

Polymer Matrices Based on Natural Compounds: Synthesis and Characterization

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Abstract : Introduction: In the preparation of polymer materials, compounds of natural origin are currently gaining more and more interest. This is particularly noticeable in the case of synthesis of materials considered for biomedical use. Then, selected material has to meet many requirements. It should be characterized by non-toxicity, biodegradability and biocompatibility. Therefore special attention is directed to substances such as polysaccharides, proteins or substances that are the basic building components of proteins, i.e. amino acids. These compounds may be crosslinked with other reagents that leads to the preparation of polymer matrices. Such amino acids as e.g. cysteine or histidine. On the other hand, previously mentioned requirements may be met by polymers obtained as a result of biosynthesis, e.g. polyhydroxybutyrate. This polymer belongs to the group of aliphatic polyesters that is synthesized by microorganisms (selected strain of bacteria) under specific conditions. It is possible to modify matrices based on given polymer with substances of various origin. Such a modification may result in the change of their properties or/and in providing the material with new features desirable in viewpoint of specific application. Described materials are synthesized using UV radiation. Process of photopolymerization is fast, waste-free and enables to obtain final products with favorable properties. Methodology: Polymer matrices have been prepared by means of photopolymerization. First step involved the preparation of solutions of particular reagents and mixing them in the appropriate ratio. Next, crosslinking agent and photoinitiator have been added to the reaction mixture and the whole was poured into the Petri dish and treated with UV radiation. After the synthesis, polymer samples were dried at room temperature and subjected to the numerous analyses aimed at the determining their physicochemical properties. Firstly, sorption properties of obtained polymer matrices have been determined. Next, mechanical properties have been characterized, i.e. tensile strength. The ability to deformation under applied stress of all prepared polymer matrices has been checked. Such a property is important in viewpoint of the application of analyzed materials e.g. as wound dressings. Wound dressings have to be elastic because depending on the location of the wound and its mobility, such a dressing has to adhere properly to the wound. Furthermore, considering the use of the materials for biomedical purposes it is essential to determine its behavior in environments simulating these ones occurring in human body. Therefore incubation studies using selected liquids have also been conducted. Conclusions: As a result of photopolymerization process, polymer matrices based on natural compounds have been prepared. These exhibited favorable mechanical properties and swelling ability. Moreover, biocompatibility in relation to simulated body fluids has been stated. Therefore it can be concluded that analyzed polymer matrices constitute an interesting materials that may be considered for biomedical use and may be subjected to the further more advanced analyses using specific cell lines.

Keywords : photopolymerization, polymer matrices, simulated body fluids, swelling properties

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