CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The samples impregnated with branched PEI showed a dramatic decrease in CO_2 adsorption performance due to the blockage of pores. An appropriate concentration of nitric acid and duration for oxidative treatment can increase CO_2 adsorption capacity of the activated carbon due to the introduction of hydroxyl, carbonyl and carboxyl functionalities through the oxidation process. These oxygen functional groups can create strong interaction with CO_2. However, oxidative treatment in nitric acid resulted in a slight decrease in the pore volume and surface area of the samples.

The impregnation with branched PEI after oxidative treatment might be a possible modification path way since the samples impregnated with PEI after oxidative treatment show a slight improvement of CO_2 adsorption capacity. However, the limitation of pore size and pore volume of the starting AC obstructed the dispersion of PEI into the pores, thus the physisorption of CO_2 was denied.

The desorption performance of the impregnated samples with branched PEI could not reach 100% regeneration when measured at low temperature (40 and 75 °C) due to the strong interaction of chemisorption between CO_2 and amine groups. For the series of samples by oxidative treatment, the tendency of desorption profile of AC and oxidized samples is similar, moreover, all samples were 100% regenerable.

5.2 Recommendations

Based on the results in this study, the following recommendation is suggested:

1. Due to the pore blocking problem occurring in this study, the starting AC should contain higher specific pore volume and proper pore size distribution, i.e. a combination of meso- and microporous, to achieve an impregnation of amine compounds at high concentration.

2. The wt% of PEI loaded onto the microporpus material is too high (10, 20, 30 wt%).

3. Other nitrogen treatment techniques should be employed to study the difference in surface chemistry of each technique and find the appropriate techniques.

4. Other oxidizing reagents should be tested to find the appropriate reagent that can enhance the interaction between oxidized AC and amine compound, consequently, enhance the CO_2 adsorption performance.

5. Because the XPS analysis presents some limitations to identify specific surface functionalities. Thus, TPD-MS should be employed to compensate with complementary information.

6. The acid-base character of the adsorbents should be probed by measuring the point of zero charge (pH_{PZC}) to ascertain the variation in surface chemistry of adsorbents.