CHAPTER I
INTRODUCTION

1.1 Introduction

In recent years, there were many researchers for developing a wide range of applications using zirconia (ZrO_2) as a catalyst, used in chemical refineries and environmental processes because it is stable at high temperature conditions. Zirconia by itself exhibits important catalytic properties. Its surface has both acidic and basic properties, as well as both oxidizing and reducing capabilities. Additionally, zirconia was successfully used as a catalyst support. One of the importance applications of zirconia is an environmental catalyst. Ceria doped zirconia has been used extensively as a part of the wash coat for Three-Way Catalyst (TWC's) found in all modern gasoline power automobiles since zirconia helps to enhance thermal stability and improve oxygen storage property of ceria (Rossignol *et al.*,1999).

Zirconia by itself exhibits important catalytic properties. The strong acid chemistry of zirconia leads to uses in many reactions. Sulphated and tungstated zirconias are well known for exhibiting very strong acid properties after activation, required in the isomerization of alkanes, such as n-butane to iso-butane (Hino *et al.*, 1998). Additionally, sulphated zirconia is used as an alkylation catalyst in linear alkyl benzene (LAB) production.

Zirconia preparation by sol-gel methods has been studied extensively. Common starting materials usually are zirconium isopropoxide ($Zr(i\text{-}OC_3H_7)_4$), zirconium propoxide ($Zr(n\text{-}OC_2H_7)_4$) and zirconium butoxide ($Zr(n\text{-}OC_4H_9)_4$), and they still have been constantly being used as precursor. Powders produced by a sol-gel method are uniform, homogenous, well-dispersed, and have high surface area. However, this process is complicate and difficult to control, because these zirconium alkoxides are highly sensitive to water. Even if the solution of a zirconium alkoxide is stirred vigorously, the rate of hydrolysis is so quick that large agglomerated zirconia particles are precipitated immediately as soon as water is added. Most importantly, the disadvantage of these alkoxides are their high cost.

Sodium tris(glycozirconate) is a promisingly alternative alkoxide precursor for preparing zirconia. A highly attractive advantage of this alkoxide is the reduction of reactivity with water. The synthesis of this precursor is carried out via the OOPS process of the reaction using inexpensive and widespread starting material (Ksapabutr *et* al.). This alkoxide is, therefore, chosen as a precursor in order to improve the preparation of zirconia by the sol-gel method.

In this work, zirconia was synthesized by the sol-gel methods using sodium tris(glycozirconate) as a precursor. The effects on structures and characteristics of the oxide of changing in the sol-gel parameters, such as pH and amount of water were examined. The properties of the oxides prepared on these studies were compared to those of commercial zirconia.