CHAPTER I
INTRODUCTION

Presently, the conductive polymers have received attentions due to their unique characteristics between metals and semiconductors; electric, electronic, magnetic, optical and mechanical properties. These polymers have conjugated double bonds along the backbones. Each bond contains a strong sigma (σ) bond and a weaker pi (π) bond, so the conjugation can occur along the polymer backbone. Hence the conductive polymers possess good electrical conductivity properties.

However, the electrical conductivity of pure conductive polymers is rather low, thus a doping process is necessary to achieve a higher conductivity (Kumar, D., and Sharma, A.C., 1998). The applications of conductive polymers are organic light-emitting diodes, super capacitors, biosensors, organic solar cells, actuators, flexible transparent displays, electrochromism, electromagnetic shielding, and possibly replacement for the popular transparent conductor indium tin oxide.

The most interesting conductive polymers belong to the chromogenic polymers which can change colors when they are stimulated by heat, biochemical reaction, electric field, ultraviolet (UV) light, pressure, ion concentration, and magnetic field. An electrochromic polymer is one type of the chromogenic polymers which can change their colors under applied electric field. This polymer is the most suitable for the chromogenic technology for energy control and saving in buildings. The mechanism occurs via the oxidation–reduction reaction. It results from the energy difference between the π-bonding orbital (conduction band) and the π*-antibonding orbital (valence band) that lies within the visible region. Upon oxidation, the intensity of the π-to-π* transition decreases, and the two row energy transitions emerge to produce a second color (Sotzing, G., *et al.*, (1997). These materials are widely used in displays, automotive industry, smart windows, and architecture.

In this work, PDMA was synthesized with an oxalic acid via the electrochemical polymerization. Then PDMA was characterized by the cyclic voltammetry (CV), FTIR, the thermalgravimetry analysis (TGA), the conductivity measurement, and the UV-VIS absorption spectroscopy to study the effects of electric field strength and electrolyte type on the electrochromic properties and the response time.