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Stimuli Responsive Phospholipid-based Nanomaterials for On-demand Drug Delivery

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Age-related macular degeneration (AMD) is the leading cause of blindness in the elderly, affecting over thirty million people worldwide. The current treatment of wet AMD requires frequent intravitreal injections which are highly invasive and expensive. Therefore, a less invasive and long-lasting treatment is required. One option for achieving such an outcome is using self-assembled lipid-based liquid crystalline (LC) systems, which can encapsulate compounds with varying physicochemical properties and allow delivery of drug to the target site [1]. Drug release from lipid based LC matrices is highly dependent on the nanostructure[2] and has been manipulated to release drug 'on demand' in response to a stimulus, in this case, near-infrared (NIR) light [3]. Such system has potential use in reducing the frequency of injections for short acting or rapidly cleared drugs. Furthermore, the LC nanoparticles can be coated with polyethylene glycol (PEG) for alternative route of administration using the enhanced permeability and retention effect. PEGylation of nanoparticles would prevent non-specific removal from the circulatory system, passively targeting tumour tissues and sites of inflammation, where drug release can then be activated. Thereby, increasing its efficacy as well as reducing the potential for adverse effects. This project is about understanding the phase behaviour of phospholipid systems upon incorporation of PEG-lipids and light-sensitive gold nanoparticles using small angle X-ray scattering to design a stealth and stimuli-responsive LC system suitable for on-demand drug delivery to improve current treatment of AMD.

Keywords or phrases (comma separated)

Summary

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