CHAPTER I
INTRODUCTION

Generally, polymers are non conducting material and widely used in insulating applications. In 1970s, Yet Alan J. Heeger, Alan G. MacDiarmid and Hideki Shirakawa discovered polyacetylene and won the nobel prize in 2000 for their discovery of conducting polymer. Polyaniline (PANI) is a common conducting polymer and has been widely studied. PANI is an attractive polymer due to its properties such as low cost, ease of synthesis, controllable optical properties that can be used in sensors (Mekki *et al.*, 2013), semiconductors (Lei *et al.*, 2010), supercapacitors (Wang *et al.*, 2009) and electrochromics (Fu *et al.*, 2014).

PANI has been used in food packaging for its optical property in acid and base for food spoilage sensing (Kuswandi *et al.*, 2012). Food spoilage is caused by microorganisms which produce gases during their metabolism and causes the color change in PANI which indicates the food condition. Since the gases that were produced by the microorganisms are in low concentration, the sensitivity of gases detection should be high enough. In order to increase the sensitivity of the gas sensing, layer by layer thin film assembly is one of the interesting choice due to its nano scale of the film thickness comparing to film casting technique which give a thicker film that may effect on the sensitivity of the film. The layer-by-layer assembly is based on an electrostatic interaction between polyanions and polycations that deposits alternately on a substrate (Decher *et al.*, 1998).

Composites of conducting polymer and noble metals such as PANI with silver (Ag) can be use in sensors (Mekki et al., 2013), bone tissue engineering (Rajzer *et al.*, 2015), conductive ink (Rajzer *et al.*, 2015), microelectronic device (Braga *et al.*, 2008) and catalysis (Sharma *et al.*, 2009). The PANI/Ag composite can be prepare in many ways such as synthesis of PANI in the presence of Ag nanoparticles (Moghaddam *et al.*, 2014), synthesis of Ag nanoparticle using soluble PANI as a stabilizing agent (Bober *et al.*, 2014), synthesis of Ag nanoparticle using PANI as a re-

ductant (Bober *et al.*, 2014) as shown in Figure 1.1. The conductivity is a prime interest in many applications.

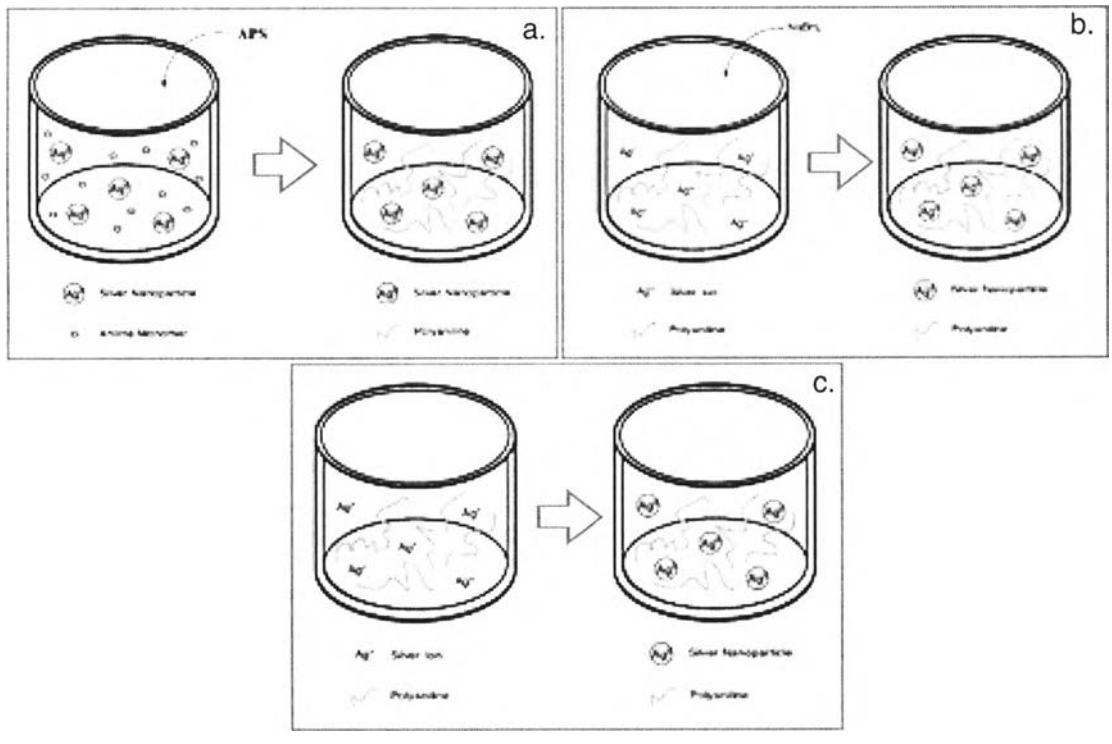

Figure 1.1 Schematic of synthesis of (a.) PANI in the presence of Ag nanoparticles, (b.) synthesis of Ag nanoparticle using soluble PANI as a stabilizing agent and (c.) synthesis of Ag nanoparticle using PANI as a reductant.

The purpose of this research is to prepare an in situ Ag nanoparticles in PANI thin film for electro-optical applications and describes the fabrication of thin film start from an effect of poly(sodium 4-styrene-sulfonate) (PSS) on an interfacial and bulk polymerization of PANI to effects of PSS concentration and pH on polyelectrolyte multilayers assembly. The thin films in this research were produced by layer-by-layer assembly of PANI complexes with PSS and Poly(diallyldimethylammonium chloride) (PDADMAC) then silver nanoparticles were synthesized by in situ approach in the film and the effect of in situ silver nanoparticles on an electro-optical properties of the thin film were studied.