CHAPTER I
INTRODUCTION

Numerous techniques for nanofiber production are available such as: template synthesis, self-assembly, solution blow spinning, drawing spinning, and electrospinning methods. Electrospinning technique is reported in several articles as method to produce nanofibers. In this process, a continuous strand of a polymer liquid (i.e., solution or melt) is ejected through a nozzle by a high electrostatic force onto a grounded collector as a non-woven fiber mat (Reneker *et al.*,2008). The morphology of the electrospun fibers depends on a number of factors, such as solution properties, processing conditions, and ambient condition (Sutasinpromprae *et al.*, 2006; Tungprapa *et al.*, 2007). These fibers exhibit several interesting characteristics, e.g., a high surface area to mass or volume ratio, small inter-fibrous pore size with high porosity, vast possibilities for surface functionalization, etc. (Doshi *et al.*,1995; Reneker *et al.*, 1996). These advantages render electrospun (e-spun) polymeric fibers good candidates for a wide variety of applications, including composite reinforcements (Bergshoef *et al.*, 1999), carriers for topical or transdermal delivery of drugs (Kenawy *et al.*, 2002), and scaffolds for cell and tissue culture (Kim, 2008). Furthermore, the introduction of appropriate functional groups onto the surface of an electrospunnanofiber mat allows it to be used as an adsorbent in waste water treatment (Huang *et al.*,2009).

Polyacrylonitrile (PAN) microfibers have been widely modified to contain a proper functional group(s) and using as adsorbent for metal ion removal (Deng *et al.*, 2004: Gong *et al.*, 2002), because it is an inexpensive and common commercial product. Additionally, PAN can easily be prepared into nanofiber mats by electrospinning process.

A selective property is the main advantages of adsorbent for remove metal ions which depend on the functional group(s) on their surface such as thiol, imimodiacetate, amine, amide, carboxylic acid, hydroxyl and sulfonic acid (Vilensky *et al.*,2002; Yan *et al.*,2005; Atia *et al.*, 2008). It has been found that an adsorbent carrying nitrogen-based functional groups was effective in the adsorption or removal of heavy metal ions (Deng *et al.*, 2004; Gong *et al.*, 2002; Kavakli *et al.*, 2004). In this research, electrospun polyacrylonitrile was modified their surface by simple reaction as hydrolysis and aminolysis to improve their adsorption properties. These nanofiber mats were investigated for the removal of silver, copper, iron, and lead ions in aqueous solution individually and under competitive adsorption condition. The effects of initial pH, contact time, initial ion concentration on adsorption of those ions were studied.

In addition, electrospinning of the PAN nanofiber allows the production of binder-free plates and gives the scientist control of mat thicknesses and chemical functionality present using a minimal amount of materials (~1mL of polymer solution) (Bezuidenhout *et al.*, 2008; Clark *et al.*, 2010). Therefore, electrospun PAN nanofiber mat also suitable to use as stationary phase for Ultra-thin layer chromatography. In the last work of the research, a manganese-activated zinc silicate was used as fluorescent indicator (UV_{254}) by mixing directly into polyacrylonitrile bsolution prior electrospinning process. The e-spun PAN nanofiber phase with UV_{254} was used for study the separation of 7 preservatives and beverage sample and compared with a commercial silica TLC plate.