About the Author

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Crosslinked chitosan microspheres for encapsulation of diclofenac sodium: effect of crosslinking agent

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(Received 28 December 2000; revised 30 April 2001; accepted 5 May 2001)

Microspheres of chitosan crosslinked with three different crosslinking agents viz, glutaraldehyde, sulphuric acid and heat treatment have been prepared to encapsulate diclofenac sodium (DS). Chitosan microspheres are produced in a w/o emulsion followed by crosslinking in the water phase by one of the crosslinking methods. Encapsulation of DS has been carried out by soaking the already swollen crosslinked microspheres in a saturated solution of DS. Microspheres are further characterized by FTIR, x-RD and SEM. The in-vitro release studies are performed in 7.4 pH buffer solution. Microspheres produced are spherical and have smooth surfaces, with sizes ranging between 40-230 μm, as evidenced by SEM. The crosslinking of chitosan takes place at the free amino group in all the cases, as evidenced by FTIR. This leads to the formation of imine groups or ionic bonds. Polymer crystallinity increases after crosslinking, as determined by x-RD. The method adopted for drug loading into the microspheres is satisfactory, and up to 28-30% w/w loading is observed for the sulphuric acid-crosslinked microspheres, whereas 23-29 and 15-23% of loadings are obtained for the glutaraldehyde (GA)- and heat-crosslinked microspheres, respectively. Among all the systems studied, the 32% GA crosslinked microspheres have shown the slowest release i.e. 41% at 420 min, and a fastest release of 81% at 500 min is shown by heat crosslinking for 3 h. Drug release from the matrices deviates slightly from the Fickian process.

Keywords: Chitosan, crosslinking agent, diclofenac sodium, microspheres.

Introduction

Chitin is a naturally occurring, and the second most abundant organic material next to cellulose. Due to its inertness, less attention has been given to chitin than cellulose. Several biomedical applications of chitosan have already been reported (Muzzarelli et al. 1986, Brine et al. 1992, Sjak-Braek et al. 1992, Muzzarelli 1997). Deacetylation of chitin yields chitosan, which is relatively reactive and can be produced in numerous forms, such as powder, paste, film, fibre, etc. (Jonathan et al. 1999; Shin et al. 1999). Chitosan has advantages over other polysaccharides, due to its non-toxicity and biodegradability, as it is broken down in the human system to harmless products (amino sugars) that can be easily absorbed.

In many studies, chitosan has been crosslinked with glutaraldehyde to make it a rigid polymer to be used as a core material in controlled release (CR) research (Gupta and Ravikumar 2000). However, the biological acceptance of such microspheres is still under investigation.
An assessment of solubility profiles of structurally similar hazardous pesticide in water + methanol mixture and co-solvent effect on partition coefficient

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Received 15 April 2001; received in revised form 23 July 2001; accepted 24 July 2001

Abstract

This paper reports solubility and partition coefficient data for the structurally similar pesticides, fenvalerate and cypermethrin, measured by UV spectrophotometry in binary mixtures of methanol and water at different temperatures. The solubility of both pesticides is much higher in methanol than in water at all temperatures. Partition coefficients were also measured between water + heptanol immiscible mixtures at 298.15 K, and these data show a decrease with increasing composition of methanol in water. © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Solubility; Fenvalerate; Cypermethrin; Partition coefficient; Pesticide

1. Introduction

The extensive use of pesticides in modern agricultural development in order to increase the production of food grains has created concern about their hazardous effects in the environment, thereby creating a threat to human and animal hygiene [1–3]. Crops can be protected by pesticides, but their heavy usage can result in environmental pollution; most pesticides when used without caution can be extremely poisonous to the plants. Illness due to pesticide exposure has been a serious and pandemic problem with farmers. Also, pesticide contamination of surface and ground water can be hazardous to drinking water sources. In order to understand the fate of toxic pesticides and to propose safe methods for their use, it is important to assess the solubility and partition characteristics of these pesticides in aqueous organic mixtures even before they are actually used in the field.

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PII: S0304-3894(01)00312-0