

SOLUBILITY OF CARBON DIOXIDE IN IONIC LIQUIDS

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Sincerely,

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ABSTRACT

In this study, Carbon dioxide, (CO_2) absorption capacity in the mixture of 1-Butyl-1-Methylpyrrolidinium bis (trifluoromethylsulfonyl) imide with methanol, aqueous mixture of 2-methylpiperidine and aqueous 1-Butyl-3-Methylpyridinium tetrafluoroborat, $[\text{B3MPYR}][\text{BF}_4]$ was measured at constant temperature of 313K and at pressure range from 300-700psi. The concentration used for 1-Butyl-1-Methylpyrrolidinium bis (trifluoromethylsulfonyl) imide and methanol mixture were 80 wt% methanol (CH_3OH) + 20 wt% ionic liquid (IL) and 50 wt% CH_3OH + 50 wt% IL with total volume of 100ml. For another two ILs of the same concentration mixed with water instead of methanol. In this work, it was found that in all the ionic liquids used increasing the pressure will increase the CO_2 loading which is consistent with the theory as well as the behavior of other type of ionic liquids that have been published. The effect of ionic liquids concentration on CO_2 loading shows different behaviour for the three ILs mixtures studied. Increasing the ILs concentration for 1-Butyl- 1-Methylpyrrolidinium bis(trifluoromethylsulfonyl) imide with methanol mixture increases the CO_2 loading, however it decreases at pressure above 700 psi. Aqueous 1-Butyl-3-Methylpyridinium tetrafluoroborat shows contradict behaviour where increasing the ILs concentration decreased the CO_2 loading but at higher pressure, greater than 550 psi, increasing the concentration will increase the CO_2 loading. For the aqueous 2-methylpiperidine the CO_2 loading increased as the IL concentration increases. The bulkiness of IL molecules and the ability of ionic liquid to capture CO_2 itself will effect the solubility of CO_2 in ionic liquids. In comparison of CO_2 loading between the ionic liquids, anion density of the ILs will affect the CO_2 loading in the ILs. The results show that CO_2 loading in the ionic liquids were

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CHAPTER 1

INTRODUCTION

1.1. BACKGROUND OF RESEARCH

From years to years the amount of carbon dioxide, CO₂ release to the atmosphere is increasing. Based on “**Trends in global CO₂ emissions: 2015 Report**”, the CO₂ emitted to the atmosphere was increasing annually by 4% on average of two years starting from 2012 to 2013. For 2014 and 2015 the CO₂ emission increased by only 0.5% and almost stalled. At the same time, the world’s economy grew by 3% and this shown the relation between the growth in global CO₂ emissions and that in the economy. (Olivier, Janssens-Maenhout, Muntean, & Peters, 2015) For Malaysia, CO₂ emission trend shown gradually increase from 2010 onwards, with the CO₂ emission was 7.7 metric tons per capita and this value increased year by years.(Olivier et al., 2015)

Carbon dioxide is categorized as one of the main greenhouse gases. Increasing the greenhouse gases give a negative impact to the environment. CO₂ emission is release to the atmosphere by human activities. For natural sources CO₂ is removed in equal measures by other natural occurrences. The natural sources include photosynthesis in plants. But human activity is the main cause of increasing of CO₂ emission to the air. The main sources of CO₂ presence in the air from human activity come from the burning of fossil fuels for transportation or power generation, steel production, the production of petrochemicals, cement production, and natural gas purification.(Olivier et al., 2015) Recently, CO₂ concentration in the atmosphere has increased