Catalytic Process to Hydrocarbons from Renewable Compounds
by Zeolite Catalysts

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Abstract

The essentially, an crisis energy is actually addressed to the shortage of hydrocarbons compounds which mainly comprise of carbon and hydrogen elements. To date, the world demands on these hydrocarbons compounds are mostly supplied from petroleum oil as the main source for fuels or chemicals. This fossil source is then processed in the refinery processes plant to recover many fraction of useful hydrocarbons such as LPG (C₃-C₄), gasoline (C₅-C₁₀), diesel fuel, kerosene fraction, etc. Among the fuel product fractions, gasoline fraction is highly desired with the recovery over 45 % yield. However, due to the depletion of petroleum oil indicated by the monotonously increasing of oil price yearly, it is not wise, if the producing of hydrocarbons is continuously depending on this oil which is non-renewable source without considering the additional resources with more sustainable in supply and environmental friendly. So, the route of hydrocarbons productions from a renewable resource material as the original materials is the best way for alternative solutions. One of the promising renewable resource is considered coming from the fermentation process that produce some organics compounds (acetone-butanol and ethanol).

So, this research work is to devote to the catalytic route to synthesize many hydrocarbons from the organic polar compounds with H-ZSM-5 based catalyst and is focused on the formation of gasoline range hydrocarbons. However, the main problem of catalytic process is the choice of catalyst which must have a high performance (activity, selectivity and stability). The suitable catalyst is decided on the zeolite materials because they have a high acidity and a homogeneous pore structure. Generally, the choice of ZSM-5 zeolite as catalyst is relevant for the reaction, because it has a high acidity which can accelerate many hydrocarbons reactions. The second choice is the utilization of natural zeolite as the catalyst with the consideration is that this type of zeolite is tremendous amount in Indonesia, even if comparing to ZSM-5 zeolite which is the synthetic zeolite with the availability is very limited. However, natural zeolite has a wide pore dimension than that of ZSM-5, making its catalytic properties is not suitable for the producing of C₅-C₁₀ gasoline hydrocarbons. Therefore, natural zeolite is needed to slightly modify by some additions of boron oxide (B₂O₃) by a impregnation technique/method which the hope that these modifications can attain a appropriate the pore structure adequately. The third choice is a hybrid catalyst prepared by the physical
mixing of H-ZSM-5 and modified natural zeolite. With three options revealed above, the optimization of catalytic features should perform to get the best catalyst.

If the best catalyst can be found, the optimization of reaction condition should be carried out to find the highest yield of gasoline fraction using this catalyst. The target of the gasoline fraction yield is expected more than 70%. The test of catalyst durability should be performed as well at the best fraction condition, because the reaction has tendency on the catalyst deactivation during several hours time on stream.