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Extended Abstract
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Biopolymer Congress 2018: Design of Drug Delivery Systems (DDS) made from biopolymers to control the porosity and obtain the desired release kinetics - Joana M R Curto - University of Beira Interior

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The design of drug delivery systems (DDS) made from cellulose building blocks at nano and microscale was done to obtain structures with the desired porosity, and therefore to control the release kinetics of the molecule that is being delivery. The DDS were developed to transport the therapeutic molecule Diclofenac, which is a very effective non-steroid anti-inflammatory drug but induces important gastric mucosa side effects during long term therapeutics. The objective is to develop a biocompatible polymeric system that can retain the drug, avoid its release at the acidic stomach pH, and release it at the alkaline duodenum pH. In the experimental and computational plan design several cellulose based materials were used: carboxymethylcellulose (CMC), nanofibrillated cellulose (NFC) and micro fibrillated cellulose (MFC) having different dimensions and functional bonding groups. The structural characterization was done using SEM image analysis and the pore optimization was done using a validated computational simulator. The results indicated that it was possible to obtain DDS with different pore dimensions and the better combinations were chosen. The nanofibrillated cellulose and microfibrillated were used to form a 3D porous network and the CMC was used to control OH bonding and water affinity. Optimization of the 3D porosity, pore dimension and distribution proved to be determinant to obtain a structure that was able to retain de drug and to release it at alkaline pH. Innovative DDS made form biopolymers have been developed to avoid Diclofenac release in the stomach and prevent the related side effects. The computational simulation proved to be an useful tool to predict the porosity for different combinations of nano and micro fibrillated cellulose fibrous materials. The method used to design these cellulosic porous materials can be used in the formation of other porous materials made from the assembly of polymeric structural units

Biopolymers are living organisms. They are made by natural polymer. Biopolymers contain monomer units which are covalently linked to form larger structures. There are three main classes of biopolymers polynucleotides, polypeptides and polysaccharides. More often, polynucleotides, such as RNA and DNA, are composed of 13 or more nucleotide monomers composed of long polymers. The last class, polysaccharides, are often structures of linear bonded polymeric carbohydrates and some examples include cellulose and alginate.

There are a number of biophysical techniques for determining sequence information. The protein sequence can be determined by Edman degradation, in which the N-terminal residues are hydrolyzed from the chain by one, derivatized, and then identified. Mass spectrometer techniques can also be used. The nucleic acid sequence can be determined by gel electrophoresis and capillary electrophoresis. Finally, the mechanical properties of these biopolymers can often be further measured using optical tweezers or atomic force microscopy. Dual polarization interferometry can be used to measure the changes in conformation or self-assembly of these materials when they are stimulated by pH, temperature.

This work is partly presented at 8th World Congress on Biopolymers & Bioplastics on June 28-29, 2018 at Berlin, Germany

Drug release has been an important topic in the field of drug delivery for many years. With advances in material design and engineering, new materials have increased complexity and additional functions have been developed in drug delivery devices and systems. Natural and synthetic macromolecules are widely used in controlled release drugs to maximize bioeffectiveness, facilitate clinical applicability, and improve quality of life. "Drug release" refers to the process by which drug solutes migrate to the initial position of the polymer system versus the outer surface of the polymer and then to the release medium. Ceaseus is seemingly simple and is influenced by a number of complex factors such as the solubility of the physicochemical properties, and the material properties of the structural system. These factors include the release environment and possible interactions. The rate of release depends on the morphology of the particles, the specific surface and the porosity of the surface.

A current trend in the field of controlled drug administration is the development of multi-component material systems with various physicochemical properties. For example, the crosslinked and stable PEG matrices and biodegradable labile gelatin macromolecules composed of semi-interpenetrating networks are subsequently determined by several factors and can be described by a single mathematical model.

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