

Heterogeneous Mixed Metal Oxides (MMO's) - Future prospects for the production of Renewable Sustainable Energy biodiesel

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Abstract - Biodiesel is synthesised from different feedstock like edible, non-edible seed, animal fat etc via different transesterification technology. Heterogeneous mixed metal oxides (MMO's) transesterification is account to be a green technological process. During the heterogeneous metal oxides process neither catalyst recovery non aqueous treatment steps is required and very high yields of methyl esters can be obtained. However the main of the investigation is how increases the reusability of heterogeneous mixed metal oxide (MMO's) and reduced the operational cost of the biodiesel. Different types of heterogeneous MMO's and solid MO like CaO-MgO, MgO-ZnO, SO_4^{2-} -ZnO were studied. This review explains the various types of the heterogeneous mixed metal oxide and their activity in the production of methyl ester.

Keywords – Edible, Non- edible seeds, Heterogeneous Metal Oxide, Catalysis, Metal oxide Catalysis, Transesterification Technology.

I. INTRODUCTION

Transesterification process is replacing the alkoxy group of an ester compound by another alcohol in the presence of acid, base, solid catalysis or enzyme. It is the process of conversion of fatty acids of seed oil to alkyl groups of the methyl ester, which is usually 8-24 in carbon length. During the transesterification process large edible, non-edible seed oil or algal oil is reduced to its size, maintain the kinematic viscosity, flash point, cloud point, pour point and other physico-chemical properties to near diesel fuel and increase the performance and emission characteristics of diesel fuel in diesel engine.

This short review attempts to summarize the development, scope and types of transesterification process over the last 20 years. Now today numerous research articles have been published on the development of bio based oil by the new process heterogeneous metal oxide and enzymatic reactions.

Rudolph Diesel (1892) invented the first diesel engine with the intension of running it on vegetable oils [1]. Biodiesel is a mixture of mono-alkyl esters of long chain fatty acids, which is made up of between 8-24 carbon atoms. Biodiesel is generally produced from edible, non edible seeds, plants, animal fats, algae etc. [2]. Produced biodiesel can be used in diesel engines without any modification of the engine [3]. Generally, in transesterification process three moles of alkyl esters are formed as a result to the formation of diglyceride, monoglyceride and glycerin is the main product of biodiesel production [4, 5] figure 1.

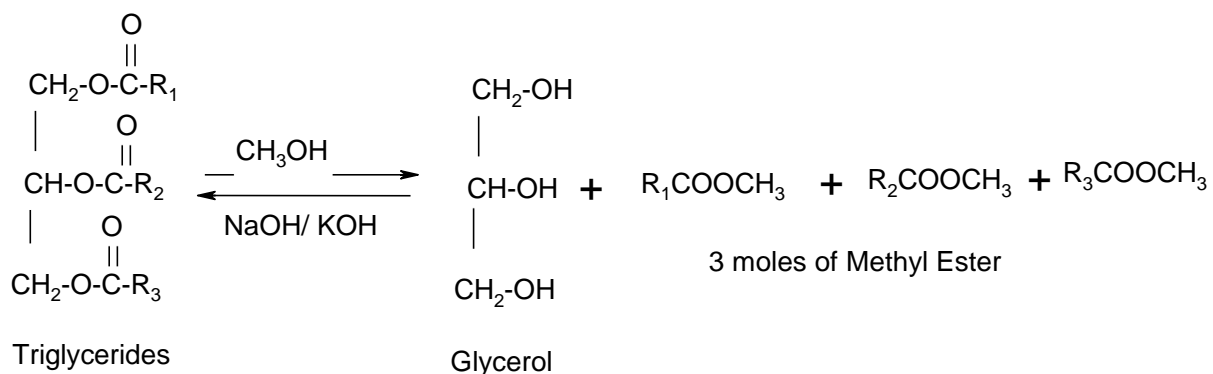


Figure 1. Transesterification reaction of triglycerides with Methanol in presence of acid or base

Few years back homogenous catalysts such as strong acid or base is used for the transesterification process transesterification and the alkali catalysts, such as NaOH or KOH have been used for the reaction [6] figure 2.

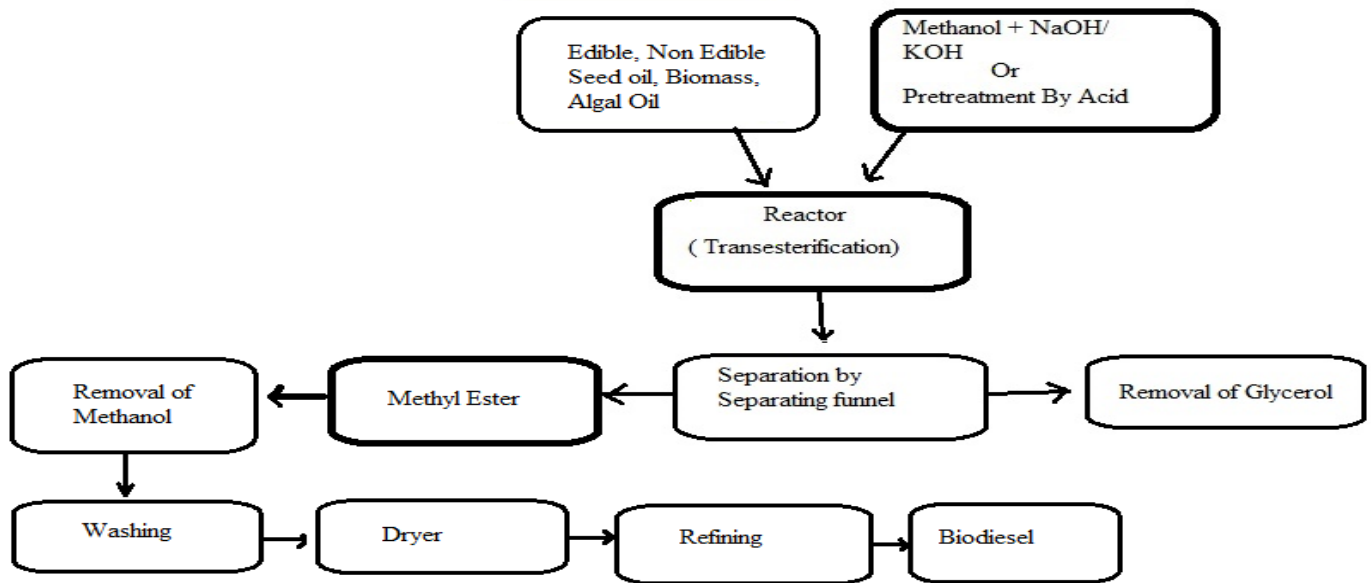


Figure 2. Flow diagram of Biodiesel Production [6].

II. TYPES OF TRANSESTERIFICATION REACTION

For increases the efficiency of biodiesel, reusability of catalysis, reduces the operational cost of biodiesel there are following transesterification technologies:

- Acid-base transesterification
- Enzymatic transesterification
- Heterogeneous Mixed Metal Oxide (MMO) Catalysis.

III. TRANSESTERIFICATION- HETEROGENEOUS MIXED METAL OXIDE (MMO'S) OR SOLID METAL OXIDE CATALYSIS

Solid Metal oxide catalyst is a fusion of heterogeneous metal-metal oxide (MMO) which is derived from the different types of metal from like alkali-metal, transition metal, alkali-earth metal, rare earth metal or noble metal [7,8]. The Heterogeneous mixed metal oxide (MMO) catalysis makes the product simple to separation easier and if catalysis is remains in the process it can be reuse [9]. The uses of heterogeneous catalysis are affectionate on the environment and do not produce the soaps in the production of biodiesel. Many scientist have been reported the two types of numerous heterogeneous metal oxide (MMO) catalyst for the biodiesel production one is basic metal oxide catalyst like base Metal-ZnO, CaO, PbO, PbO₂, Ti₂O₃, MgO, SrO₂, La₂O₃ and modified zeolite catalyst [10-14] other is acidic MMO such as sulphated-ZrO₂ [15]. Literature also reported that Sn(IV) is also used as a heterogeneous MMO catalyst in the combination of SnO - TiO /SiO catalyst [16]. It has been shown that alkaline

based MMO's catalysts like CaO-MgO, MgO-ZnO, CaO-ZnO, CaO- La₂O₃ etc are the surpassing over the bulk MMO like CaO-MgO-ZnO etc. for the physicochemical properties and reusable properties and efficiency of the MMO's catalyst in the biodiesel production [17, 18]. Figure 3 shows a simplified flowsheet of preparation of heterogeneous MMO's and figure 4 show the preparation of heterogeneous mixed metal oxide catalysis (MMO's). Heterogeneous MMO's activities increase the production of biodiesel and their stability.

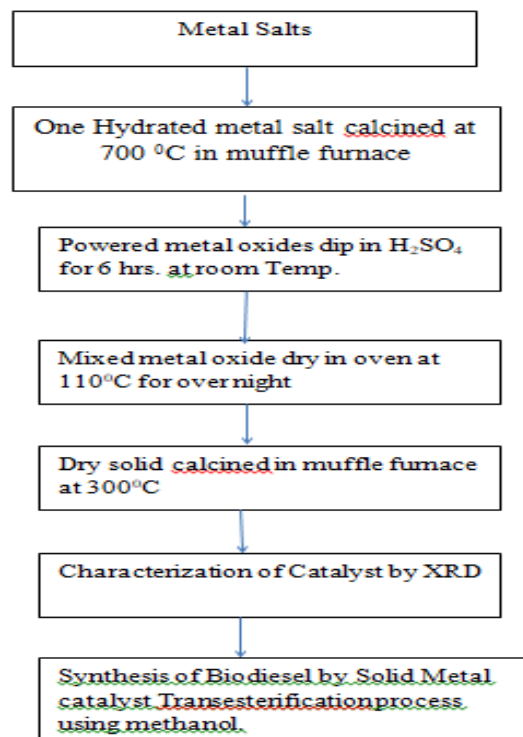


Figure 3: Preparation of heterogenous metal oxide [19]

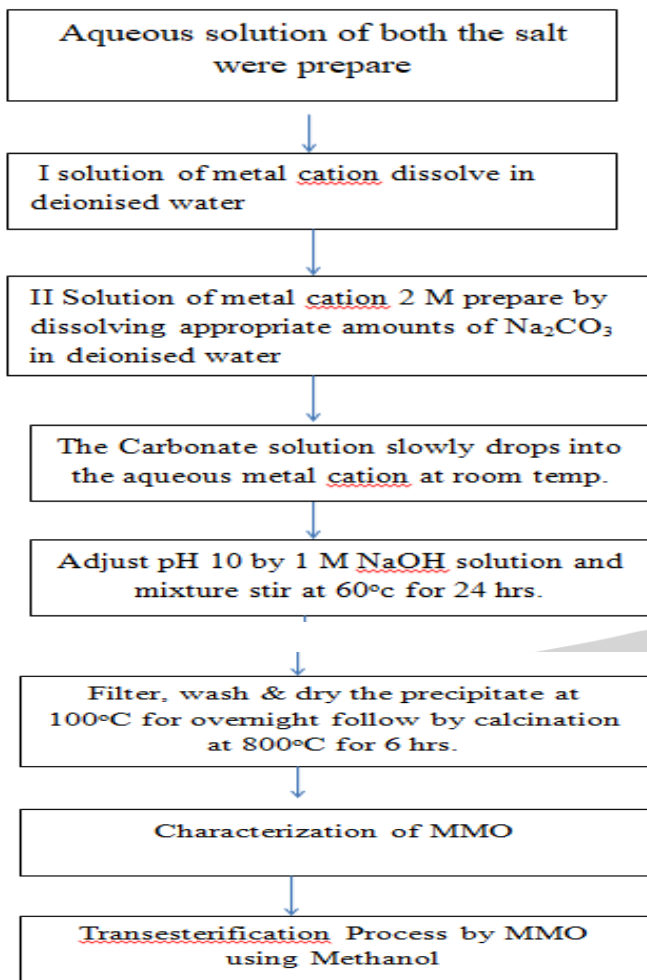


Figure 4: Preparation of heterogenous mixed metal oxide (MMO) by co-precipitation method[20].

IV. FUTURE CHALLENGES

To achieve the potential of heterogeneous MMO's catalysis, additional research and development are needed. Some of the important challenges for future heterogeneous MMO research are given below:

- Selectivity and Specicity of the solid MO's and MMO's
- Understand the proper working of MMO's
- Improvement of catalysis quality.
- Upgradation of catalysts for bio-oil production.
- Development of the reactor for the transesterification with heterogenous MMO's reaction.

V. CONCLUSIONS

A heterogeneous MMO's catalyst is the optimistic materials. Heterogeneous MMO's catalysis is reusability & high tolerance to water content. The use of heterogeneous MMO's and solid MO's catalysis reduce the operational cost of biodiesel production and increases the efficiency and production of biodiesel.

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