Αγγλική Περίληψη

This diploma thesis describes the synthesis and study of surfaces with Zinc Oxide nanoparticles and polycaprolactone polymeric scaffolds for use in antimicrobial applications. The increasing resistance of microbes to the antibiotic drugs used has made the need for new methods of controlling microbial infections significant and Nanotechnology has played an important role in recent years to this direction. The first two chapters of the theoretical part of the work are an introduction to the development of infections, resistance to antibiotics and solutions that Nanotechnology can give to these problems. In the second chapter, more specifically, there are presented the nanomaterials used in recent years for the treatment of microbial infections and a more detailed reference is made to the materials selected for use in the present study. The next two chapters describe the synthesis and construction methods of the nanostructures used in this work and the description of the characterization techniques of the resulting nanostructures. In the fifth and final chapter of the theoretical part, reference is made to the methods used in microbiology for controlling the sensitivity of microbes to antimicrobial agents. The first section of the experimental part of the thesis refers to the synthesis of Zinc Oxide nanoparticles. These nanoparticles have been selected due to their proven microbiocidal activity, which is increased by the reduction in nanoparticle size but also due to their non-toxic effect on eukaryotic cells. The ability to synthesize these nanoparticles with very simple and economical methods, while attaining the desired size, makes them even more attractive to use. The sixth chapter of the paper, which is the first chapter of the experimental part of the work, describes the process of synthesizing nanoparticles by two different methods, with and without surfactant, and then comparing the two methods by studying the nanoparticles by microscopy techniques and X-ray techniques. In this chapter, the appropriate method of depositing nanoparticles on a substrate is also selected. The seventh chapter describes the construction of polymer scaffolds and the incorporation of zinc oxide nanoparticles into them. Their study with microscopic techniques and the attempt to deposit them on PET substrates is also presented. In the eighth chapter we present the study of the antimicrobial action of the nanostructures that were created and the evaluation of the results, while the ninth and final chapter investigates the mechanical properties of the surfaces and their hydrophobicity. In the last part of the paper a brief review of the methods and protocols used is presented and the results and conclusions that have been

obtained are presented briefly. It also mentions the concerns and problems raised during the study and proposes solutions and future steps.