CHAPTER I
INTRODUCTION

Nowadays, the demand in petroleum, mineral coal, and natural gas are increasing while the amounts of petroleum resources are largely decreasing because of a rapidly increasing of population and a growth of industrial. In addition, the impact of environmental pollution of exhaust gases from petroleum fuels is important. Therefore, alternative energy resources are more interesting. Biodiesel is one of alternative fuels that has received more attention.

Biodiesel is biodegradable renewable fuel derived from vegetable oils, animal fats, or used cooking oils. Biodiesel has similar combustion properties to fossil diesel but it is non-toxic and clean-burning, which can decrease the exhaust emissions of CO_2, SO_X, and unburned hydrocarbon. On the other hand, biodiesel has good properties; for example, low volatility, flammability, good transport and storage properties, and high cetane number.

Biodiesel is produced by transesterification reaction in which triglyceride molecules present in vegetable oils or animal fats react with an alcohol in the presence of a catalyst to form ester (biodiesel) and glycerol. Different types of alcohols such as methanol, ethanol, propanol, and butanol can be used in order to produce biodiesel. However, methanol is the most widely used due to its low cost and industrial availability.

Catalysts mainly used for biodiesel production can be classified according to its chemical presence in the reaction into homogeneous catalysts and heterogeneous catalysts. Homogeneous basic catalysts are the most widely used for biodiesel production, for example NaOH and KOH due to the reaction using homogeneous basic catalysts obtain very high yields under mild conditions and that reaction generally takes short time for completion. However, homogeneous basic catalysts show great disadvantages: need a high purity feedstock in order to prevent undesirable saponification reaction, production costs are high as the processes involve washing and purification steps in order to meet the stipulated biodiesel quality, it is quite difficult to remove traces amounts of catalyst remaining in biodiesel product, high amounts of water are needed in washing and consequent

waste water treatment of the effluent adds to the overall process cost. Therefore, extensive researches on heterogeneous catalysts have received much attention because of the easy catalyst separation from product, the reduction of environment pollutants and its reusability.

In this work, the effects of precursor concentration in catalyst preparation by impregnation and co-precipitation methods, % loading of Ca on ZnO support, and calcination temperature on the catalytic activity of CaO-ZnO as a heterogeneous catalyst for the transesterification reaction of vegetable oil with methanol under mild reaction conditions were studied. In addition, the catalyst reusability of CaO-ZnO catalysts in biodiesel production was compared.