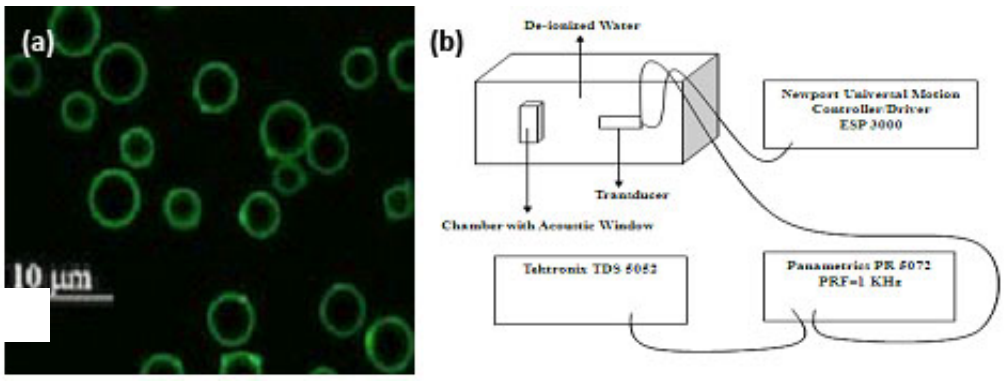
Polymer-shelled ultrasound contrast agents with controlled size and polydispersity (PUCA)

Ultrasound imaging techniques can be greatly improved by the use of ultrasound contrast agents (UCAs). Air bubbles encapsulated into biocompatible polymer shell are of particular interest of this work. Shell of the bubbles produced from Poly-Vinyl-Alcohol (PVA) offers considerable chemical versatility and stability. However, questions regarding the size and polydispersity of the microbubbles must be further investigated.



(a) Laser scanning confocal micrograph of the florescent labeled microbubbles. (b) The schematic diagram of the testing set-up employed to assess backscattered enhancement.

Methods

The ideal UCAs should not be larger then 10 µm, i.e. typical diameter of pulmonary capillaries, and not smaller than hundreds of nanometres in order to avoid the response of the primary immunosystem. From the technical perspective UCAs should modify the acoustic properties of a region of interest, by increasing backscattered efficiency. In order to enhance the ultrasound response UCAs should be engineered with as narrow size distribution as possible.

Results

In the present work PVA-shelled UCAs with controlled size and polydispersity is manufactured under varied parameters of the manufacturing protocol. It was observed that temperature of the surrounding atmosphere has major effect on the size of the UCAs, while polydispersity is regulated by geometry and speed of the disperser. Finally, the acoustic response of these microbubbles is tested using developed ultrasound test rig. The enhancement of the backscattered power of about 25 dB from a suspension of the microbubbles is observed at 5 MHz ultrasound frequency. Keeping in mind that in clinical practice ultrasound scatter from the blood is of about 30 dB weaker than scatter from surrounding tissue, introduction of novel PVA microbubbles will potentially improve diagnosis of the cardiovascular patients.

Collaborations

This is a collaboration project between STH (School of Technology and Health, KTH), the Division of Structural Biology and CLINTEC (Departement of Clinical Science, Intervention and Technology), Karolinska Institute. The project received research grant from “Stiftelsen Lars Hiertas Minne”.

Contact persons
Miaomiao Zheng, Dmitry Grishenkov, Johan Härmark and Birgitta Janerot Sjöberg

Search words

Ultrasound, microbubbles, contrast agent, size distribution, polymer

Belongs to: Medical Imaging
Last changed: Dec 21, 2011

The QR-code contains the print web address