

Biodegradable in situ gel-forming controlled drug delivery system based on thermosensitive PCL–PEG–PCL hydrogel

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Abstract

Objectives

In this work, biodegradable and injectable in situ gel-forming controlled drug delivery systems based on thermosensitive poly(e-cap-rolactone)–poly(ethylene glycol)–poly(e-caprolactone) (PCEC) hydrogel were studied. The prepared PCEC hydrogels undergo temperature-dependent sol–gel–sol transition, which are a flowing sol at refrigerator temperature and turn into a non-flowing gel at around physiological temperature.

Methods

PCEC copolymers with different CL/PEG ratios and different PEG (1000, 1500, 2000) were synthesized by two methods: by a ring opening polymerization under microwave irradiation and by a classic method in a reactor. Phase transition temperatures of the copolymers were determined by an inverting test tube. invitro drug release studies were done in different concentrations of copolymers and drugs to investigate the effect of these variables. Naltrexone Hydrochloride, Vitamin B₁₂, Vancomycin Hydrochloride and Amphotricin B were dissolved in copolymer solutions at two different concentrations of copolymers and drugs. The amount of release was determined by HPLC for all drugs.

Results

copolymers were synthesized easily during 15 minutes by a microwave irradiation. Most samples had a phase temperature of about 15-25°C which showed the system is in sol in refrigerator and become gel in the body. The rate of drug release was much less than for higher copolymer concentrations and PCL/PEG ratios. Up to 80% drugs were released in a time range of 6-17 days through different formulations of the hydrogel. It was found that the copolymer structure and concentration had also a critical role in controlling sol-gel transition temperature.

Conclusion

Using microwave irradiation is a suitable method for copolymer synthesis. PCL-PEG-PCL tri-block copolymer is an ideal system for controlled release of different hydrophilic and hydrophobic drugs.

Keywords: PCEC, controlled drug delivery, in situ gel-forming, tri block copolymer, vitamin B₁₂, naltrexone hydrochloride.

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