CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The different surface treatments of AC, ACB, and ACP were performed to study their effects on adsorption performance of CO_2. It was found that the physical properties of the samples were not significantly affected by the treatments. The surface chemistry of the samples was improved after the modifications resulting in general enhancement in CO_2 adsorption.

The AC oxidized with HNO_3 showed an increase in CO_2 adsorption performance due to the presence of oxygen surface groups which can create the interaction with CO_2. It was found that an increase in the oxidative duration led to an increase in the CO_2 uptake of the AC. The amination at the suitable temperatures can increase CO_2 adsorption capacity of the AC. This could be attributed to the strong basic nature of nitrogen groups introduced during amination. The incorporation of nitrogen groups via amination after oxidative treatment can improve the ability of the aminated AC to adsorb CO_2, reaching maximum values of 1.76 mmol/g.

The CB carbon gave a very low adsorption capacity of 0.34 mmol/g, while there was no CO_2 adsorbed on the CP carbon. The commercial AC showed the highest amount of adsorbed CO_2 (1.35 mmol/g) since it presented the largest micropores among AC, CB and CP samples. The micropores of the raw carbon nano spheres (CB and CP) were created after carbonization and activation, therefore the amount of CO_2 uptake increased. Moreover, the CO_2 adsorption capacity of the CNSs was improved by the surface modification treatment. The amination with pre-oxidation method gave highest CO_2 adsorption capacity of 1.39 mmol/g and 1.28 mmol/g for CB and CP samples, respectively. Although CNS performed a fair CO_2 adsorption performance after carbonization and activation, the portion of micropore is relatively low compared to the commercial AC. This is needed to investigate further to find out suitable techniques to improve the porosity in the micropore ranges of the CNS in order to improve the CO_2 adsorption performance.

Due to the limitations of XPS analysis to identify specific surface functionalities, therefore conducting of TPD-MS is recommended for complementary

information. And the point of zero charge (pH_{PZC}) should be measured to investigate the acid-base character of the samples.