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Design of dietary polysaccharide and binary monomer mixture of acrylamide and 2-acrylamido-2-methylpropane sulphonic acid based antiviral drug delivery devices

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ABSTRACT

The present article discusses the functionalization of psyllium by binary monomer mixture of acrylamide and 2-acrylamido-2-methylpropane sulphonic acid to develop the new drug delivery devices. These were characterized by SEMs, FTIR, TGA and swelling studies. The swelling kinetics of the hydrogels and release dynamics of drug (indinavir sulphate) from the drug loaded hydrogels has been studied for the evaluation of the swelling and drug release mechanism respectively. The release of the drug from the hydrogels occurred through Fickian diffusion mechanism in pH 2.2 buffer. The antiviral activity of indinavir sulphate for AIDS, anti-diarrhoeal action of psyllium and inhibitory effects of sulphated polymers on STD pathogens will enhance the potential of the drug delivery devices.

Keywords: Polysaccharide; Co-polymerization; Drug delivery; Indinavir sulphate

1. Introduction

Polysaccharides are promising biodegradable, non-toxic and less expensive polymeric materials which have been used to develop various drug delivery devices. However, these materials have certain drawbacks, like uncontrolled rate of hydration, thickening, drop in viscosity on storage and microbial contamination. In order to overcome these drawbacks these materials need some functionalization or modification (Lloyd et al., 1998; Durso, 1980). Grafting and crosslinking of vinyl monomers are the common techniques to modify and to improve the functional properties of polysaccharides and to make them advanced materials for drug delivery applications. Graft copolymerization of binary mixtures has more significance in comparison of single monomer. It provides properties of both monomers to the grafted material. It also adds grafted chains with tailor-made properties to the backbone for biomedical applications. The mutual effect of monomers in the reaction mixture controls the fraction of individual monomer in the grafted chains. This synergistic effect of co-monomers enhances the fraction of monomer in the graft yield. Hence, this technique provides an opportunity to prepare tailor-made grafted chains of desired properties by using suitable monomers. For example, hydroxyethyl methacrylate (HEMA) and acrylamide (AAm) are hydrophilic monomers containing hydroxyl and amide groups giving a unique combination of properties. Graft copolymerization of mixtures of vinyl monomers is important, since different types of polymer chains containing various functional groups can be introduced into the structure of trunk polymers used (Zhang et al., 2006; Kim and Park, 2004). The advantage of binary monomer based hydrogels system is that the swelling and drug release properties of gel can be better controlled by varying the relative concentration of the monomers involved. Further, by choosing the suitable monomers, the drug delivery systems can be made site specific in gastrointestinal tract (GIT).

AIDS had killed millions of people worldwide (Kallings, 2008). Therefore, there is a great urgency to develop therapeutic agents and drug delivery systems to blunt the progress of this pandemic (Pope and Haase, 2003). The treatment of the human immunodeficiency virus (HIV) infection has been extremely improved by a new class of protease inhibitors anti-HIV drugs (Flexner, 1998). GI disorders are among the most frequent complaints in patients with HIV infection. It has been reported that 50–93% of all the patients with HIV disease had marked GI symptoms during the course of their illness

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