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ABSTRACTS BOOK

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Al-waste zeolites and their application as cadmium adsorbents

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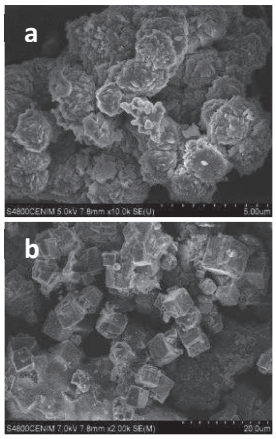
1. Introduction – Zeolites are crystalline aluminosilicates with a wide range of applications in catalysis, ion exchange, chemical separation, *etc.* Such applications are due to their high porosity and the possibility to introduce variations on their compositions as well as morphologies. Methods to obtain zeolites from unconventional sources such as fly ash from carbon combustion plants and municipal solid waste incinerators have been reported [1]. However, as far as we know, the use of hazardous aluminium waste from the tertiary industry has not been described. Therefore, the aim of this work was to evaluate the complete recovery of a very fine powdered solid waste from the aluminium industry in order to obtain added value materials as zeolites. Besides, their applications as Cd^{2+} adsorbents were also studied.

2. Experimental - Zeolites were synthesised by a simple one-step process without a previous activation. The hazardous waste, used as main source, provided the required amount of Al_2O_3 to adjust an appropriate Si/Al molar ratio and minor amounts of SiO_2 and Na^+ were added. Different raw material compositions and parameters (time, temperature, pressure, *etc.*) were assayed to study their effect on crystallographic, morphological and textural characteristic of zeolites. Cd^{2+} adsorption assays were performed by batch.



3. Results and Discussion -Two zeolites analcime (ANA) and NaP1were obtained in the NaO_2-Al_2O_3-SiO_2-H_2O system with similar characteristics to zeolites obtained from conventional raw materials [2]. Their formation and crystal growth were strongly dependent on the experimental temperature conditions. ANA exhibited a higher crystallinity than NaP1, with well-formed cubic crystallites (Image 1), as well as higher particle size. NaP1 showed a morphology formed by small cubic crystallite agglomerates, a smaller particle size distribution and specific surface area thrice higher than ANA. The Cd^{2+} adsorption efficiency was of 94.2 % for ANA and 99.9 % for NaP1. The high adsorption capacity of NaP1 allowed removing Cd^{2+} for contact times as low as 10 min at the initial concentration of 20 mg/L.

4. Conclusions - Different zeolites can be predesigned from a hazardous waste by means of controlling operational parameters. The process allows the complete recovery of the industrial waste as an added value material. Zeolites showed a very high ability to remove Cd^{2+} from aqueous solutions. Thus, through a simple process, a hazardous waste (traditionally disposed in safety landfills) can be used in the field of water remediation, solving two environmental concerns.

5. References

[1] Querol, X., et al., *Synthesis of zeolites from coal fly ash: an overview.* International Journal of Coal Geology, 2002. **50**(1-4): p. 413-423.

[2] HOU, Z., et al., *Synthesis of NaP with controllable morphologies.* Microporous and Mesoporous Materials, 2012. **158**: p. 137-140.