Transdermal protein delivery systems obtained from the hydrogels membranes matrix

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Abstract

The great demand for biomaterials for biomedical applications is increasing continuously, creating the need for new products commercially competitive. Hydrogels are polymeric materials of special interest in controlled release systems. In this work a series of membranes were prepared using PVP (poly vinyl pyrrolidone), PEG (poly ethylene glycol) and agar and cross-linked by radiation. The encapsulated protein in natural products were physically incorporate in the hydrogel solution at 40°C, poured to Petri dishes, packed and were irradiated at gamma source of ^{60}Co at 25 kGy. The study of protein release was carried out *in vitro* in a modified Franz cell with 10 mM phosphate buffered saline solution (PBS) pH 5.4 under magnetic stirrer. The released protein was measured each 2 h into 8 h and after 24 h in a spectrophotometer at 280 nm. The protein concentrations were determined from optical density at 280 nm in a spectrophotometer. The protein release in the extract were in the range of 0.0199 - 2.0513 mg/cm^2 for a period of time of 30 h.

Introduction

The great demand for biomaterials for biomedical applications is increasing continuously, creating the need for new products commercially competitive [1]. Hydrogels are polymeric materials that have a three-dimensional network structure and can swell considerably in aqueous medium without dissolution. Hydrogels are of special interest in controlled release applications because of their soft tissue biocompatibility, the easy dispersion of the drugs in the matrix and the high degree of control achieved by selecting the physical and chemical properties of the polymeric network [2]. A variety of synthetic or natural polymeric hydrogels have been employed as the controlled release systems for drug delivery [2,3]. In the present work was prepared a membrane of PVP (poly vinyl pyrrolidone), PEG (poly ethylene glicol) and agar with encapsulated protein incorporated for medical application in the treatment of skin ulcers. The aim of this study was to develop a membrane of hydrogel with encapsulated protein to obtain a controlled release system.

Experimental

The membranes with 5 cm of diameter were prepared using 6% PVP (poly vinyl pyrrolidone), 1.5% PEG (poly ethylene glycol) and 0.5% of agar and cross-linked by radiation. The encapsulated protein in natural products were physically incorporated in the hydrogel solution at 40°C and poured on Petri dishes, packed and were irradiated at gamma source of ^{60}Co at 25 kGy. The study of protein release was carried out *in vitro* in a modified Franz cell with 10 mM phosphate buffered saline solution (PBS) pH 5.4 under magnetic stirrer at 37ºC (Fig.1). The released protein was measured each 2 h into 8 h and after 24 h in a spectrophotometer (Carry 1E) at 280 nm.

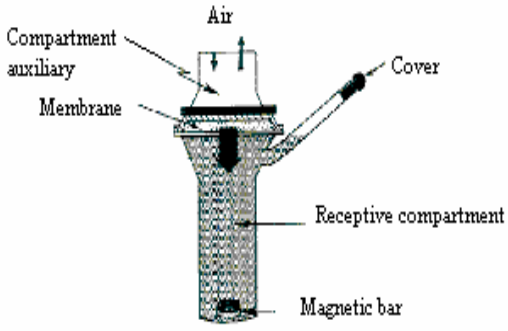

Figure 1. Modifed Franz Cell (1.1 cm of diameter)

Results and Discussion

The protein release profiles from membrane in PBS at pH 5.4 is shown in Fig 2 and only after 8 h we can observe protein release in PBS. The protein amount was increasing with increase of the time until around

28 h, stabilizing in this period. The protein release in the extract was in the range of 0.0199 - 2.0513 mg/cm^2. The relatively low amount of protein released from the membrane was probably related to encapsulation of protein that forms a layer delaying release *in vitro* condition. The immobilization of protein in natural product protected the protein in the irradiation process and retarded the release *in vitro* condition.

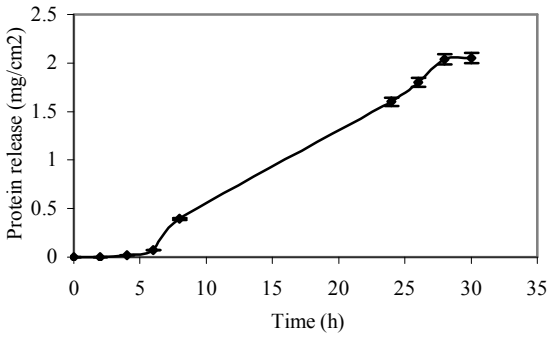

Figure 2. Protein release profile for polymers membranes

Conclusions

The process of immobilization of protein in natural products resulting in encapsulated active which was protected during obtaining process and retarded the release to 8 h *in vitro* assay. The protein release in the extract was measuring in the range of 0.0199 - 2.0513 mg/cm^2 for a period of time of 30 h. However, the systems can be optimized in terms of the time of protein delivery.

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