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Investigation of thermosensitive polymeric micelles in scope of nasal drug administration

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Polymeric micelles are novel nanocarrier systems capable of encapsulating active substances with poor water solubility to improve on their physicochemical and pharmacokinetic characteristics. There are numerous fields where these nanocarriers can be applied and the utilization of intelligent polymers, such as thermosensitive micelle-forming co-polymers, has additive values as well. Regarding the nasal drug delivery pathway, thermosensitive polymeric micelles can decrease their micelle size in the temperature of the nasal cavity, leading to enhanced paracellular uptake through the olfactory and trigeminal nerves, providing rapid drug permeation to the brain.

Our aim with this current study was to conduct base research whilst answering the elemental questions regarding the relations between the thermosensitive behaviour of the model drug (risperisode)-loaded polymeric micelles and the nasal dosage form requirements.

Dynamic light scattering measurements were performed to find the micelle forming temperature described as the low critical solution temperature (LCST). The temperature was changed by means of 0.5 Celsius degrees to find the LCST. To find the optimal composition of the binary polymeric micellar system, the same experiment was conducted from 25 to 40 °C. The micelle size and distribution were investigated via varying conditions of pH in the nasal administration range and via the change in formulation viscosity.

Our results show that the optimal composition of the binary system has an LCST value of 28 °C, which is high enough that the size decrease would not occur at ambient temperature during storage, but low enough that it would fit the temperature of the nasal cavity. The micelle size was approximately 23 nm in monodisperse size distribution. Change in the pH and viscosity did not affect the optimal nanoparticle characteristics.

To conclude the base research, it can be claimed that optimization through the investigation of each critical dosage form requirements can add value to the formulation design predicting value-added nasal administration.

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