ABSTRACT

The present diploma thesis deals with the development of biodegradable polymer nanoporous thin films with Spraying Coating Deposition Method within the framework of Targeted drug delivery and especially for applications at cardiovascular implants. The ultimate goal was to create a biomimetic nanoporous environment that can be used as drug delivery platforms for coating cardiovascular implants. The structural features of thin films affect cell response and must be engineered to support cell adhesion, proliferation and differentiation of blood components, which activate after the insertion of implants in the vessels, like cardiovascular stents. Thin films act like a temporary platform coating interior to vascular implant and deliver chemical compounds that inhibit platelet adhesion and thrombus formation.

It is already known that the biodegradable polymers are used widely into targeted drug delivery systems. In drug delivery implants is observed controlled drug release patterns during polymer degradation while drug levels maintain stable. The last decade, the first treatment choice of acute coronary diseases is the implantation of implants that release anti-proliferative drugs, known as Drug Eluting Stents (DES). Metanalysis showed that DES have better results in comparison with bare metal implants, the first used stents, known as Bare Metal Stents (BMS). That is the main reason that research in cardiology focuses on optimization of construction techniques of cardiovascular implants.

Spraying coating deposition method is the most common method for the fabrication of coatings at industrial scale. Its considerable attention in the field of Drug delivery systems relies on the production of polymer thin films with nanopores in the range of nanometers to micrometers, with the use of a gas pressure to deposit a polymer solution from an orifice to flat substrates. Specifically, Poly-caprolactone (PCL) and Poly lactide-co-glycolyte acid (PLGA), as synthetic biodegradable polymers, and drugs, Dipyridamole (DPM) and Curcumin (CCM), as anti-platelet chemical compounds, were chosen for this study. Also, PCL/PLGA copolymers in different ratios (80:20, 75:25, 70:30) were prepared and tested in order to find the optimal solution for the fabrication of each polymer thin film. The optimization of growth conditions for thin films, is proven to be particularly related to the polymer concentration, the airbrush distance and the applied pressure/flow rate. The structural/morphological/topographic characterization of thin films was conducted with Scanning Electron Microscope (SEM) and Atomic Force Microscopy (AFM).

Drug release kinetics were studied in vitro after the platform incubation in PBS at 37oC over 60days, which reveal the release profile of drugs from the optimal ratio and optimal fabrication conditions polymeric thin films. Both of the release patterns are described from a ‘burst release phase’ with the first 24 hours followed by a lower rate release phase, known as ‘lag phase’.

The scaffolds and thin films were also studied for their biocompatibility with cell lines. Particularly, stem cells of dental series were seeded on the surface of thin films for three intervals (24hrs, 3 days, 6 days). MTT assay was performed for the

quantitative assessment of the cell-seeded thin films. To complete the cell studies, images were obtained by Scanning Electron Microscopy (SEM) and optical microscopy after staining with methylene blue. In the group of thin films, biocompatibility studies have controversial conclusions.