CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

HMF and furfural are suitable starting materials for the preparation of hydrocarbons (C_9-C_{15}), which have the same property as petroleum fuels and their production was therefore investigated in this study. Cassava waste was used as a feedstock in this study to determine the effect of carbon based catalyst and the suitable conditions for the production of these two intermediates for fuel production. In addition, in order to understand the role of the catalyst in the reaction pathways for HMF and furfural production, conversions of cellulose, hemicelluloses, and monomers of sugars were investigated. The results can be summarized as follows.

1. The carbon based catalyst can be applied in the process of HMF and furfural production from cassava waste. The production yield of HMF and furfural was higher 10 % when the process was catalyzed by the carbon based catalyst. The activity of heterogeneous carbon based acid catalyst is comparable to that of the homogeneous acid catalyst such as sulfuric acid. Furthermore, this catalyst showed high stability and low deactivation.

2. The suitable conditions for HMF and of furfural production from cassava waste were found. The suitable condition of medium was 10:90 (w/w) of acetone/DMSO (70:30 w/w) to water mixture (2 wt % of dry cassava waste). That is for 0.1 g of cassava waste. The suitable dose of catalyst was found to be 0.05 g. The suitable reaction temperature and reaction time were at 250°C and 1 minute. At the above condition, 12.1% and 2% yield of HMF and furfural from cassava waste were obtained.

3. Based on the investigation of the reaction pathways of biomass conversion HMF and furfural, the carbon based catalyst was found to promote hydrolysis of cellulose and hemicellulose to glucose and xylose, and promote the dehydration of fructose and xylose to HMF and furfural according to the diagram shown in Figure 5.1. However, this catalyst can neither promote isomerization from glucose to fructose nor dehydration from glucose to HMF and AHG.

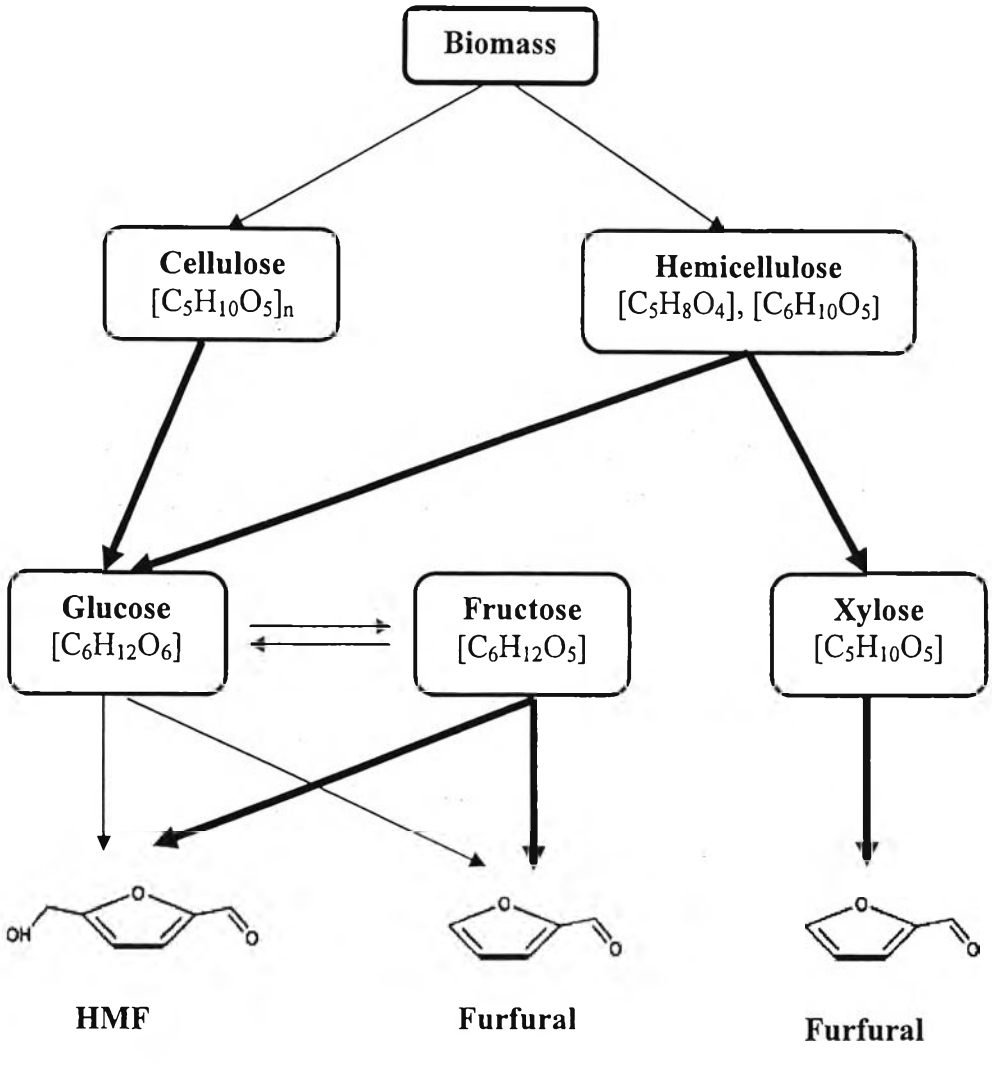

Figure 5.1 The effect of carbon based catalyst on pathway of HMF and furfural production from biomass

5.2 Recommendations

1. To improve the production yield of HMF and furfural from biomass, some amount of base catalyst should be added to promote the isomerization from glucose to fructose with carbon based catalyst.

2. The other product that occurs from the production of HMF and furfural from biomass such as levulinic acid, formic acid, phenol, aldehyde and gas should be determined to confirm the result of the catalyst activity.

3. The production of HMF and furfural form biomass should be operated in two separate steps. The first is hydrolysis biomass to monomer sugar which should be produced in high temperature process (230-250 °C). In the second step the dehydration

of monomeric sugar to HMF and furfural should be produced in low temperature process (200-220°C) to minimized HMF and furfural decomposition at high temperature.