

CO₂ Capture in Porous Silica Assisted by Lithium

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Abstract : Carbon dioxide (CO₂) and methane (CH₄) are considered as the compounds with higher abundance among the greenhouse gases (CO₂, NO_x, SO_x, C_xH_x, etc.), due to its higher concentration, this two gases have a greater impact in the environment pollution and provokes global warming. So, recovery, disposal and subsequent reuse, are of great interest, especially from the ecological and health perspective. By one hand, porous inorganic materials are good candidates to capture gases, because these type of materials are higher stability from the point view of thermal, chemical and mechanical under adsorption gas processes. By another hand, during the design and the synthetic preparation of the porous materials is possible add other intrinsic properties (physicochemical and structural) by adding chemical compounds as dopants or using structured directed agents or surfactants to improve the porous structure, the above features allow to have alternative materials for separation, capture and storage of greenhouse gases. In this work, ordered mesoporous materials base silica were prepared using Surfynol as surfactant. The surfactant micelles are commonly used as self-assembly templates for the development of new structure porous silica's, adding a variety of textures and structures. By another hand, the Surfynol is a commercial surfactant, is non-ionic, for that is necessary determine its critical micelles concentration (cmc) by the pyrene I1/I3 ratio method, before to prepare silica particles. One time known the CMC, a precursor gel was prepared via sol-gel process at room temperature using TEOS as silica precursor, NH₄OH as catalyst, Surfynol as template and H₂O as solvent. Then, the gel precursor was treatment hydrothermally in a Teflon-lined stainless steel autoclave with a volume of 100 mL and kept at 100 °C for 24 h under static conditions in a convection oven. After that, the porous silica particles obtained were impregnated with lithium to improve the CO₂ adsorption capacity. Then the silica particles were characterized physicochemical, morphology and structurally, by XRD, FTIR, BET and SEM techniques. The thermal stability and the CO₂ adsorption capacity was evaluated by thermogravimetric analysis (TGA). According the results, we found that the Surfynol is a good candidate to prepare silica particles with an ordered structure. Also the TGA analysis shown that the particles has a good thermal stability in the range of 250 °C and 800 °C. The best materials had, the capacity to adsorbing 70 and 90 mg per gram of silica particles and its CO₂ adsorption capacity depends on the way to thermal pretreatment of the porous silica before of the adsorption experiments and of the concentration of surfactant used during the synthesis of silica particles. Acknowledgments: This work was supported by SIP-IPN through project SIP-20161862.

Keywords : CO₂ adsorption, lithium as dopant, porous silica, surfynol as surfactant, thermogravimetric analysis

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