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Adsorption Isotherms and Kinetics of Ethanol onto Powder and Consolidated Activated Carbon

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Abstract: *Adsorption cooling systems (ACS) are a feasible alternative to vapor compression cooling systems as they use natural or low GWP refrigerants and can be driven by low temperature waste heat or solar energy. Consolidated adsorbents are one way to reduce the volume and improve the performance of ACS. In this study, we measured and compared the adsorption characteristics of ethanol onto powder and consolidated activated carbon (AC). The consolidated adsorbent was made of 80% AC powder and 20% binder of type Polyvinylpyrrolidone (PVP). The adsorption isotherms and kinetics were measured using a constructed constant volume variable pressure (CVVP) apparatus. The equilibrium adsorption uptake of ethanol per unit mass of adsorbent agreed fairly with that measured by thermogravimetric analyzer (TGA). We found that the adsorbed mass in consolidated material (powder + binder) were lower of 20% comparing to powder AC. Also, the adsorption rate in powder sample was faster than that of consolidated sample as consolidation decreased the permeability. The measured adsorption characteristics will be helpful in designing more compact and efficient adsorption cooling system.*

Keywords: Adsorption; CVVP; consolidated activated carbon; ethanol; isotherms and kinetics.