In Situ Gelation of Low acyl Gellan Gum powder for nasal drug delivery

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Background: Recently, nasal drug dosage form has gained a great attention over the last few decades because of its great potential utility for both local and systemic drug delivery. However, the protective feature of the nasal cavity make intranasal delivery challenging. Therefore, in this study an attempts was made to design a novel drug delivery to sustain drug action at nasal cavity using *in situ* LA gellan gum and caffeine as powder formulation. Caffeine was used as model drug in this study.

Methods: The formulations were prepared by adding different concentration (0.1, 0.25, 0.5 and 1%) of LA acyl gellan gum to deionized water heated to 85 °C while stirring. Once fully dissolved the solution was cooled to ~60 °C and then, caffeine (100 mg/ml) was added. The formulations were then dried by spray drying. The rheological behavior of the rehydrated samples were evaluated in terms of the elastic (storage) modulus (G') and the viscous (loss) modulus (G") as a function of angular frequency (0.1–100 rad s^{-1} angular frequency) to produce mechanical spectra of the samples. Measurements were taken at 34 °C and performed at 1% strain (strain amplitude chosen was within the linear viscoelastic region of the sample). Bespoke mucoadhesion apparatus was used to predict drug retention time from dry powder formulations. PBS was then perfused over the dialysis tube surface at flow rate of 1 mL/min. The PBS perfusate was collected at time points upto 60 min and caffeine content was measured using spectrophotometer at wavelength of 272 nm.

Results: Dynamic small deformation oscillatory measurements of G' and G" highlight the viscoelasticity of the 0.25, 0.5 and 1% with G 'slightly greater than G" across a range of frequencies; this is typical 'weak gel' rheological behavior. To investigate the mucoadhesion properties of rehydrated gellan powder, the release of caffeine from formulations at different concentration were studied. 0.1 % LA gellan shows almost 96% of drug released after 20min; whereas 1% LA gellan shows only 40% drug release at the same time point with the 0.25 and 0.5 % of these two polymers releasing 80 and 60 % respectively after 20 min.

Conclusions: In this study we have demonstrated that a mucoadhesive property of gelling nasal spray has the potential to be formulated using gellan gum powder and the elasticity of the rehydrated gel after dispensing great enough to adhere to the mucosal membrane.