

Preformulation studies of polymeric hydrogels with insulin for pharmaceutical applications

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BACKGROUND

Hydrogels are carriers of active substances often used in pharmaceutical technology. They are biocompatible with human tissues. They show the ability to absorb biological fluids and have the potential to develop new therapies for the treatment of exudative and chronic wounds. Numerous studies support their potential use as hormone carriers. The aim of our research was to develop a hydrogel containing insulin (INS) for administration on the skin. This hormone exhibits reparative and regenerative effects in lesional tissues.

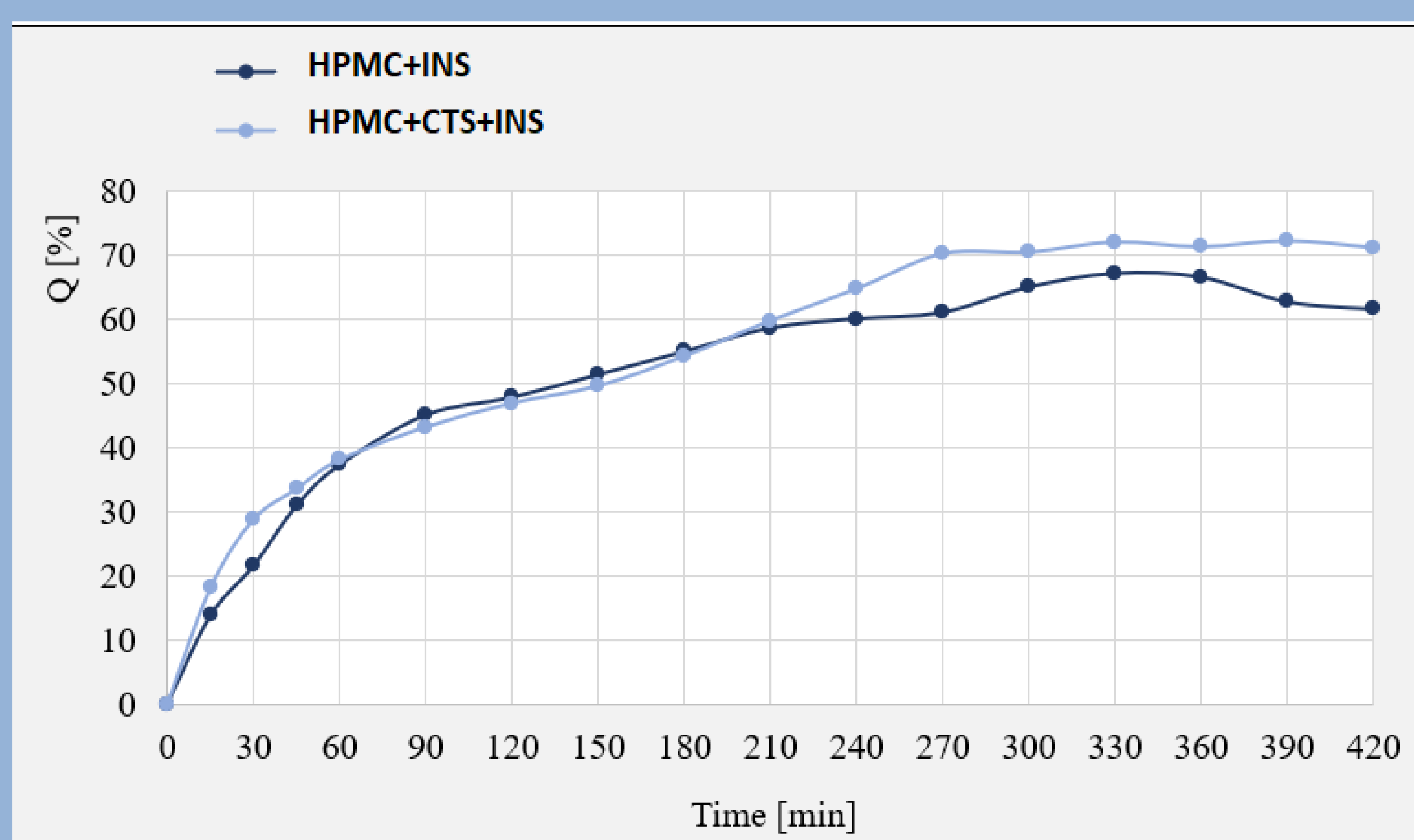
MATERIALS AND METHODS

Hydrogel carriers of insulin based on hydroxypropyl methylcellulose (HPMC) and hydroxypropyl methylcellulose (HPMC) with chitosan (CTS) were developed. The insulin concentration (Insulatard Penfill, Novo Nordisk Denmark) was 1mg/g of hydrogel. A paddle apparatus (DT 600, ERWEKA GmbH, Germany) equipped with Enhancer Cell type chambers was used for pharmaceutical availability testing. The semipermeable membrane was a Spectra/Por 2 dialysis membrane. Rotational rheometry was used for rheological tests. A Lamy RM 200 Touch laboratory rheometer (Lamy Rheology Instruments, Champagne au Mont d'Or, France) equipped with an MK-CP 2445 measuring system and a CP-1 Plus thermostat was used. Measurements were carried out at $25 \pm 1^\circ\text{C}$. Hydrogel flow curves were determined and the thixotropy effect of the analyzed systems was tested. Graphical and mathematical analysis of the results was carried out using Rheometric-P Software.

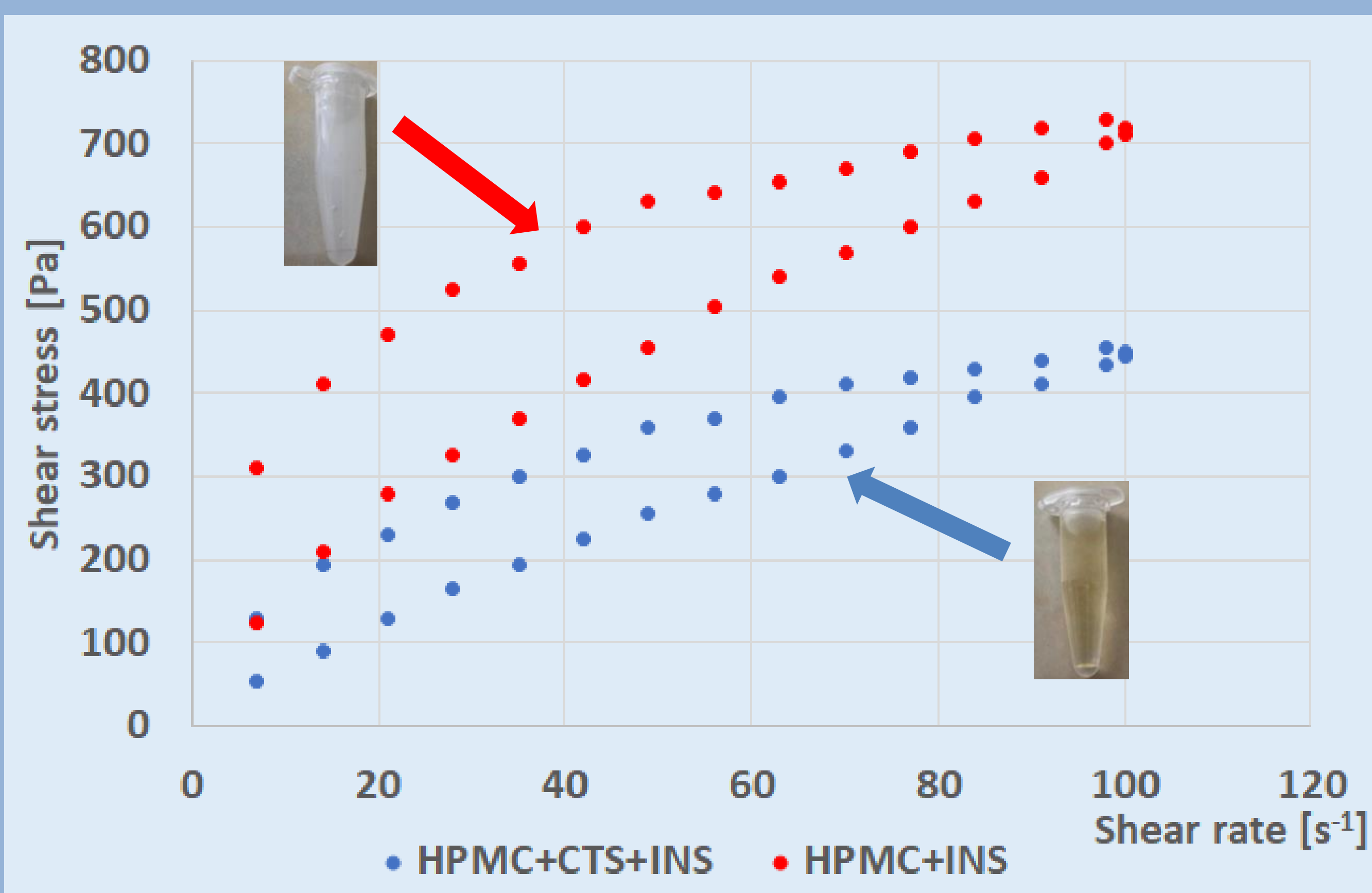
RESULTS

The study showed that the release of INS from the developed formulations occurred in a prolonged manner. From the HPMC+CTS-based hydrogel formulation, 73% of the INS was released at 6.5 hours, while from the HPMC-based hydrogel, 65% of the INS was released after 5.5 hours. Rheological studies confirmed that the developed hydrogels are non-Newtonian, shear-thinning systems and have a yield stress. The analyzed formulations exhibit thixotropy.

Ryc.1. Comparison of drug release profiles.



Ryc.2. Thixotropic behavior of hydrogels.



CONCLUSION

After pre-formulation studies, it was concluded that the hydrogels based on HPMC+INS and HPMC+CTS+INS show a high application potential.



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