CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this work, the 1/16″ and 1/8″ 4A molecular sieve size were prepared under hydrothermal conditions to extend the degree of deactivation to more than those in the previous work. From the TGA, the static adsorption capacity of both fresh and deactivated adsorbents was investigated to find the changes of the percentage of deactivation in which was found that both adsorbents can be deactivated to over 70-80% greater than the previous work to about 5 times.

The SEM images have shown that the relationship between the % crystal size reduction for both 1/8" and 1/16" 4A molecular sieves can be related to the % loss of adsorption capacity by equations $y = 0.561x$ and $y = 0.516x$ respectively.

The mass transfer coefficients were calculated for each adsorbent to be used in the mass balance equation, and they changed with the degree of deactivation as shown in Figure 5.1 below.

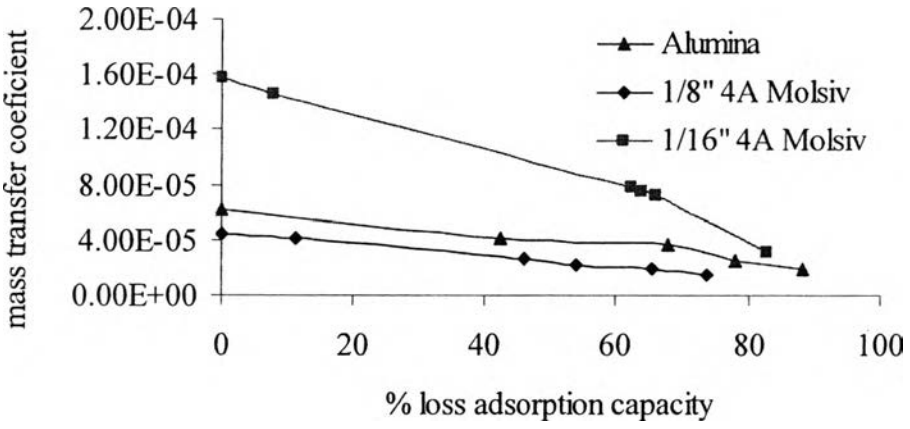

Figure 5.1 Change of mass transfer coefficients with the degree of deactivation.

The void fraction and mass transfer coefficient can be related with the degree of deactivation by the equations as shown in Table 5.1

Table 5.1 Mass transfer coefficients and void fraction function as a degree of deac vation

Adsorbent	**Mass transfer coefficients (k)**	**r^2**
Alumina	$y = 1.345x10^{-9} D^2 - 3.543x10^{-7} D + 6.169x10^{-5}$	0.982
1/8" Molsiv	$y = 8.449x10^{-10} D^2 - 3.555x10^{-7} D + 4.525x10^{-5}$	0.996
1/16" Molsiv	$y = 7.212x10^{-9} D^2 - 7.993x10^{-7} D + 1.557x10^{-4}$	0.982
Adsorbent	**Void fraction (ε)**	**r^2**
Alumina	$y = 2.834x10^{-7} D^2 - 1.597x10^{-5} D + 0.3698$	0.996
1/8" Molsiv	$y = 3.348x10^{-8} D^2 - 4.606x10^{-6} D + 0.3448$	0.996
1/16" Molsiv	$y = -4.604\ x10^{-4}\ D^{0.028} + 0.3297\ ;\quad 0 \le D \le 62.39$ $y = 0.369D^2 - 1.106x10^{-3} D + 7.439x10^{-6};\quad 62.39 < D \le 82.95$	1 0.858

The Aranovich-Donohue (A-D) for Toth model can fit well with the adsorption isotherms obtained from the experiments for a wide range degree of deactivation. And the adsorption isotherm can be predicted by an equation written as a function of the degree of deactivation. Then, the breakthrough time at any degree of deactivation for each adsorbent can be predicted.

The modified mathematical model can be used for prediction the breakthrough time, which in this work, the difference between the experimental and theoretical breakthrough time for fresh adsorbent was about 1.2 hours, and for the deactivated adsorbent (88.3% deactivated alumina, 73.75% deactivated 1/8" molecular sieve, and 82.95% deactivated 1/16" molecular sieve) was 1.75 hours.

5.2 Recommendations

In this work, the deactivated adsorbents were acceratingly aged under the conditions that were different from real commercial conditions. Thus, the deactivation can not be written as a function of real time of operation. So, in order to more useful, the data from the real commercial operation at all time of operation should be taken to verify those obtained from the experiments and model. And, the breakthrough model in this work can predict the breakthrough curve for any degree of deactivation of each adsorbent. However, the real degree of deactivation for each adsorbent at the same time can not be known. So, if the degree of deactivation for each adsorbent is written as a function of real operation time as above suggestion, the programming can be used for prediction the change of breakthrough curve with the real time of operation because the real combinations of adsorbent at that time can be specified.