DETERMINATION OF HYDROCORTISONE RELEASE PROFILE FROM POLYMERIC NANOCARRIERS

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Introduction

In the preparation of controlled delivery system of active substance, the selection of an appropriate drug carrier is the most important. Currently, it can used the synthetic and natural biodegradable polymers, which occur in the nanometric scale. Moreover, polymeric materials which react to specific external factors, such as: temperature, pH, ionic strength, electric or magnetic field, light, and other chemical and biological stimuli, are particularly interesting. Due to they can be used in different area of medicine and pharmacy [1-4].

Materials and Methods

In this studies pH sensitive (poly(acrylic acid-co-methyl methacrylate) and temperature sensitive (N-isopropylacrylamide) polymeric nanocarriers were obtained by radical polymerization and the initiator of the reaction was ammonium persulfate (APS), while poly(ethylene glycol) diacrylate (PEGDA, Mn = 575 g/mol) or N, N'-methylenebisacrylamide were used as the crosslinking agent, respectively. After that, the encapsulation of the model active substance – hydrocortisone, was carried out. The hydrocortisone is a corticosteroid which helps to reduce swelling (inflammation) in the skin [5]. After, the encapsulation efficiency was assessed and the average particle size of the carrier – drug system was determined. In addition, various studies were carried out using the following research techniques: SEM, DLS and FT-IR, which allowed to analyze both the carrier and the carrier-drug system.
The release test was carried out using the Spectra/Por Standard regenerated cellulose (RC) membrane. Each dialysis bag was placed in a thermostatic chamber containing 250 ml of receptor solution. The assays were performed in buffer /ethanol solution (70:30 v/v) at pH 7.4, at 37°C for 7 days. The released concentration of steroid in the receptor solution was analyzed by means of UV-Vis spectroscopy (Perkin Elmer Company), at the wavelength of 245 nm.

Results and Discussion

The analysis of the obtained hydrocortisone release profiles from the systems containing the thermosensitive (FIG. 1) and pH-sensitive (FIG. 2) carrier showed a slow and prolonged release of the active substance - hydrocortisone. In the case of the pH-sensitive carrier - hydrocortisone system, the maximum drug release - 70%, occurred after 2,880 minutes (2 days). From then on, the second phase of drug release can be seen - slow, sustained release, maintained at an average of 65%. For the system with the same drug concentration but with a thermosensitive vehicle, the maximum release of hydrocortisone, ie 77%, was observed after 7,200 minutes (5 days). According to literature reports, the hydrocortisone-loaded nanomicelles containing dextran-PLGA copolymer (pH-sensitive system), also shows similar results, i.e. slow and sustained release of the drug [5].

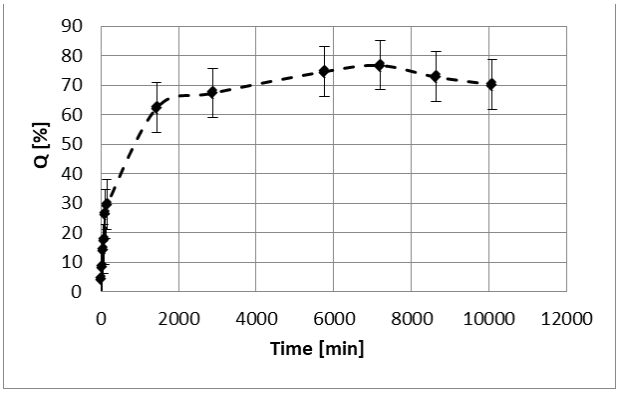

FIG. 1. The release profile of hydrocortisone from thermosensitive nanocarrier, at pH = 7.4 and T= 37°C.

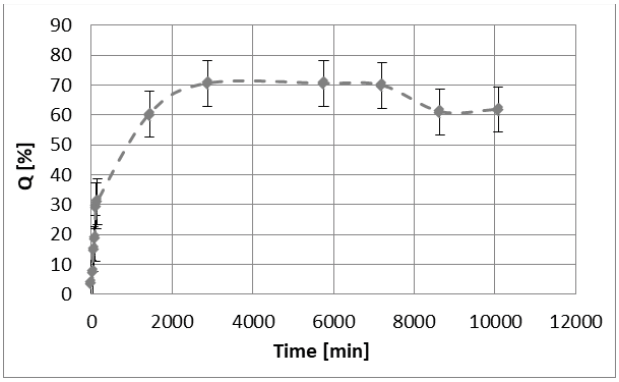

FIG. 2. The release profile of hydrocortisone from pH-sensitive nanocarrier, at pH = 7.4 and T= 37°C.

Conclusions

The results have shown that the pH-sensitive and thermosensitive polymeric nanocarriers developed in this study could be used as effective carriers for topical administration of hydrocortisone. Thanks to prolonged drug release profiles, it is possible to reduce the frequency of corticosteroid administration and the side effects.

Acknowledgments

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