CHAPTER I
INTRODUCTION

Recently, metal nanoparticles have attracted enormous research interest in both fundamental and practical aspects due to its quantum size effect. In comparison with bulk material, metal nanoparticles provide a large surface-to-volume ratio; hence, surface activity is enhanced. Their potential applications in various fields have been developed, for instance; catalysts, photocatalysts, microelectronics, magnetic devices and chemisorptions, etc.

Nano-sized platinum and platinum alloy are widely used metal for practical and laboratorial catalytic purpose. Many significant reactions documented have been carried out by Pt as a catalyst; such as, oxidation of carbon monoxide at low temperature (Tang *et al.*, 2005); hydrogenation reactions (Toebes *et al.*, 2004), methanol oxidation (Zhao *et al.*, 2006), oxygen reduction (Wei *et al.*, 2005) and hydrogen electro-oxidation (Zhou *et al.*, 2007). There have been various methods investigated and reported of how to prepare Pt nanoparticles supported on high surface area substrates (For instance; carbon nanotubes, clay, polymer nanofibers or titania), ion exchange, incipient wet impregnation (IWI), chemical vapor deposition (CVD) and chemical reduction. However, the most widely used method is chemical reduction which is simple. The method requires a reducing agent and a stabilizer simultaneously. Some effective reducing agents have been found to be able to reduce platinum salt to metal form; for example, citrate salts (Lin *et al.*, 2005), $NaBH_4$ (Zeng *et al., 2006*), alcohols (Jiang *et al.*, 2004) and alkoxides (Kim *et al.*, 2007). A stabilizer is added in order to prevent metal particles from aggregation. Linear polymers are often used as a stabilizer during preparation of Pt nanoparticles because bulky long chains of polymer can prevent an agglomeration between metal nucleuses.

Electrospinning technique is an efficient technique capable of fabricating superfine fibers in microscale to nanoscale range from polymer solutions or polymer melts. The method and apparatus are simple and cheap. In general process, an electrical potential is applied between the tip of a capillary and a metal grounded collector. Once the potential applied overcomes the solution surface tension (in some case a trace of surfactant is required in order to lower solution surface tension), the ejected jet is then produced. A diameter of the fiber becomes thinner as the fiber travels away from the needle tip. In addition, the evaporation of solvent occurs before fiber is collected on the ground electrode (Huang *et al.*, 2003). Some factors affecting the fibers obtained are electrospinning condition (voltage applied, take-up speed, and a distance between a needle tip and a collector) and polymer solution properties (solution viscosity and surface tension).

Among many widely used polymers in the industry, poly(vinyl alcohol)(PVA), a water-soluble polymer, has many outstanding chemical and physical properties, high tensile strength and flexibility. It is also odorless, non-toxic, and resistant to oil and grease. PVA has high hydrophobicity, processibility and biocompatibility, hence, PVA has been documented in many medical researches. Also, PVA has been reported of ability to be electrospun. Incorporation with metal nanoparticles, PVA has been electrospun directly with Au (Bai *et al.*, 2007) and Ag (Jin *et al.*, 2007). In this present work, platinum salt is reduced directly by citrate ions in PVA aqueous solution prior to being electrospun.