Nano-composite Polymeric Membrane System for Drug Delivery

The Advantages

- The system can change pore size quickly in response to external stimuli. Our scientist has shown through in vitro experiments changes in pore size in response to such stimuli as alterations in pH, temperature, ionic strength. Therefore, the membrane is stimuli-responsive and consequently it can provide stimuli-responsive drug release. Our scientist has also shown through in vitro experiments that the membrane can release insulin in response to glucose levels for the treatment of diabetes.

- The pore size of the system can be tailored for release and/or separation of solutes of different sizes.

- The polymeric system protects protein and polypeptide drugs from enzymatic degradation.

- The new system can be made to be biocompatible and can be biodegradable depending on the polymers used.

The Problem

Then human body has its own homeostatic mechanisms to regulate a variety of physiologic parameters within a certain range. In instances of disease, however, these parameters may be affected due to various mechanisms. Regulated drug delivery is a concept in which drugs are delivered at an appropriate rate in response to stimuli. Disease states may cause a change in some parameters of the body and this can be used as a stimuli or trigger for the onset and offset of the delivery of drugs.

A number of polymers that exhibit property change in response to variations in temperature and pH have been investigated for their success in drug delivery. However some polymer systems have been shown to be associated with hyperthermia. Membranes that have been developed to overcome this problem are prepared by chemical reactions. Therefore, purification is required after the fabrication of the membrane. More importantly, and a clear disadvantage of such systems is that the reaction conditions are hazardous for therapeutic agents. In vivo instability especially enzymatic degradation hinders applications of proteins and polypeptides as therapeutic agents. As such it is desirable to have a delivery system that can allow therapeutic agents to diffuse out while preventing the enzymes from entering.

The Solution

The invention is a composite polymeric system to provide enhances stimuli-responsiveness. The first aspect provides particles including nanoparticles or microspheres in which the particles are made of stimuli-responsive polymer which responds to various stimuli as temperature and pH change. Incorporated with this polymer is another polymer which in turn is relatively insensitive to stimuli. The invention can be potentially applied to other systems comprising a hydrogel and nonswellable hydrophobic polymer.
The Applications

The use of the polymer membrane is for regulated delivery of proteins, peptide and therapeutic agents. However because of the unique fabrication and novel make-up of this technology it can be easily altered to be useful in various applications of drug delivery; such as oral, topical, and internal deliveries.

The composite polymeric systems of the present invention may also be used in any one or more of the following applications: solute separation and filtration; temperature, pH and ionic strength and biochemical ions-responsive drug delivery; diagnostic and monitoring tools; proteins and peptide delivery; and coating and microencapsulation of solid dosage forms such as tablets, or microencapsulation of live cells.

The present invention may also be used for treating inflammation, infection, diabetes, arthritis, and cancer, as well as a method for stimuli-responsive separation of solutes of different sizes in an aqueous medium.

The Business Opportunity

The current business opportunity is to license the nano-composite polymeric membrane system for specific drug delivery applications to biotech and pharma companies that are working in the area of these applications.

The Literature


