CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The dielectric-barrier discharge reactor is another feasible means of activating the methane molecule for initiating its conversion. The reactions are achieved by the collisions between high energetic electrons, released from the metal electrode, and the methane molecules inside the discharge gap to form higher hydrocarbons. Moreover, ethane and propane were added to the system as reactants is order to determine their effects on the methane conversion. From the experimental results, the conclusions which can be drawn are as follows:

1. An increase in the external voltage supplied to the reactor caused an increase in the electrons of the discharges and, therefore, caused more successful attack of the molecules of reactants and thus convertd them into more active species suited for reactions.

2. Upon a decrease in the reaction residence time, the conversion of reactants decreased because the molecules had less time for collision with the discharges.

3. Ethane added to the methane system would convert to activated molecules in the discharge environment and could activate methane better than the discharges. This leaded to more methane conversion with an increasing percentage of ethane in the system.

4. The presence of propane with methane appeared to act as an inhibitor for methane conversion because the cracking rate of propane to

methane (and ethane) was higher than the conversion rate of methane to other products.

5. In the pure methane system, its coupling produced ethane as the primary product and propane as the next product with molecular hydrogen as a by-product. Because of a lot of hydrogen gas in this system, olefins formation was suppressed.

6. In the pure ethane or propane systems, the dehydrogenation of them to form ethylene or propylene were the main products. Hydrogen gas, a by-product, would allow further reaction to produce paraffins.

7. No C_5+ hydrocarbons were found in the system.

8. The rates and mechanisms of the reactions depended on the flow rate, voltage and composition of reactants.

9. Because the orders of the reactants in the rate of reaction models were low, the conversion rate increased only slightly with an increase in the partial pressure of reactants. Thus, to increase the rate significantly, the value of the rate constants have to be increased by increasing in the applied voltage.

5.2 Recommendations

From the experimental results, it can be stated that the conversion of the reactants was relatively low. Hence, it is obvious that an improvement in the efficiency of this dielectric-barrier discharge reactor will be needed to produce an economic chemical process system.

Another interesting point that is needed to be investigated further is about the ways to control the mechanisms that occurred in those systems by using the suitable catalysts. This may lead to the effective production of some important hydrocarbons. And a more detailed investigation in large range of all conditions will help to determine effective strategies for promoting desirable mechanisms.