CHAPTER V

CONCLUSION AND RECOMMENDATION

The results of this study show the possibility of using adsorbents on a model of combining fermentation and adsorption in a single process for adsorption of ethanol from ethanol-water mixture.

1) Silicalite, activated carbon, and XAD-2 have the ability to preferentially adsorb ethanol over water.

2) The silica gels are not adequate to use as an adsorbent in adsorbing ethanol from an ethanol-water mixture. These materials all contain an abundance of hydroxyl groups in their molecular makeup which are necessary for adsorbing water molecules to the surface of the adsorbents. In the case of silica gels treated by chemicals, their properties are not significantly different from untreated silica gels.

3) Good ethanol recovery can be achieved using silicalite and activated carbon, but not XAD-2. Of the materials studied, XAD-2 offers more adsorbency; however, because of its swelling ability and structure, care must be taken to prevent column flooding. Moreover, the surface of XAD-2 possesses a strong affinity for ethanol, resulting in difficult ethanol removal.

4) Both silicalite and activated carbon are suitable adsorbents to incorporate into the fermentation-separation process.

It is important to note that all data of the vapor phase experiment are not relevant to the liquid phase adsorption because vapor phase adsorption is conducted in a single component system whereas an ethanol-water mixture is used in liquid phase experiments. In other words, the vapor phase experiment uses pure adsorbate; so, the results only show the ability of the adsorbents to adsorb ethanol and water molecules in the adsorption process at different temperatures. Additionally, a consideration of the different value adsorption capacities between vapor and liquid phase experiments is that they have different adsorption phenomenon and adsorbate. Although there is no difference, in principle, between adsorption from the liquid and vapor phases since the thermodynamically adsorbed phase concentration in equilibrium with a liquid must be precisely the same as the saturated vapor, the

differences do arise in practice because liquid phase adsorption is almost consistently concerned with high adsorbed phase concentrations close to the saturation limit. Moreover, in adsorption from a binary fluid mixture; there may be an additional resistance to mass transfer associated with transport through the laminar fluid boundary layer surrounding the particle. Furthermore, when the second component is adsorbed, it may also affect the intraparticle diffusion rate (Ruthven, 1984).

These experiments were conducted on a model of the fermentation and adsorption process on a lab scale, resulting in the obtaining of limited information. Further study and the conducting of the experiments on a pilot scale are recommended to understand how heat adsorption will affect the adsorptive capacity and the rate of adsorption.