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Nanostructured chitosan-based hydrogels for psoriasis: Rheological and drug release characterization

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Nanostructured hydrogels (NSH) provide many advantages for topical administration of drugs, as well as provide adequate viscosity and stability, they can prolong drug release into the skin. This work proposes the development of NSH based on chitosan containing 8-Methoxypsoralen (8-MOP) for topical treatment of vitiligo. Prior to NSH, nanoemulsions (NE) were formulated containing 5 wt% of clove essential oil as oil phase and 10 wt% of surfactant Pluronic F68 (NEC) and also containing 5 wt% of sweet fennel essential oil as oil phase and 3 wt% of the surfactant Cremophor® RH40 (NEF). Chitosan with low, medium and high molecular weight (MW) was used as hydrogel-forming polymer. NE were characterized for their morphology with atomic force microscopy, average droplet diameter and physical stability. NSH were characterized regarding their rheological behavior, physical stability and drug release properties. Results showed that stable NE were obtained with average droplet diameters of less than 100 nm. The rheological characterization showed that all developed NSH produced had shear thinning behavior as expected. NSH with high and medium MW were characterized as weak gels, while those consisting of low MW chitosan were essentially viscous systems. NSH consisting of sweet fennel oil and Cremophor RH40 (NHF) showed drug rapid release, apparently depending on MM chitosan, following the Korsmeyer-Peppas model with anomalous behavior of 8-MOP release. However, the NSH consisting of clove oil (NHC) showed the opposite behavior, with slow and sustained drug release for a period up to 6 hours following the Higuchi kinetic model. Drug release from NHC showed strong dependency on chitosan molecular weight. On the other hand, NHF showed an unexpected pH-dependent behavior not fully understood at the moment. These results need further investigation, nevertheless NSH revealed to be interesting and complex dermal delivery systems for poorly soluble drugs. From the results, it can be seen the complex interaction between the components of the formulation and how it affects drug release.

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