CMTKG Based Hydrogel incorporating Metal Oxide Nanoparticles for Drug Delivery Applications

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Abstract

In this study, a novel hydrogel network based on carboxymethyl tamarind kernel gum/Polyacrylamide is synthesised and N,N'-Methylenebisacrylamide (MBA) was used as a cross-linker. $CuCl_2.2H_2O$ was used to produce copper oxide nanoparticles (CuO NPs), which were then embedded in CMTKG/PAM hydrogel for ciprofloxacin controlled drug release. The produced CuO NPs, pure hydrogel, and hydrogel nanocomposites were characterized using several kinds of methods, including FTIR, PXRD, and FESEM. For every hydrogel nanocomposite that is synthesized, a number of parameters were estimated, including drug loading (DL%), drug entrapment (DE%), gel content, and porosity. Swelling studies were conducted using the gravimetry method. The swelling studies were conducted at 2.2 and 7.4 pH. The results of swelling studies of hydrogel nanocomposites concluded that the embedded CuO NPs decreased hydrogel's swelling as we increased NPs amount. This is observed due to enhancement of cross-linking in the hydrogel matrix. The higher swelling ratio was observed at alkaline pH whereas higher drug release was seen at acidic pH. The Disc diffusion method was usedto study the antibacterial activity of CMTKG-based nanocomposite hydrogel using gram-negative E. coli bacteria. The outcome demonstrated that the antimicrobial activity of ciprofloxacin-loaded CMTKG-based hydrogels was improved by the addition of CuO NPs. The Higuchi and Korsmeyer-Peppas model was used for the kinetic modeling of drug release. The mechanistic pathway of drug release from the hydrogels was better fitted in the Korsmeyer-Peppas model, followed by Fickian diffusion, according to the higher regression coefficient (R2) value near unity.