

Investigation of impregnation methods in amine modification of mesoporous solids

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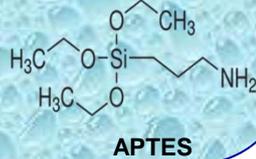


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Carbon dioxide is one of a number of gases known as green-house gases which is thought to contribute to global climate change. CO₂ released from fossil-fuel fired electric power generation plants is believed to be one of the main contributors to these emissions.

It was found that wet impregnation (WI) of APTES onto mesoporous solids adsorbed high amounts of CO₂. Therefore, it was decided to investigate other impregnation methods such as dry impregnation (DI). This study also highlighted that anhydrous solvent may be a crucial part of the amine modification synthesis. These topics were investigated.



Mesoporous silica, SBA-15 and mesoporous Al-SBA-15 were chosen as supports because of their large, accessible surface area and large pores which allows for the grafting of amine molecules.

Prepared sorbents were tested for CO₂ adsorption capacity using an on-line gas system with mass spectrometry detection, as shown in Figure 1.

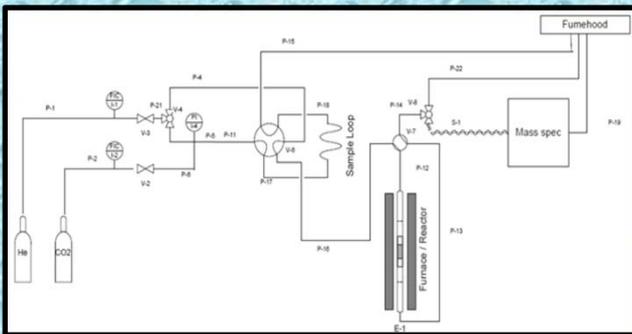


Figure 1: Laboratory Test Rig

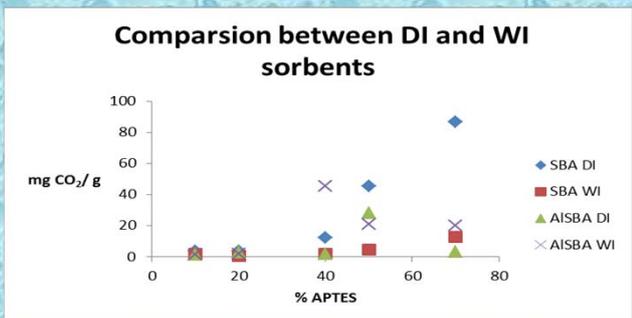


Figure 2: CO₂ adsorption capacity of prepared solids

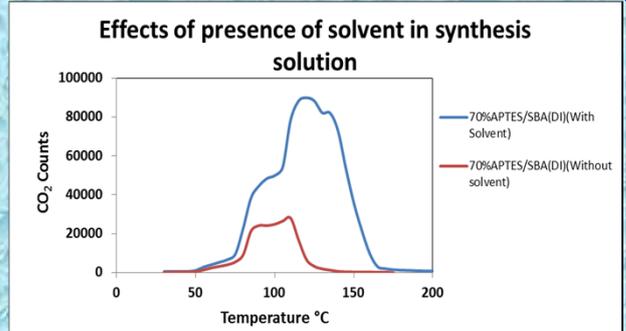


Figure 3: Effect of solvent in dispersing APTES for CO₂ adsorption

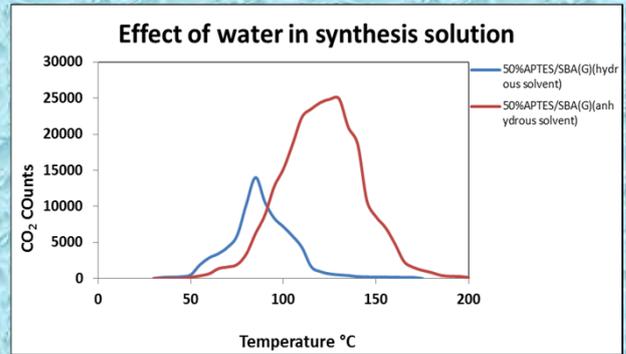


Figure 4: Effect of CO₂ adsorption when water is used in synthesis

- The presence of even the smallest amount of solvent greatly increases CO₂ adsorption abilities.
- Overall anhydrous solvent gave the best results,
- Dry impregnated prepared sorbents results in higher abilities to adsorb CO₂ rather than wet impregnation. This may be due to direct interaction between APTES and the mesoporous solvent leading to more uptake of APTES.

Acknowledgments

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