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Abstract

Cryogels Based on Chitosan for Antibiotics Retention †

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1. Introduction

In recent years, chitosan has gained a lot of interest, especially when it comes to medical uses (wound healing, excipients for drug administration), due to its great biocompatibility and low toxicity [1]. However, the low mechanical properties of this polymer limit its use to some extent. For this reason, in this study, chitosan was used in mixture with a natural clay, i.e., kaolin. The clay (Kaolin) was chosen due to its low toxicity and the occurrence of hydroxyl groups, which is suitable for preparing cryogels with adsorption properties [2,3]. Carbamazepine (CBZ) and Ciprofloxacin (CIP) are two types of antibiotics which are widely used in the treatment of upper infection, epileptic diseases, and many others [4]. Due to their large applications, a significant part of these antibiotics ends up in wastewaters. In order to retain all the traces of the antibiotics, new materials based on chitosan and clay have been studied.

2. Materials and Methods

To develop new cryogels with an adsorption capacity towards antibiotics, commercial chitosan (CC) and organophilized clay (K-MAPTES) were required. The other reagents used include acetic acid, which was used in mixture with water for chitosan dissolution; methacryloxypropyltrimethoxysilane (MAPTES, Sigma Aldrich), the organophilization agent for Kaolin modification; and a crosslinking agent and two antibiotics (CBZ and CIP). The organophilization stage was needed because kaolin is an inorganic compound and, in order to be incorporated into the chitosan matrix, it needs some organic moieties on its surface. The cryogels obtained were lyophilized and tested for antibiotic retention.

3. Results

Several characterization techniques (FTIR, SD, UV-Vis) were required to demonstrate the preparation of the developed materials. The FTIR spectra confirmed the incorporation of the inorganic component into the polymer matrix by the appearance of the characteristic bands for the silylation agent—MAPTES—and for the involved materials. The swelling degrees were able to determine the swelling capacity of the samples and also establish how much time they were able to resist in water. The UV-Vis results indicate the great adsorption capacity of cryogels for both antibiotics (CIP and CBZ).

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4. Conclusions

In conclusion, following the results obtained, new cryogels based on chitosan and clay were obtained. These materials show a great adsorption capacity for antibiotics and present potential for future use in wastewater treatment.

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