CHAPTER I
INTRODUCTION

Biodiesel derived from transesterification reaction of triglycerides in vegetable oils or animal fat with alcohol is a promising alternative to petroleum-based diesel fuels. Nowsday, biodiesel production has increased dramatically. An abundance of crude glycerol, which is an inevitable by-product of biodiesel production, has significantly impacted to the glycerol price. Therefore, research has been focused on increasing the utilization of glycerol by converting to higher value products.

Glycerol is widely used in many applications due to its unique physical and chemical properties. It can also be used as a starting material for many other high-value added chemicals such as glycidol, glycerol esters, polyglycerols and polyglycerol esters. Polyglycerols are used in many industries such as cosmetics, pharmaceuticals and food. Furthermore, they are intermediates in the formation of polyglycerol esters. Both polyglycerols and polyglycerol esters are also used in the formulation of various cosmetics and personal care products (Parolla and Draves, 1958).

Polyglycerols are obtained from the polymerization or condensation of glycerol. Generally, the polyglycerols are widely used in the form of oligomers (a few repeating unit of glycerol, *i.e.* di- or tri-glycerol). Oligoglycerols are soluble in water, alcohol, and many polar solvents. They offer greater flexibility and functionality than glycerol. They can be incorporated in a variety of consumer products to perform many functions such as emulsification, wetting, foaming, thickening, dispersion, solubilization, and mildness. Therefore, the main uses of polyglycerols are in foods, cosmetics, pharmaceuticals, emulsifiers, and surfactants industry.

Generally, polyglycerols are prepared by polymerization of glycerol at elevated temperature in the presence of homogeneous catalysts (sodium hydroxide, potassium hydroxide). The homogeneous catalysts give high conversion but low selectivity. However, the use of homogeneous catalysts has several disadvantages, for example, impurities from the by-products, less selectivity, product degradation and catalyst contamination after reaction. Typical homogeneous catalytic process is needed to separate impurities and catalysts to obtain higher purity of the products. On

the other hand, heterogeneous solid catalysts can be easily to removed by filtration, centrifuge and etc.

The objective of this work is to study the synthesis of diglycerol by heterogeneous catalysts. The base heterogeneous catalysts are calcium oxide (CaO), magnesium oxide (MgO), barium oxide (BaO), strontium oxide (SrO) and zirconium oxide (ZrO_2). Parameters such as types of catalyst, reaction time and reaction temperature are examined.