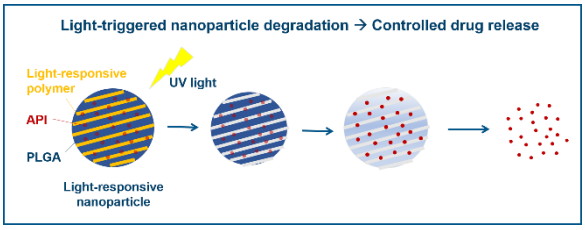
Nano-BioTransporter

Polymer-particle light-cleavable carrier systems for photodynamic therapy (PDT)

Invention

Cancer is one of the main causes of death worldwide. One of the newer therapeutic approaches is photodynamic therapy (PDT), a treatment that uses a photosensitizing chemical substance, a particular type of light and oxygen. Each photosensitizer is activated by light of a specific wavelength and produces reactive oxygen that kills nearby target cells. One of the limitations of current PDT lies in the challenge of administering highly lipophilic anti-tumor photosensitizers. Though this can partly be overcome by suitable nanoparticle formulations and carrier systems, there remains the difficulty of release of the photosensitizer molecule from the carrier system. The compositions of the current invention and especially the used polymers address this problem by providing innovative biocompatible formulations which can be cleaved or degraded by light irradiation thereby releasing the photosensitizer molecules at the desired treatment site. The molecules thus released can then additionally be activated by light irradiation for photodynamic treatment. In addition due to their light-absorbing and -emitting properties these compounds may also be employed for diagnostic purposes e.g. by detecting their fluorescence. The present invention uses newly developed self-immolative polymers for nanoparticle manufacturing. Light-responsive polycarbonates (LrPC) as well as PEGylated LrPC (LrPC-PEG) were synthesized via ring-opening polymerization of trimethylene carbonate-based monomers and fully physico-chemically characterized. Lightresponsive nano formulations were obtained by blending LrPC or LrPC-PEG with the FDA-approved polymer poly(DL-lactide-co-glycolide) (PLGA). The nanoparticles were loaded with the photosensitizer 5,10,15,20-tetrakis(m-hydroxyphenyl)chlorin (mTHPC).



Light-triggered nanoparticle degradation

Commercial Opportunities

This technology provides effective carriers respectively photosensitizer compositions for a wide range of light irradiation treatments such as PDT of cancer, e.g. gastrointestinal tumors, but also of infections and other diseases.

Current Status

The light-induced nanoparticle degradation was analyzed as well as the drug release behavior with and without illumination. Furthermore, biological safety of the degradation products was investigated in an *in vitro* cell culture study. In addition, *in vivo* experiments were conducted. PROvendis offers access to rights for commercial use as well as the opportunity for further co-development. We will be pleased to inform you about the patent status.

Relevant Publications

Anderski, J. *et al*. (2019) Light-responsive nanoparticles based on new polycarbonate polymers as innovative drug delivery systems for photosensitizers in PDT. Int J Pharm. 557:182-191

Mahlert, L. *et al*. (2019) In vitro evaluation of innovative light-responsive nanoparticles for controlled drug release in intestinal PDT. Int J Pharm. 565:199-208

Sun, J. *et al*. (2019) Preparation of Light-Responsive Aliphatic Polycarbonate via Versatile Polycondensation for Controlled Degradation. Macromol. Chem. Phys. 220:1800539

Sun, J. *et al*. (2018) Use of Light-Degradable Aliphatic Polycarbonate Nanoparticles As Drug Carrier for Photosensitizer. Biomacromolecules 19, 4677−4690

Advantages

- Innovative drug delivery system for photosensitizers in PDT
- Light-responsive nanoparticles based on new polycarbonate polymers
- Composition for PDT of cancer and bacterial infections

Technology Readiness Level

1 2 3 4 **5** 6 7 8 9

Technology validated in relevant environment

Sector(s)

- Pharmaceutical Industry
- Chemical Industry

Ref.-No.

5405

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