STUDY OF EXTRACTION AND IMMOBILIZATION POSSIBILITY OF POLYPHENOLIC COMPOUNDS FROM SPRUCE WOOD BARK

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The thesis focuses on the extraction and immobilization possibility of the phenolic compounds from spruce wood bark and is divided into two parts with a total of 5 chapters.

The first part, Chapter I, *Polyphenols - important biologically active compounds* presents the newest information regarding the classification of the phenolic compounds, chemical, biochemical and biological properties, the extraction and characterization of the phenolic compounds, the electrosppinning method and possibile applications of the polyphenols in the immobilized forms.

The second part, Chapter II entitled *Extraction of polyphenolic compounds from spruce wood bark*, discusses the extraction of the phenolic compounds by using ultrasound and microwave assisted extraction, allowing the optimization of the processes. In this context, the main parameters that influence the extraction process were evaluated. Processing conditions have been optimized by mathematical modeling and statistical analysis. Chemical characterization of the extracts was carried out using FTIR analysis and ^{31}P NMR Ramman spectroscopy.

Chapter III, *Immobilization of phenolic compounds found in spruce wood bark extract by electrospinning using poly(2-hydroxyethyl methacrylate) (PHEMA) support. In vitro release study*, reports on the development of electrospun poly(2-hydroxyethyl methacrylate) (pHEMA) fibers loaded with synthetic and natural antioxidants in the form of selected types of polyphenols, such as vanillic, gallic, syringic acids, catechin, or natural spruce bark extract, to investigate their release behavior in terms of antioxidant activities. Homogenous fiber morphologies were obtained at specified concentration ranges of pHEMA within the spinning solutions, exhibiting fiber diameters in the range from 0.5 ± 0.1 μm to 1.9 ± 0.5 μm. The 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay used to monitor the antioxidant activity showed that polyphenols retained their activity after incorporation into the pHEMA nanofibers. Furthermore, it was demonstrated that the encapsulation of polyphenols in pHEMA nanofibers can delay to a high extent their degradation induced by environmental factors.

In Chapter IV – *Obtaining of PLGA catechin loaded nanofiber to reduce in vitro oxidative stress induced by multi-walled carbon nanotubes (MWCNT)*, PLGA nanofibers carrying different concentrations of catechin were developed by emulsion electrospinning procedures. Emulsion and spinning process parameters and their influences on fiber properties were studied. Likewise, the polymer degradation behaviour of the fibers, as well as the release characteristic of catechin in phosphate buffered saline as release medium (the total immersion method) was investigated. Last, the antioxidant effect of catechin released from the fibers on the human alveolar epithelial cell line A549 was examined.

Finally, Chapter V presents the general conclusions of the thesis. The results reveal that electrostatic spinning procedures are an effective tool for encapsulation and controlled release of functional active substances, allowing localized and sustained application in the fields of tissue engineering and wound healing.

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