# CHAPTER I
# INTRODUCTION

Oligomers ($C_4$-$C_{20}$) of ethylene are important intermediates that are able to be transformed to various chemical compounds. They have several advantages in chemical industries and our diary life. For example, $C_4$-$C_8$ can be used as co-monomers with ethylene in polymerization processes to yield branched linear-low density polyethylene, which can be used to make plastic bags. Branched $C_5$-$C_9$ can be used as gasoline booster in vehicle fuels, and $C_{10}$ can be used as synthetic lubricant and plasticizers in polymer processing process. Moreover, $C_{12}$-$C_{20}$ can be used as reactants of detergent production (Speiser *et al.*, 2005).

In the past, hydrocarbons, such as olefins, paraffins, oligomers, and aromatics, can be produced form fossil fuels, but nowadays the attention has been changed to bio-mass as an alternative source substituted for petroleum, since crude oil price increases continuously. Moreover, there are several disadvantages of crude oil usage such as $CO_2$ emission, and high energy consumption, which are causes of global warming. In Thailand, there are large quantities of bio-mass such as sugarcanes, corn, and cassava, which are used to produce bio-ethanol. Furthermore, bio-ethanol can be used as feedstock to produce hydrocarbons such as ethylene, propylene, oligomers, paraffins, and BTX via catalytic dehydration reaction. The production of hydrocarbons from ethanol using a catalyst has been proposed by many researchers. Earlier, ethylene production from the catalytic dehydration of ethanol over $\gamma$-$Al_2O_3$ was studied by Zhang *et al.*, (2008), but its required high reaction temperature to achieve good ethanol conversion as similarly as Chen *et al.*, (2007a) who studied ethylene production form ethanol dehydration over $TiO_2$ dope $\gamma$-$Al_2O_3$. Later on, zeolites, such as HZSM-5, with loaded metal oxides became attractive in ethanol dehydration in order to produce ethylene, propylene, and aromatic hydrocarbons. Ethylene can be obtained by using Fe-modified HZSM-5 (Lu *et al.*, 2011), propylene can be obtained by using Zr (Song *et al.*, 2009), P (Inaba *et al.*, 2011), Fe (Inaba *et al.*, 2009), La, and Mg-modofied HZSM-5 (Inoue *et al.*, 2010), and BTX can be obtained by using Pt, Pd, Rh and Ga doped on HZSM-5 (Inaba *et al.*, 2006).

Recently, the considerable attention, in the catalytic dehydration of bio-ethanol, has been changed from metal oxide-promoted catalysts to metal-promoted catalysts in order to produce long chain alkane or alkene hydrocarbons, which have many benefits to use in our daily life. There have been few researchers who have studied in this area. For example, Tsodikov *et al.*, (2008) did their experiment using both metallic- and bimetallic-promoted catalysts such as Pt, and intermetallic hydride in the catalytic dehydration of ethanol, and they found that aliphatic hydrocarbons in the range of $C_2$-$C_{10}$ can be obtained. Similarly, Chistyakov *et al.*, (2013) also used metal catalysts, such as Pt, Pd, Zn, Re-W, and Re-Ta, in ethanol conversion reaction, and the obtained products were alkanes and alkenes in the range of $C_3$-$C_{12}$ hydrocarbons.

As aforementioned, metal-promoted catalysts are interesting in the catalytic dehydration of bio-ethanol, but the knowledge in this area is still limited. To fulfill the knowledge of metal-promoted catalysts in the catalytic dehydration of bio-ethanol; therefore, the goal of this research work was to study the performance of metal catalysts selected from two groups of catalysts; that are, Fischer-Tropsch synthesis and olefins polymerization, aiming to produce oligomer products, at least $C_4$, from the catalytic dehydration of bio-ethanol.