



Synthesis, characterization of β -CD based novel hydrogels with dual objectives of drug release and dye removal

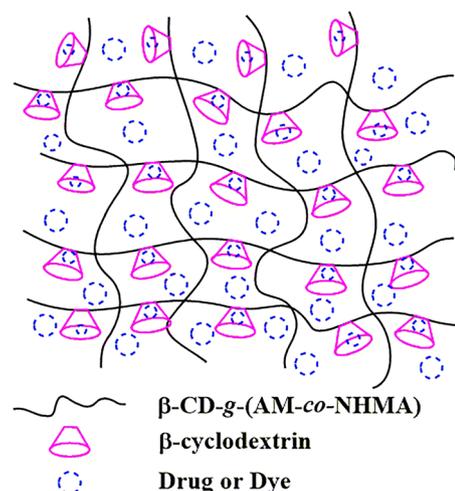
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Abstract

In our recent work, we have reported on hydrogels devoid of cross-linkers. After observing the successful swelling and water retention properties, we have introduced β -cyclodextrin in acrylamide-*co*-*N*-(hydroxymethyl)-acrylamide hydrogel to introduce hydrophobic cores. In this work, we have focussed to improve the sustainable drug release and toxic dye removal performance of hydrogel by introducing β -cyclodextrin (β -CD). Four different grades of β -cyclodextrin grafted acrylamide-*co*-*N*-(hydroxymethyl)-acrylamide have been synthesized through free radical polymerization technique at room temperature. Different proportions of β -CD and fixed amount of acrylamide (AM), *N*-(hydroxymethyl)-acrylamide (NHMA) and 2,2'-azobis-[2-(2-imidazolin-2-yl)-propane] dihydrochloride (AIPD as an initiator) have been used. The synthesized grades were characterized using FTIR, SEM, TGA, UV-visible and powder XRD. Hydrogels have shown high swelling capacity, i.e. 3000 times higher than dry weight. The diffusion studies of drug loaded hydrogels have been performed which have followed quasi-Fickian drug release behavior. Cumulative drug release studies of diclofenac sodium has been investigated in buffer solution at pH 7.4 for 66 h. The toxic cationic dye (methylene blue) removal studies have been carried out in highly concentrated dye contaminated aqueous solution at neutral pH. Hydrogel resulted in complete removal of MB dye with lesser dose and in short span of time. β -Cyclodextrin grafted acrylamide-*co*-*N*-(hydroxymethyl)-acrylamide-2 and β -cyclodextrin grafted acrylamide-*co*-*N*-(hydroxymethyl)-acrylamide-3 showed highest 77% drug release and almost 100% dye removal from solution, respectively.

Graphic abstract



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Keywords Cross-linker free hydrogel · Drug delivery · Dye removal · Swelling properties · Polyacrylamide