

Synthesis and characterisation of p (Hema) hydrogel for ophthalmic drug delivery

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Abstract: Hydrogels represent 3D polymeric networks specially for various medical applications. Due to their porous structure, they are able to swollen and to entrap large amounts of therapeutic agents and other molecules. In addition, their biocompatibility and biodegradability properties, together with a controlled release profile make hydrogels a potential drug delivery system. In vivo studies have demonstrated their effectiveness as curing platforms for various diseases and affections. In addition, the result of the clinical trials are very encouraging and promising for the use of hydrogels as future target therapy strategies.

(Key words: Hydrogel, P (HEMA) Hydrogel drug delivery, MMC Mitomycin), Polymers biocompatibility)

Introduction

The polymer is biologically inert and physiologically compatible with eye tissues. The simplest hydrogel material used for contact lens were P(HEMA), which was developed by Wichterle in the year 1960. One of the major problems encountered with the topical delivery and extensive precorneal loss caused by drainage. Polymeric gels are classified into two distinct groups, preformed and insitu formig gels both of which improve bioavailability and decrease the side effects induced by the systemic absorption of topically applied ophthalmic drugs.²⁻⁸

We prepared P (HEMA) hydrogels and investigated their possible application to inhibits fibroblast proliferation. A vision threatening cellular proliferation also occur following glaucoma surgery. Glaucoma is characterized by a classical trial of symptoms elevated intraocular pressure

(IOP), optic nerve damage and progressive field loss. Recent chemical studies have demonstrated of agent which inhibit the wound healing. Such as painful injection into the conjunctive after the operation.

In the present work we use drug MMC (mitomycin) and its possible application in haze prevention was investigated.

Experimental Chemicals :

Neutral buffered formalin, Toluidine blue, hematoxylin and eosin solution, sodium dodecyl sulphate, mitomycin C, reagents for hydrogel synthesis-2-hydroxy ethyl methyl acrylate (HEMA)-2 hydroxy ethyl-methyl acrylate as monomer, N,N' methylene bisacrylamide (MBA) as crosslinker, ammonium persulphate (APS) as initiator and reagents for tissue culture (Culture medium, trypsin antibiotics) cos-1 cells were obtained from promocell.

Hydrogel Synthesis

For P (HEMA) hydrogel synthesis. 508 g of MBA (X-er) was dissolved in 4 ml distilled water followed by the addition 4 ml of HEMA monomer and thorough mixing 1 ml aliquot of APS in water (0.5 mol% with respect to HEMA) monomer) was subsequently added following mixing of all components, the solution was put into glass test tube and allowed to react at 70 C for half an hour to form the hydrogel network. Polymer is synthesized by redox polymerization and the crosslinkers were included at a 1:100 mol ration of crosslinker to monomer (1%*x*-ed)

Drug loading and release

We loaded mytomycin C (MMC) into the hydrogel by two methods. In the first method by directly mixing the drug with the hydrogel precursors before polymerization crosslinking reaction. After hydrogel formation, the solid polymer hydrogel was cut into a circular discs of about 8 mm diameter. The disc were sterilized for a period of 2 hours, and then used in cell culture studies.

In the second method first we synthesized the polymer and cut into circular discs of about 8mm diameter. unreacted species were removed from the polymer by washing with a 50/

50 (v/v) soln of distilled water and ethanol. The use of ethanol as solvent in drug loading helped sterilize the polymer material.

Results and Discussion

The MMC loaded known amount of hydrogel were placed in ethanol or water and the release amount was calculated via-UV-Vis-spectrophotometer from the calibration curves constructed 360 nm from the linear relationship between drug concentrations and absorbance in ethanol or water. From the fig 1.1 it can be deduced initially there in a linear drug release up to 3 hours.

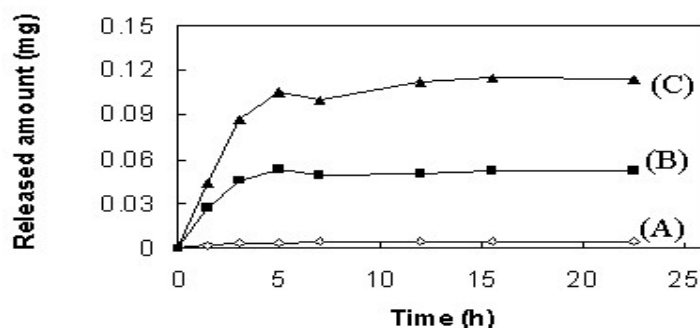


Figure - 1

Different amount of MMC loaded 1% X - ed p (HEMA) hydrogel release study in ethanol. (A) 0.02 (B) 0.075 mg and (c) 0.25 mg MMC loading per gram dry gels.

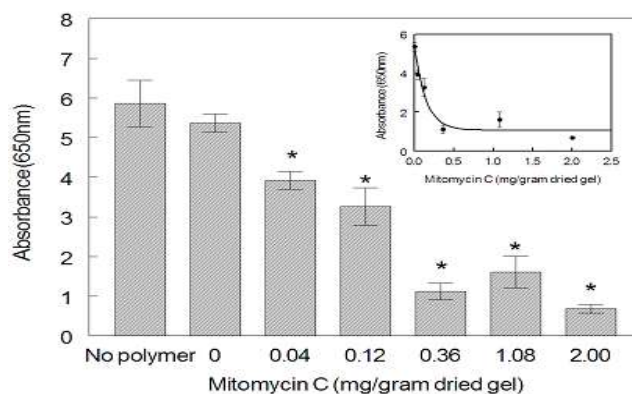


Figure -2

Conclusion :

The main cause of glaucoma surgery failure is conjunctival fibrosis. Anti-fibrotic agents such as MMC has increased the success of the trabeculectomy operation. But the use has little or no the success of glaucoma drainage devices. It may be that conjunctival fibroblasts are less sensitive to one time application of MMC

The result of these experiments suggest

that the slow release device has potential for future human use

In summary we present a novel slow release mitomycin C device that has proven its efficacy *in the vitro* model. This device and the technique can potentially be used with other drug that might better antifibrotic activity and safer profile than MMC

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