CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The pyrolysis of waste tire has been studied in this research. The goals were to maximize the yield of light olefins (ethylene and propylene) in the gaseous product by varying the pyrolysis conditions and the amount of ruthenium metal loaded on the zeolytic support in order to investigate their effects on the quality and quantity of pyrolysis products. In this work, the pyrolysis of waste tire with its life time more than 50,000 km was carried out in a bench-scale autoclave reactor at room temperature to the final temperature, which was varied from 500-700°C, with a 10 °C/min heating rate in atmospheric pressure. The nitrogen flow rate was also controlled in order to vary the residence time of the reaction. Other parameters; particle size, holding time, heating rate, the amount of samples and catalysts, were fixed at 8-18 mesh, 90 min, 10°C/min, 30 g and 7.5 g, respectively. The catalysts used in this research were composed of 2 commercial zeolites (HMOR and HZSM5) and noble metal (Ruthenium) loaded on each zeolite using incipient wetness impregnation method to obtain the bifunctional catalysts with different amounts of metal loading.

For the effects of operating conditions; pyrolysis temperature and residence time, it can be concluded that gaseous products increased with increasing temperature at a low residence time. When the residence time is prolonged, the yields to gas products decreased whereas the liquid fractions increased as the temperature was increased. For light olefins production, it was found that the shorter residence time, the higher the yield of light olefin was obtained. So, light olefins production for non-catalytic pyrolysis was favored at an optimum temperature with a short residence time. Moreover, high temperature and long residence time promoted the formation of heavy hydrocarbon molecules, especially poly-aromatic hydrocarbons. For the catalytic cases, total light olefins production showed the maximum yields at

0.7% loading of ruthenium metal. For the different supports, Ru/ZSM5 showed the lower yield to liquid product whereas the yield to gas product was comparable with Ru/MOR. Moreover, it gave the highest selectivity to propane whereas the selectivity to light olefins went to minimum due to its high selectivity toward the cracking of terminal C-C bond.

The bifunctional catalysts can reduce the oil yield and produce a higher amount of gas yield. Moreover, it can narrow the carbon distribution of pyrolysis oil as compared with non-catalytic pyrolysis. It also reduced heavy fractions such as heavy oils resulting in an increase in the yields to gasoline and kerosene fractions, which reached the maximum at 0.7% loading of ruthenium metal.

The solid yields for both catalytic and non-catalytic cases remained constant at about 47.5 %wt by average because the tire was completely cracked into pyrolysis product in the pyrolysis zone at the same condition and no further cracking of solid product at the catalytic zone was possible.

5.2 Recommendations

According to the results, the production of light olefins by ruthenium loaded on zeolytic supports has a limit. The yields to these fractions are not much improved. But, the yields to petroleum fractions in liquid product and asphaltene reduction are very interesting for studying further using other characterization method.