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Gas Aided Imaging Using Amphiphilic Block Copolymers

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Technology description

Background

Polypropylene carbonate (PPC) is a plastic material that can be mass produced from naturally abundant carbon dioxide (CO2). This polymer is known to decompose back to CO2 when heated to a specific temperature. It is a promising material for pharmaceutical and biomedical applications due to this biodegradable and biocompatible nature, and the released gas can be used for imaging, such as ultrasound, when the material is bound to a site within a patient's body. However, the decomposition temperature is above 200 degrees C and bulk PPC is not water soluble. Therefore, use of PPC for such processes has been limited. Conventional gas-containing ultrasound contrast agents consist of a nano- or micron-sized gas bubbles surrounded by a shell layer made of a polymer or lipid. These previous systems have suffered from several problems and shortcomings including limited stability, low efficiency of delivery, and difficulty of manufacture.

Technology Summary

Researchers at Purdue University have investigated the thermal degradation of a PPC-based amphiphilic block copolymer and found that these triblock copolymers form stable small-sized (less than 200 nm) micelles in water. They have also demonstrated that the CO2-generation temperature of PPC can be reduced to between 40 and 80 degrees C in aqueous environments by using a photoacid generator (PAG) as the catalyst for activating the random scission reaction of PPC. Therefore, using micelles and the PAG, the CO2 bubbles can be generated within a target tissue in vivo by delivering the polymer as micelles; the gas is produced by hydrolysis of the polymer precursor in mild heating conditions (less than 80 degrees C). This approach avoids limitations of previous approaches and allows enhanced imaging techniques.

Application area

Ultrasound devices industry
Biomedical technology

Advantages

Bubbles generated in target tissue
Enhanced imaging

Institution

Purdue University

Inventors

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