

Niti Ninchawee 2009: Catalytic Upgrading of Bio-oil from Pyrolysis of Soybean Cake using HZSM-5/MCM-41 Catalysts. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Apinya Duangchan, Ph.D. 72 pages.

Bio-oil from soybean cake was produced by pyrolysis in a fixed bed reactor and characterized in terms of high heating value and chemical class composition. Soybean cake collected from waste of soybean milk production was dried and ground until its diameter was 0.250-0.850 mm. Pyrolysis reaction took place under nitrogen atmosphere with a heating rate of 2 K min^{-1} in a semi-batch reactor from room temperature to 673 K and 250 g of biomass was used in each reaction. The yield of bio-oil was 48%wt of biomass and the high heating value (no water) of organic phase of the bio-oil was 19.9 MJ/kg of the organic phase. Bio-oil contained 29%wt of aliphatic fraction and 21%wt of asphaltene.

MCM-41 and HZSM-5 catalysts were used to upgrade bio-oil properties and mixtures of MCM-41 and HZSM-5 at ratios of 1:1, 1:2 and 2:1 were investigated their activities. Upgraded bio-oil by MCM-41, the bio-oil showed the highest high heating value of 38.5 MJ/kg of the organic phase of bio-oil at 673K. Moreover, aliphatic compounds increased from 29 to 47%wt and asphaltene compound decreased from 21%wt to 16%wt. The effect of sequence of catalysts packing was investigated by using of two conditions; order packing and random packing. MCM-41 and ZSM-5 with the ratio of 1:1 showed the best performance among other ratios. In addition order packing showed the best performance by increasing high heating value to 38.5 MJ/kg of the organic phase of bio-oil. The optimum upgrading temperature is 673K. Spent MCM-41 and HZSM-5 were regenerated by heat at 773 K in the presence of air for 12 h to remove the coke deposited. MCM-41 which was used and regenerated two times showed no significant change in its activity.

Student's signature

Thesis Advisor's signature

____ / ____ / ____