CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Since valuable petrochemicals can be produced from waste tires, the waste tire pyrolysis was carried out in the bench-scale autoclave reactor at the atmospheric pressure to investigate the effects of the Ni/HBETA, modified Ni/HBETA (NiMo/HBETA, and NiW/HBTEA), and modified Co/HBETA (CoMo/HBETA, and CoW/HBETA). Modified Ni/HBETA and modified Co/HBETA catalysts with the fixed amount of 5 wt% Ni and Co, were prepared by impregnation technique. The amount of the second metals (Mo and W) was varied to 10 and 20 wt% on the catalyst.

In order to increase the quality and quantity of the waste tire pyrolysis products and reduce the cost of catalyst, the non-noble metals were chosen to use in this research due to the low prices, especially Ni and Co that have good activity on hydrogenation and ring-opening. The results showed that the modified Ni/HBETA and modified Co/HBETA catalysts can be used to improve the qualities and quantities of the pyrolytic products. Moreover, the modified Ni/HBETA and modified Co/HBETA catalysts on HBETA zeolite produced the good quality of pyrolytic oil, which contained high saturated hydrocarbons with a low sulfur content in oils. It was also found that the bimetallic catalysts (NiMo, NiW, CoMo, and CoW on HBETA) had the higher efficiency to produce the high qualities of the pyrolytic oil than the monometallic catalysts (Ni/HBETA or Co/HBETA). The catalysts with high amounts of the second metals (5Ni20Mo, 5Ni20W, 5Co20Mo, and 5Co20W on HBETA) also gave the higher qualities of the pyrolytic products than the catalysts with 10 wt% of Mo or W. For the modified Ni/HBETA catalysts, especially 5Ni20Mo/HBETA showed the best performance among the others. 5Ni20Mo/HBETA had the good cracking ability because it gave high gas to liquid ratio, and it can produce the high yield of olefins and cooking gas in the pyrolytic gas. The pyrolytic oil obtained from 5Ni20Mo/HBETA also had high saturated hydrocarbons (48.6 wt%) with low sulfur contents (0.82 wt%). The reason why

5Ni20Mo/HBETA can be used to improve the quanlity and quantity of the pyrolytic oil was due to the good interaction between Ni and Mo. For the modified Co/HBETA catalyst, both bimetallic catalysts (CoMo/HBETA and CoW/HBETA) showed good interaction between the two metals. The pyrolytic gases obtained from 5Co20Mo/HBETA and 5Co20W/HBETA also had a high quality and quantity of the petrochemicals such as light olefins and cooking gas. 5Co20W/HBETA gave a high content of saturated hydrocarbons (63.8 wt%) in the pyrolytic oil, and decreased the sulfur content to 0.51 wt%. It can be concluded that the bimetallic catalysts can be used to improve the quality and quantity of the pyrolytic product. Moreover, 5Co20W/HBETA showed the best hydrodesulfurization ability among the other bimetallic catalysts because it can reduce the sulfur content of the pyrolytic oil from 1.36 (non-cat) to 0.51.

5.2 Recommendations

For the future experiments, the percentage of the second metal (Mo and W) can be varied in a narrow range to obtain the specific loading percentage that can give the better quality and quantity of the pyrolytic products. The other acid support zeolite could be used to substitute HBETA zeolite for a better value of the products.