CHITOSAN, STARCH AND PECTIN FOR MINERAL-POLYMERIC MATRICES

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Introduction

With increasing demand for materials for medicine, the field of tissue engineering has become very popular all over the world. But the development of biomaterials for regenerative medicine is still considered a new field [1]. The creation of materials for medicine is of the primary task for researchers in the field of chemistry and medicine. Hydrogels have been extensively studied as synthetic extracellular matrices (ECMs) to use in tissue engineering and regenerative medicine mainly due to their high viscoelastic and diffusive transport properties. These properties make them similar to the ECM of many tissues [2]. Many biomaterials have been explored. Biocompatible materials involving biopolymers, such as collagen and poly-lactic acid (PLA), are the most widely studied materials for the regeneration of damaged tissues, acting as artificial supports for cell growth [3]. Biopolymers, such as polysaccharides, have been used to create materials for the field of tissue engineering too. Numerous studies have demonstrated that polysaccharides have similar properties with the extracellular matrix and the property of cytocompatibility. Similarly, chitosan is widely investigated to obtain hydrogels for tissue engineering. The chitosan and its derivatives are promising for the creation of implants and carriers of medicines such as gels, films, fibers, sponges and other forms of matrix, due to its ability to form films, fibers and due to its unique sorption and complexing properties [4]. It may be useful in medicine, for example, in bandages to reduce bleeding and as an antibacterial agent; it can also be used to help deliver drugs through the skin. Based on recent works, researchers are actively studying porous biodegradable matrices for their application in the tissue engineering. The use of natural/bio fiber reinforced composites has rapidly expanded due to the availability of such renewable resources, for use as reinforcing composites [5, 6]. The Chitosan has significant disadvantages, for example, a relatively low rate of resorption in the body, as well as a poor elasticity of sponges and films, so it is difficult to use in the medicine. It is recognized that one of the methods to eliminate these disadvantages is to use (chitosan blends) [4] a mixture of chitosan having more resorbed macromolecules. Some of studies have shown that calcium phosphate (CP) contributes to the healing of wounds.

The aim of our investigations was the study of mineral-polymer matrices based on the starch, chitosan and CP with different Ca/P ratios.

Some authors consider that the fast degradation rate is a relative property, as it is dependent on the aim of the study; it could be interesting for an application in which fast cell proliferation and production of the extracellular matrix are desirable. The results of the work show how versatile pectin hydrogels can be, and also how fast they can degrade without the need for extensive chemical modifications [7]. Considering the described benefits, it was proposed to use the pectin and modified pectin, as reinforcing composites with other biodegradable polymer matrices. Modified Pectin, modified citrus pectin, also known as MCP, has a reduced molecular weight compared to regular citrus pectin, a mostly linear homogalacturonanic chain, which are easily processed by the digestive system and absorbed into the bloodstream. [8] Scientists believe that MCP is working by inhibiting two key processes involved in cancer progression: angiogenesis and metastasis.[9,10] Modified pectins and nano-pectins being vary from the semi-crystalline to highly crystalline material and differ from the initial pectin by GE, MW [11]. The classification and properties of nanostructured materials and systems [12] essentially depend on the number of dimensions which lie within the nanometer range. The process ability of MCP, Nano-pectin is similar to conventional pectin-based polymers. Preliminary data suggests that modified pectin and nano-pectin are beneficial for nanostructured materials and systems and mineral-polymer matrices.

The other aim of our investigations was the study of structure changes by the production of modified pectins.

Conclusions

This paper successfully has demonstrated that the films of starch-chitosan mixture do not have a toxic effect. There is growing interest in using other polysaccharides, such as pectin, for the medical application.

Generally, the MCP has a molecular weight of 10-20 KDa, a degree of polymerization of 30-70 units and a degree of esterification of less than 50%. In this way, modified pectins of high antitumor power are obtained. This study represents an initial assessment of the in vivo performance of hydrogels with pectin. Further studies are required to better elucidate the in vivo behavior of pectin.

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