Interpenetrating polymer networks of polyacrylamide and poly(N,N-diethylaminoethyl methacrylate) as drug delivery systems for diclofenac sodium sustained release

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The polymeric vehicles for drug delivery are widely used nowadays mainly due to their versatility and environmental responsiveness that give rise to controlled drug release. They could enhance the drug solubilization and strong drug-polymer interaction that result into sustained drug release, or drug release triggered by changes in the environment.

Interpenetrating polymer networks (IPNs) are still not fully exploited as drug delivery systems although they possess many advantages for this application. They allow combining polymers which significantly differ in nature and properties into one material thus resulting into tough, strong material which swells controllable in the body.

This study aims to develop new polymeric vehicles for sustained diclofenac sodium release utilizing the advantages of IPNs. To this purpose we have synthesized new IPNs based on polyacrylamide (PAAm) and poly(N,N-dimethylaminoethyl methacrylate) (PDMAEMA) (cationic IPN) and used them as drug delivery systems for diclofenac sodium (anionic drug). By tuning IPNs composition we were able to control the drug-IPN interaction and hence the drug release properties. High resolution magic angle spinning nuclear magnetic resonance (HRMAS NMR) was used to reveal the drug-polymer interactions. All IPNs possessed nanocomposite-like structure due to the fine phase separation that takes place during their preparation. In conclusion, the IPN structure and composition appear to be powerful tools to efficiently control the drug loading as well as drug release kinetics.

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