Production of Biodiesel from Peanut Oil by Transesterification

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Abstract：

Recently, because of increase in crude oil prices, limited resources of fossil oil and environmental concerns, there has been a renewed focus on vegetable oils and animal fats to make biodiesel. Continuous and increasing use of petroleum will intensify local air pollution and magnify the global warming problems caused by CO_2. In a particular case, such as the emission of pollutants in the closed environments of underground mines, biodiesel fuel has the potential to reduce the level of pollutants and probable carcinogens. As a kind of alternative renewable biofuels, development of biodiesel is helpful to realize sustainable development of human being.

A potential diesel oil substitute is biodiesel, which is produced by tranesterification of reacting a vegetable oil or animal fat with an alcohol such as methanol with catalyst. Diesel engines operated on bio-diesel have lower emissions of carbon monoxide, unburned hydrocarbons, particulate matter, and air toxics than those when operated on petroleum-based diesel fuel. Usually, a strong base, acid and enzyme such as sodium or potassium hydroxide, sulfuric acid and lipase are used as catalyst. In addition, supercritical fluid technology is also used in production of biodiesel.

In our research, production of biodiesel from peanut oil with alkali catalyst by transesterification was discussed, and effects of operational parameters. In our experiment, the peanut oil was purchased from Lu-hua Co.Lit. China. KOH and methanol were purchased from Beijing Chemical Agents Company in China. Transesterification reaction was carried out in flask. The peanut oil reacted with methanol with KOH catalyst at certain temperature. The effects of operation conditions such as molar ratio of peanut oil to methanol, amount of catalyst and temperature on biodiesel were discussed. Biodiesel conversion rate and components were measured by GC-MS.

The results showed as follows:

The effects of molar ratio of peanut oil to methanol on conversion rate of biodiesel were discussed, As reaction time increased, conversion rate increased using different molar ratio of peanut oil to methanol. Before 20 min, conversion rate

increased fast. After that, conversion rate became stable with increasing reaction time. Also, it has been found that conversion rate was higher than that using other molar ratios of peanut oil to methanol when molar ratio of peanut oil to methanol was 6:1. Therefore, an appropriate molar ratio of peanut oil to methanol was 6:1, and reaction time was 20 min.

The effects of NaOH amount on conversion rate of biodiesel were invsetigated, the results made it clear that conversion rate increased gradually with increasing NaOH amount. Conversion rate reached the highest when NaOH amount was 1%. After that, conversion rate decreased as NaOH amount enhanced. When NaOH amount was lower, Transesterification reaction can not been carried out totally due to shortage of catalyst. However, when NaOH amount was higher, too much NaOH amount made the viscidity of reaction solution increased. So, the optimal NaOH amount was 1%.

In the case of the effects of reaction temperature on conversion rate of biodiesel, it has been found that conversion rate of biodiesel increased when reaction temperature increased. The reason was that lower reaction temperature was not helpful to finish transesterification reaction of biodiesel production, but higher reaction temperature was benefit to transesterification reaction. When reaction temperature was larger than 45℃, conversion rate reached more than 82%. Considering boiling point of methanol and production cost, 45℃ was chosen as an appropriate reaction temperature.

By analyzing the components of biodiesel by GC-MS analysis, it was found that biodiesel product was consisted of various kinds of fatty acid methyl esters by GC-MS analysis, among which relative contents of palmitic acid methyl esters and linolenic acid methyl esters were higher. In addition, glycerol was obtained as a by-product after transesterification. Compared with diesel oil, main properties of biodiesel are shown to be well confirmed to that of No. 0 mineral diesel oil.

Keywords：peanut oil；biodiesel；transesterification；fatty acid methyl esters

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