An Insulin-loaded Nanoparticle and the Method for Preparing Thereof

Published date: March 17, 2017

Technology description

Unmet Need:
Repeated injections of insulin is the standard of care for treating Type 1 diabetes, and essential for control and management of Type 2 diabetes. Drawbacks of this treatment include poor patient compliance, discomfort, and an impaired lifestyle, and hypoglycemia. Oral administration of insulin, if successful, could deliver insulin such that it mimics the natural process of insulin metabolism, avoiding the hypoglycemia and discomfort associated with injections. Therefore, there is an unmet need to overcome the challenges associated with oral delivery of insulin, including, insulin degradation in the stomach, and low oral bioavailability of insulin due to inability to absorb through the intestines.
Technical Overview:
JHU researchers have developed a new optimized method to make and manufacture nanoparticles (NPs) appropriate for oral delivery of insulin. NPs have recently been identified as a promising platform for oral delivery of insulin. Chitosan (CS) is a carrier for delivery of proteins and nucleic acids by forming polyelectrolyte complex nanoparticles. Production of these nanoparticles with controlled quality in a scalable manner is critical for the clinical translation. Currently available batch-mode mixing methods face significant challenges in scaling up while maintaining size control and uniformity. JHU researchers have developed a new method, termed flash nano-complexation (FNC), which is capable of achieving scalable and continuous production of complex nanoparticles by infusing CS, tripolyphosphate (TPP), and insulin together. This FNC method not only allows for generating more uniform nanoparticles with narrow size distribution and higher encapsulation efficiency (90%) compared with batch-mixing methods, but also enables control of nanoparticle size to as small as 45 nm by tuning flow rate and Reynolds number. Experiments using this new method, showed that smaller nanoparticles produced by FNC method were more effective than larger particles in delivering insulin and controlling blood glucose level through oral administration in Type 1 diabetes rats. This easy, reproducible and efficient FNC technique can be readily extended to prepare a wide range of polyelectrolyte complex nanoparticles.
Publication(s):
Not available at this time.

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