Abstract Format

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Enhancement of Post-combustion Carbon Capture via Adsorption Technology

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Abstract

Thermal power plants are the biggest source of carbon dioxide (CO_2) and any attempt to mitigate these emissions must address CO_2 capture from the combustion systems. One of the technological options to mitigate the issue of CO_2 emissions from power plants is through Carbon Capture and Utilisation (CCU) approach. The main advantage of CCU is that it can be retrofitted with the existing thermal power plant, through the post-combustion carbon capture route. CCU encompasses methods and technologies to remove CO2 from flue gas and followed by recycling of CO_2 for utilization. Adsorption technology is increasingly becoming popular for CO_2 capture because of its potential low energy consumption and their selective removal capability. At TNB Research, R&D on post combustion carbon capture through adsorption technology focuses on the development of adsorbent that is capable to selectively separate CO2 over other gases from coal fired power plant flue gas stream. The study was performed in a vacuum pressure swing adsorption system (VPSA) because the pressure of flue gas streams is approximately atmospheric. This paper provides an overview of the development of VPSA processes for CO2 capture from biomass based adsorbent materials, which are palm kernel shell (PKS) and coconut shell (CS). The adsorbents were chemically or physically activated to create the pores. The adsorbents were later impregnated with metal oxide to enhance its selectivity and adsorption capacity. The trend in process performance with respect to adsorbent characteristics and operating conditions were discussed in this paper. The impact of impurities in feed gases which are SO_x and NO_x on VPSA processes were also investigated. Finally, energy consumption in CO2 capture in VPSA processes is summarized. The process performance is mainly based on pilot scale of work of 25m^3/hr of flue gas feed flow rate.