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Synthesis and Characterization of PH Sensitive Hydrogel and Its Application in Controlled Drug Release of Tramadol

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Abstract : Conventional release dosage forms are known to provide an immediate release of the drug. Controlling the rate of drug release from polymeric matrices is very important for a number of applications, particularly in the pharmaceutical area. Hydrogels are polymers in three-dimensional network arrangement, which can absorb and retain large amounts of water without dissolution. They have been frequently used to develop controlled released formulations for oral administration because they can extend the duration of drug release and thus reduce dose to be administrated improving patient compliance. Tramadol is an opioid pain medication used to treat moderate to moderately severe pain. When taken as an immediate-release oral formulation, the onset of pain relief usually occurs within about an hour. In the present work, we synthesized pH-responsive hydrogels of (hydroxyl ethyl methacrylate-co-acrylic acid), (HEMA-AA) for control drug delivery of tramadol in the gastro-intestinal tractus. The hydrogels with different acrylic acid content, were synthesized by free radical polymerization and characterized by FTIR spectroscopy, X ray diffraction analysis (XRD), differential scanning calorimetry (DSC) and thermo gravimetric analysis (TGA). FTIR spectroscopy has shown specific hydrogen bonding interactions between the carbonyl groups of the hydrogels and hydroxyl groups of tramadol. Both the XRD and DSC studies revealed that the introduction of tramadol in the hydrogel network induced the amorphization of the drug. The swelling behaviour, absorptive kinetics and the release kinetics of tramadol in simulated gastric fluid (pH 1.2) and in simulated intestinal fluid (pH 7.4) were also investigated. The hydrogels exhibited pH-responsive behavior in the swelling study. The (HEMA-AA) hydrogel swelling was much higher in pH =7.4 medium. The tramadol release was significantly increased when pH of the medium was changed from simulated gastric fluid (pH 1.2) to simulated intestinal fluid (pH 7.4). Using suitable mathematical models, the apparent diffusional coefficients and the corresponding kinetic parameters have been calculated.

Keywords : biopolymres, drug delivery, hydrogels, tramadol
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