Abstract

This research focuses on the fabrication of a series of xanthan gum-based hydrogels for the efficient delivery of the hydrophobic drug. The study investigates the influence of crosslinker (MBA), biopolymer (XG), and initiator (KPS) amounts on hydrogel properties. Various characterization techniques, such as PXRD, ATR-FTIR, SEM, and TGA, were utilized to analyze the fabricated hydrogels. The sol–gel analysis revealed that a higher quantity of reagents led to a greater increase in the gel fraction of the synthesized hydrogels. Porosity measurements indicated enhanced porosity with higher biopolymer and initiator amounts, while porosity decreased with increased crosslinker concentration. The incorporation of amphiphilic polymer in the hydrogel significantly improved its properties such as gel fraction, swelling ratio, porosity, drug loading, drug entrapment and drug release percentage. Notably, under alkaline conditions (pH 7.4), the synthesized hydrogel exhibited an increased swelling ratio and drug release in the comparison to acidic conditions (pH 1.2). The drug release mechanism from the synthesized hydrogel followed a Fickian diffusion pattern, and the Korsmeyer-Peppas model was identified as the most appropriate for describing drug release kinetics in the both pH 1.2 and 7.4 buffer solution. The pH-responsive nature of the developed hydrogel highlights its potential as an effective and versatile candidate for drug delivery application.