Innovations
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Targeted Nanogels for Bladder Therapy

Category

Technology: Nanogels
Developed: 2018

Problem

Treatment of UTIs

Technology Overview

Local and sustained release of drugs by a nanogel

IP Status

- PCT patent pending
- Available for Exclusive Licensing

Value Proposition

- Biocompatible and biodegradable/non-biodegradable
- Controlled delivery rate

Market Attractions

- Intravesical drug delivery
- Multi-day delivery
- Other possible local applications

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Problem: Urinary tract infections (UTIs) are among the most common bacterial infections in the US with an estimated 150 million cases every year. UTIs are responsible for nearly seven million office visits and one million emergency visits each year, resulting in over 6 billion dollars in healthcare costs (source: GlobalData). UTIs are most frequently caused by gram-negative bacteria infecting the urethra and bladder. To date, the most current treatment for UTIs remains the prescription of antibiotics. However, administration of antibiotics is not always efficient due to their limited penetration into the mucosa and the development of antibiotic resistance. Photoactive nanogels present an appealing alternative as they permit localized and sustainable drug delivery.

Invention and Key Value Propositions: A group of researchers, led by Drs. Devatha Nair and Dmitri Simberg at the University of Colorado, synthesized and tested a nanogel specifically designed to treat UTIs. The nanogel is formed as a polymeric 3-dimensional network that can act as a drug carrier. The presence of a cell-penetrating peptide (such as CGKRK) enables the nanogels to bind and penetrate the bladder epithelium to deliver the therapeutic within the urothelium. The presence of functionalized nanogels designed to covalently bond to the urothelial layers in response to a light source enables the retention of the nanogel within the urothelium. Variations in the type of the polymers, their concentration, and the production process, allow the encapsulation of a variety of molecules and modulation of the drug release rate over time.

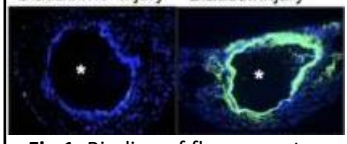

Fig.1. Binding of fluorescent CGKRK- nanogel conjugate to a mouse urothelium. Injury of the urothelium, is a necessary condition for binding.

Compared to other delivery systems, the nanogel provides the advantage of a long lasting (from 48 to 120 hours) drug delivery in the location where it is needed. The nanogel has been tested in vitro and in vivo in mice, and strong adherence to the bladder mucosa was demonstrated. In vivo experiments also showed the binding and penetration of CGKRK into the mouse urothelium (Fig.1). The nanogel can be synthesized to be biodegradable and naturally excreted by the body without accumulation.

This new invention provides a method for synthesizing a photoactive nanogel suitable for drug delivery. Although the nanogel has been tested for treatment of UTIs, it is suitable for any mucosal surface or epithelium using topical, local, oral, inhalation or systemic routes. This nanogel offers a unique delivery system to overcome microorganism resistance and treat recurrent UTIs.

Key Documents and Sources:

1. *Targeted nanogels for urinary bladder therapies*. WO2018/175899
2. *Photopolymerization kinetics of methyl methacrylate with reactive and inert nanogels*. D'Ovidio et al., 2018. J Mech Behav Biomed Mater.
3. *Thiol-functionalized nanogels as reactive plasticizers for crosslinked polymer networks*. Saraswathy et al., 2017. J Mech Behav Biomed Mater.