Method of long-term storage for medically versatile microbubbles

Microbubbles have been used as contrast agents in ultrasound, to deliver bioactive gases to biological tissues, and in transporting compounds across the blood-brain barrier. Despite their many applications, microbubbles have been difficult to store long-term, limiting their usability. This technology describes methods of stabilizing microbubbles for long-term storage and increasing their persistence in the body. By coating the bubbles' surface in lipids, this technology provides a durable drug delivery system with increased versatility. Previously unattainable tissues can be treated with a wide variety of vapor-based drugs. In addition, biologically relevant gases can be stored in the bubbles indefinitely, increasing their viability. As such, this technology results in a highly cost-effective drug delivery and storage system with wide applications in the medical field.

Lipid-coated microbubbles for stable, low-cost, drug delivery and storage

The methods described by this technology allow for both manufacture and storage of high-concentration microbubble suspensions. During the sonication process, two lipids (DPCC and Peg40S) are added to heated and oxygenated water. The lipids act as surfactants, resulting in stable bubbles ranging from 0.5-10μm in size. The microbubbles' lipid surfactants act as “shells” that can be freeze-dried and refilled as necessary with oxygen or other gases, resulting in great versatility. Freezing the suspensions at -80°C degrees does not affect the shape or contents of the microbubbles, demonstrating the durability necessary for a wide range of applications. Additionally, thawing and rehydrating may be postponed for months, making the microbubble suspensions highly cost-effective in the long-term. The microbubbles' increased durability can be applied in numerous medical settings, from cheap storage of gaseous ultrasound contrast agents to rapid reperfusion of ischemic tissues, providing a higher degree of marketability. A prototype of this technology has been found to be stable in the body and persistent in circulation, suggesting that these suspensions will be appropriate for therapeutic use.

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Applications:

- Rapid re-oxygenation of ischemic tissues
- Gaseous drug delivery for anesthesia
- Long-term storage for echocardiogram and ultrasound contrast agents
- Can act as a viable, cheaper alternative to more expensive oxygenation techniques, such as mechanical ventilation
- Promote wound healing via oxygen delivery

Advantages:

- Increases microbubble durability, minimizing supply costs
- Acts as an on-demand source of drug standards, streamlining patient treatment protocols
- Versatile and customizable drug delivery
- Increased efficiency; microbubbles can be refilled and reused

Patent Information:

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Related Publications:


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