Oral nanosponge-based formulation for the treatment of diabetes

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Short Communication

Cyclodextrin-based nanosponges have been found to be promising drug delivery systems capable of protecting a great variety of drugs susceptible to physicochemical and enzymatic degradation and improving the outcome of treatment. This study is focused on the development of an insulin-loaded nanosponge formulation for the treatment of diabetes. This nano-techonological approach is meant to overcome the inconvenience of daily subcutaneous injections of insulin, which is the most common route of administration to date, by enabling insulin to be administered orally, which would be extremely beneficial for patients as it is painless and simple.

The nanosponge selected for this purpose was synthesized by crosslinking β-cyclodextrins with pyromellitic dianhydride, the formulation of which was tuned by adopting a top-down approach in order to obtain stable nanosuspensions. Insulin-loaded nanosuspensions were characterized from a physicochemical point of view and tested both in vitro and in vivo.

The formulation was nanometric (around 250 nm) with a high negative zeta potential (-28 mV), it had good mucoadhesion and swelling capacities, loading capability of about 14% and over 90% of encapsulation efficiency. In addition, the release of insulin was negligible at a gastric pH while sustained at an intestinal pH and the intestinal absorption of insulin was found to be enhanced in the Caco-2 cell in-vitro assay.

The results collected up to now justify the continuation of this study to determine the effectiveness in vivo of insulin-loaded nanosponges and this nano-technological approach may pave for the delivery of other proteins of pharmaceutical interest.

Keywords: cyclodextrin-based nanosponges, insulin, oral delivery.

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