CHAPTER I
INTRODUCTION

Over the past of century, polyelectrolytes have been an interesting topic in polymer science because of the broad variability of their molecular and supramolecular structure and the strong dependence of their properties in solution or dispersion on the surrounding medium. Polyelectrolytes have been used in several industrial processes for some time. Beside classical applications such as colloid stabilization, flocculation for water treatment and paper making, adsorbed polyelectrolyte layers are used to develop novel application in the fielded in nano and biomaterial engineering. Especially their potential concerning charging, binding (biomolecular recognition), repelling (bioinertness), vertical and horizontal structuring is promising for the development of sensors, biomaterials, membranes and carrier systems. During recent years, the field of nanostructured material formation has progressed significantly and there has been a large development in the use of polyelectrolyte multilayers.

Ultra thin films of polyelectrolyte multilayers can be prepared using an alternating sequence of positively and negatively charged polyelectrolytes. Multilayers (PEM) are obtained by means of electrostatic layer-by-layer deposition. This method, called Layer-by-Layer deposition (LbL) or Electrostatic self-Assembly (ESA), has been successful in producing thin films with unique optical, electrical, and mechanical properties. These polyelectrolyte multilayer thin films exhibit a linear growth regime where the thickness increases linear with the number of deposited layers, leading to micrometer thick films. There were several substrates which PEM can be coated onto including textile fibers.

Meanwhile, the preparation and study of metallic particles with submicroscopic dimensions is of a recent interest in both technology and research. The reasons for this growing interest are the specific and unique properties of nanometer sized metal particles. The mentioned properties are utilized in the development and fabrication of novel biosensors, catalysts or substrates for SERS.

There have been several studied which focused on silver in nanoparticle form as it can be employed in various applications especially for its antimicrobial activity. The antimicrobial activity of silver is known for a long time. There is evidence

showing that in ancient time people used silver containers to preserve water, wine or beverages and some research showed that silver was a highly effective antimicrobial substance and it was safe. Moreover, silver compounds have been used as medicine to prevent inflection for patients who get burnt and is eye inflection.

Layer-by-layer nanoparticle assemblies can also be prepared by alternately dipping a substrate into nanoparticle and polyelectrolyte solutions. The resulting material is a nanoparticle-polymer hybrid, which combines the unique properties of nanoparticles and the mechanical properties of polymers and it is an important target of modern materials research.

This thesis proposed that PEM technique is a simple and low cost technique to deposit silver nanoparticles onto fibers. This technique relies on the well studied layer by layer deposition of oppositely charged species through electrostatic interactions. PEM technique has already been used to immobilize silver nanoparticles on flat surface but never on fibers. This technique allow for the deposition of a particular high amount of silver nanoparticles on the fiber which gives a certain advantages in the antimicrobial performance of fibers.

In this research, silver nanoparticles were prepared by photo-reduction of a silver nitrate solution in a dilute solution of polyelectrolytes under sun light. Then, the polyelectrolyte capped silver nanoparticle solutions were deposited onto silk and nylon fibers with poly (diallyldimethylammonium chloride) (PDAD) by the layer-by-layer technique. The coated fibers were then tested for their antimicrobial efficiency.