Stealth Biodegradable Nanoparticles for Improved Drug Delivery

Novel methods of producing "stealth" polymer nanoparticles allow extended therapeutic delivery and increased in vivo particle retention time

Contact

Hamid A. Bhatti
Consultant
TreMonti Consulting, LLC.
2944 Hunter Mill Rd.,
Suite 204
Oakton, Va. 22124
Cell: 305.467.5942
hbhatti@tremonticonsulting.com

Dan McCabe
Associate General Counsel
Howard University
(202)806-2650
contracts@howard.edu

Inventors

Dr. Emmanuel O. Akala and Dr. Simeon Adesina

Benefits / Features

Novel mechanism for producing polymer nanoparticles with potential for long circulation times for extended delivery to specific tissues

Potential Commercial Applications

Delivery of small molecule compounds, including diagnostic and therapeutic agents, to solid tumors or to specific cell types.

Stage of Development

Technologies covered by two pending PCT applications*; in vitro* studies performed, limited mouse studies performed.

Status

Seeking development & licensing partners

Background

"Stealth" nanoparticles are defined as possessing properties that allow them to evade clearance by the body and remain in circulation for extended periods of time. Their extended presence in the bloodstream allows for a greater percentage of compound cargo to reach target tissue, as well as to provide more consistent dosing of the tissue.

Description of Technology

The current invention involves a method of producing polymer nanoparticles with potentially "stealthier" characteristics. In the method of this invention, the polymer nanoparticles are produced by free radical dispersion polymerization. Polymer macromonomers that are suitable for use in the method of this invention include polylactic acid (PLA) and polycaprolactone (PCL), which are crosslinked with N,O-dimethylacryloylhydroxylamine (MANHOMA), and polymethylmethacrylate (PMMA). Although the nanoparticles are capable of passive targeting of tumor vasculature, the nanoparticles can further comprise PEG, which can be functionalized for active targeting of therapeutics to specific cell types (including tumor cells) by decoration with ligands for cell type-specific receptors. Size variation of the nanoparticles can be tightly controlled according to initial component ratios, particularly for the PEG-PMMA particles.
The encapsulation of paclitaxel and 2-chloro-3-diacetylamino-1,4-naphthoquinone (zapp88) has been demonstrated; these hydrophobic chemotherapeutics show good retention in *in vitro* studies, encapsulating significant fractions of therapeutic by mass. In *in vitro* release assays, nanoparticles showed extended release over the course of hundreds of hours.

Opportunity

The novel method of producing polymer nanoparticles is expected to lead to an *in vivo* small molecule delivery agent with improved extended release properties over existing nanoparticle delivery systems. In particular the nanoparticles should be useful in the delivery of diagnostic and treatment agents to solid tumors.
Dr. Akala and colleagues are seeking development partners to complete animal studies. Dr. Akala is available for detailed conversations about his inventions under NDA.