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Preparation of hydrogels based on inclusion complexes of the triblock copolymer PCL-PEG-PCL with α-cyclodextrin (α-CD)

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Background and Aims: Recently, supramolecular hydrogels resulting from the inclusion complexation of Cyclodextrins (CDs) with other polymer molecules have attracted much attention due to their potential applications in the field of biomedical engineering and as delivery matrixes for drugs or cells. In this work, water-soluble poly (caprolactone) (PCL)-poly-(ethylene glycol) (PEG)-poly (caprolactone) (PCL) triblock copolymers with good biodegradability were synthesized and used as a building block for constructing supramolecular hydrogels upon coplexation with α -CD.
Methods: The triblock copolymers PCL-PEG-PCL were synthesized by the ring-opening polymerization. Their composition, structure and molecular weight were characterized by NMR and GPC techniques. Supramolecular hydrogels were prepared in aqueous solution by blending an aqueous α -CD solution with aqueous solution of PCL-PEG-PCL block copolymer at room temperature. The rheological properties of hydrogel was also studied using a rotational viscometer.
Results: The gelation was found to occur within a minute after mixing. The viscosity of the hydrogel systems was determined as a function of shear rate. At last, In vitro B12 release through the hydrogel systems was studies. Copolymers were synthesized easily during 15 minutes by a microwave irradiation. The most viscose system with good syringeability was prepared by mixing of 12% wt α -CD and 10% wt of copolymer. Vitamin B12 was released through this system up to 80% during a period of 20 days. The system showed thixotropic behaviour and was found to be syringeable as well.
Conclusions: It can be concluded that microwave irradiation is a suitable method for copolymer synthesis. Supramolecular hydrogels made up of complexation of triblock copolymers with α-cyclodextrin can be an ideal system with desirable flow behaviour which could be used for controlled release of drugs.

Keywords: Hydrogel; Cyclodextrins; Triblock copolymer; Controlled release