Engineered Chitosan Based Multi-reservoir Devices for Effective Localization to Treat a Multifaceted Set of Diseases

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Substantial challenges of drug delivery to treat various diseases exist in our modern world. The acidic environment of the stomach, combined with an array of intestinal digestive enzymes, poorly permeable mucous layer, and peristaltic shear conditions have made oral drug delivery challenging, therefore there is an inherent need for new drug delivery methods. Crohn's disease is an inflammatory bowel disease current preventative medications include anti-inflammatory drugs, steroids, immune system suppressors, and antibiotics. A microfabricated device loaded with a polymeric material that releases drug only to the presence of mucous unique the ilias is a novel method in localized therapy. I microfabricated microdevices using a series of photolithography and reactive ion etching. Using this technique, I created 500,000 devices with 3 drug reservoirs each in 2 hours. The advantage of this technique is that photolithography controls the size and shape of the microdevice and etching controls the depth of the reservoir. The microdevices were composed of chitosan: FDA approved, biocompatible polymer, known for its mucoadhesive property to adhere to mucous at sites of inflammation. It also invokes specific binding for longer retention time. Unlike current nanoparticulate systems that require cumbersome synthesis steps to introduce multiple drugs, chitosan microdevices will be fabricated with multiple reservoirs to load multiple antioxidant enzymes with ease. To implement time dependent controlled release, sacrificial layers of base-soluble polymer caps were implemented on chitosan microdevices. the unidirectional release from these reservoirs should achieve a highly localized drug concentration in close proximity to the intestinal cells resulting in an increase in uptake of drug.

Awards Won:
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