Synthesis of type A zeolites from natural kaolinite for their application in CO2 capture processes

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Climate change is the greatest environmental threat of the 21st century, with major economic, social and environmental consequences. The level of carbon dioxide (CO_2) emissions has increased by 31%, therefore, both governments and the scientific community are taking steps to mitigate emissions into the atmosphere. The most economically sustainable method is the use of low cost adsorbents that perform a selective adsorption of CO_2 with respect to other inert gases such as N_2. Clay minerals are highly available materials on the planet, are a low cost raw material and have great versatility for various processes in the field of adsorption and catalysis. The present work describes the synthesis of type A zeolite from a hydrothermal process in basic medium using metacaolinite as a starting material. Several parameters such as temperature and time were modified to evaluate the relationship between the formation conditions of the zeolite and its CO2 adsorption capacity.

Synthesized catalysts were characterized by X-ray diffraction (XRD), N_2 adsorption-desorption at -196 ºC, nuclear magnetic resonance of solids (NMR) and infrared spectroscopy (IR).

In addition, the absorption capacity of CO_2 with type A zeolites has been evaluated, and all the results were compared with the commercial zeolites.

With respect to the results obtained, it can be said that the bands obtained by IR for the synthesized Zeolites are similar to those of the commercial Zeolite. On the other hand, the NMR results show that the synthesized and commercial zeolite present the same chemical environment. Finally, the textural parameters corroborate that in all cases the surface area is low from 12 m^2g^{-1} for kaolinite to 7 m^2g^{-1} for commercial zeolite A.

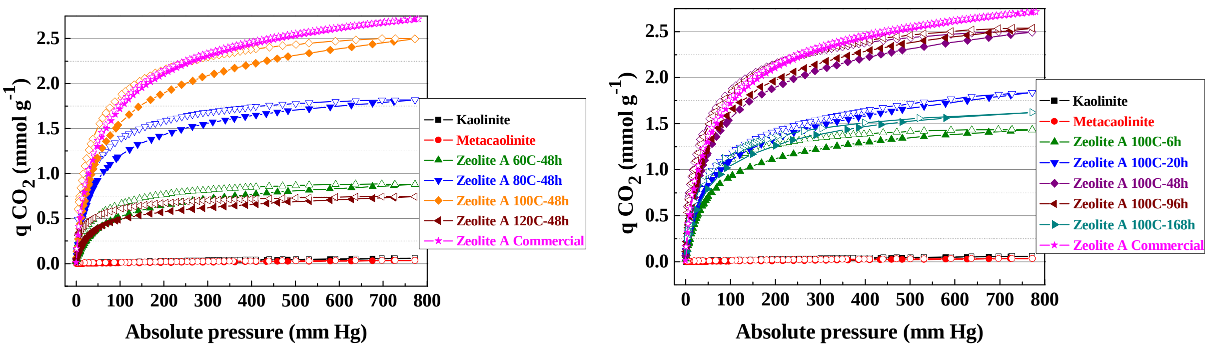

Figure 1. Isoforms of CO_2 at 25ºC.

References

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