METHANOLYSIS AND ETHANOLYSIS OF SUNFLOWER OIL CATALYZED BY SILICA SUPPORTED 12-TUNGSTOPHOSPHORIC ACID

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1. Introduction– Biodiesel, with a very low toxicity and biodegradability, is one of the most promising alternative fuels. It is a clean fuel produced from transesterification of vegetable oils, animal fats and recycled cooking oils and fats in the presence of methanol. It is known that the acids catalyze the transesterification reaction without soap formation unlike basic catalysts. Moreover, the use of solid acid catalyst is important in the catalysis field for its recovery and reuse.

On the other hand, the use of an alcohol as ethanol coming agricultural source (betteraf, sugar cane…) can be also a promising alternative to methanol use. In addition, a biodiesel consisting of fatty acid ethyl esters presents a higher cetane number and a higher calorific value than fatty acid methyl esters [1, 2].
In this context, the catalytic activity of 12-tungstophosphoric acid (HPA) in homogeneous and heterogeneous (30 wt% HPA /SiO_2) systems was evaluated for triglycerides of sunflower oil transesterification with methanol and ethanol to form fatty acid alkyl esters (biodiesel) under mild conditions. The effect of alcohol/oil molar ratios (14.5/1, 29/1, 43.5/1 and 58/1) on the biodiesel yield was examined in the case of both alcohols.

2. Experimental – Methanolysis or ethanolysis of triglyceride refined sunflower oil was carried out in a 250 cm^3 glass reactor at atmospheric pressure under reflux conditions with constant stirring (300 rpm) [3]. In a catalytic test experiment, for each quantities of alcohol /oil molar ratio, 2.61 g of sunflower oil were added, heated up to 60°C in the case of methanolysis and 70°C in the case of ethanolysis, 0.25 g of catalyst was then added to reaction mixture. After 3 h of reaction, the fatty acids alkyls (methyl or ethyl) esters were extracted with chloroform and analyzed by GC gas chromatograph (Agilent Technologies 7890A) technique.

3. Results and Discussion- The results (table 1) showed that for an alcohol/oil molar ratio of 1/29, biodiesel yields obtained from methanol are higher than those obtained from ethanol, with 63 against 37% for the homogeneous system and 60 against 21% for the heterogeneous system.
The study of the influence of the alcohol /oil molar ratio on biodiesel yield in the case of supported catalyst (30 wt% HPA /SiO_2) showed that the highest yields of biodiesel 60 and 29% were obtained with molar ratios of 29/1 and 43.5/1 for the methanolysis and ethanolysis respectively (Table 2). A high alcohol/oil molar ratio (>43.5/1) makes difficult the separation glycerol-esters [4].