CHAPTER I

INTRODUCTION

One of the most commonly arisen questions in the biodiesel industry is how to increase the economy of the whole manufacturing process. Because of the rapid development of biodiesel production by transesterification of vegetable oils, large quantities of glycerol are available as a reaction by-product; for every 9 kg of biodiesel produced, about 1 kg of glycerol is formed (Dasari *et al.*, 2005). An abundance of glycerol has significantly impacted a glycerol market, resulting in a decrease in glycerol price. Finding new technology to convert glycerol to high value-added products is being developed.

The main characteristic of glycerol is the high functionality such that reaction can proceed along multiple pathways to give mixtures of products. Various reaction routes based on bond rupture, oxidation, reduction, and polymerization reactions are available to the glycerol molecule to derive chemicals of commercial products.

One of the most attractive routes is the catalytic dehydroxylation of glycerol to propanediol. Propanediol may refer to either of two isomeric organic chemical compounds, 1,2-propanediol and 1,3-propanediol. 1,2-Propanediol or propylene glycol is an important commodity chemical. It is used as antifreeze, aircraft de-icer, and lubricant (Behr *et al.*, 2003). 1,3-Propanediol is also a high value specialty chemical that is mainly used in polyester fibers, films, and coatings. In the market, the price of 1,3-propanediol is generally higher than that of propylene glycol; however, the use of propylene glycol is much greater, especially in Thailand. These considerations led us to focus on the production of propylene glycol.

The catalytic dehydroxylation of glycerol to propylene glycol can be carried out in the presence of metallic catalyst and hydrogen. Previous study (Sitthisa, 2007) has demonstrated the effectiveness of Cu/Al_2O_3 catalyst. The results showed that 100% glycerol conversion and 90% propylene glycol selectivity were obtained. However, the conversion decreased as a function of time on stream. It was suggested that the carbon deposition and the formation of aluminum copper might be attributed to the deactivation of Cu/Al_2O_3 catalyst. Swangkotchakorn (2008) introduced ZnO into Cu/Al_2O_3 catalyst and found that the addition of ZnO could prolong the stability of the catalyst by reducing the metal-support interaction to form aluminum copper.

In this work, the catalytic dehydroxylation of glycerol to propylene glycol was conducted over the copper- and copper/zinc oxide-based catalyst. The main purpose is to investigate the effect of the catalyst itself with intention of improving the conversion rate of glycerol and selectivity toward propylene glycol. This study deals with the effect of calcination temperature and catalyst preparation method on the catalytic performance of the copper/zinc oxide-based catalysts. In addition, the characterizations of the prepared catalysts were performed to understand the role of catalyst in the production of propylene glycol from glycerol.