation exchange in all samples followed the methodology of SILVA, Aryandson [3]. The samples were subjected to X-ray Diffraction (XRD) analyses and experiments to obtain CO_2 adsorption isotherms. As a result, regardless of the cation, the samples presented reflections with peaks at the angles related to the miller indices of the RHO zeolite, therefore, there was no amorphization of the zeolite's crystalline structure after the exchanges, as shown in Figure 1a.

Figure 1 - (a) Diffractography of standard Zeolite RHO and after cation exchange; (b) CO_2 adsorption isotherm of standard RHO zeolite samples and after cation exchange at 23°C.



In Figure 1b it is clear that the different cations in the structure cause the adsorption process to change: at a pressure of approximately 7000 mmHg, the Na-RHO sample (exchange made by the Na^+ cation) had a higher adsorption than all the samples, including the standard RHO zeolite. However, in atmospheric pressure (760mmHg) the K-RHO sample adsorbs more CO_2 than both. Furthermore, RHO zeolites with Ca^{2+} and Sr^{2+} showed a significant reduction in adsorption capacity, different from that observed in LTA zeolites, where Ca^{2+} in the crystalline structure increases the amount adsorbed on the material [3]. Therefore, it is possible to conclude that different cations in the structure strongly influence adsorption, and therefore, new analyses to verify the influence of the composition of the structures on the CO_2 adsorption process must be carried out.

Keywords: zeolite, CO_2 adsorption, cation exchange

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