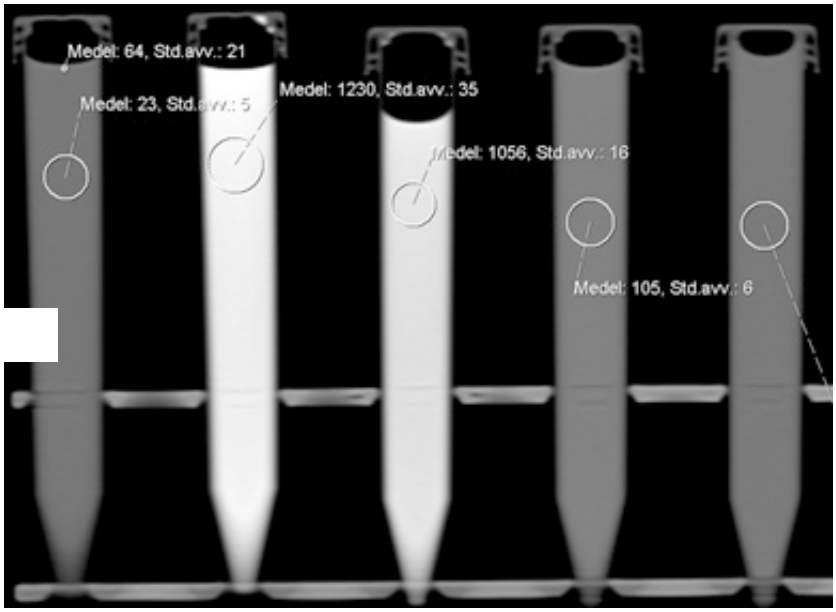
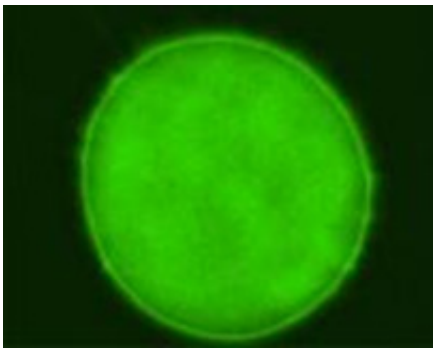
Contrast Agent for CT and Ultrasound (CACTUS): manufacturing and characterization

In recent years, the contrast agents have moved from being just a visualization tool to a new multifunctional device for drug delivery and targeted imaging. Gasholdning microbubbles encapsulated into biocompatible polymer shells are of particular interest for this study. We have shown that a polymer shell can be chemically or mechanically modified to incorporate pharmacological material, such as Iron, by itself clinically already used as contrast agents for MRI. Clinical partners, KI and KS, put forward the need of hybrid imaging, which is defined as imaging by at least two techniques, ideally with as close time and space interval as possible. Such combination as SPECT/CT; PET/CT and recently announced PET/MR are now becoming a standard. In this work the possibility to introduce Iodine-consisting particles in the shell is investigated, with a final goal to use the bubbles as combined computer tomographic (CT) and UCAs.



Ulrasound contrast agent loaded with Omnipaque and various concentrtions of plane Omnipaque (from left to right)



TEM of single microbubble loaded with Omnipaque.

Methods

Up to now two different approaches to incorporate commercially available CT contrast agent, Omnipaque, into the shell of novel polymer microbubbles have been tested. First approach concerns direct introduction of Omnipaque into fabrication solution during the last step of the manufacturing protocol. Second approach utilizes the fact that freeze-dried microbubbles can be reconstituted after immersion into the liquid solution. It has been shown that both methods yield acoustically active microbubbles in a test solution.

Results

The current project should be considered as a pilot study that serves the solid background in the possibility to incorporate CT contrast media into the polymer-shelled UCAs. This study allows us to carefully assess risks on the very early development stage and formulate the amendment plan for a follow-up research. The feasibility of the physical incorporation of commercially available CT contrast agent (Omnipaque) has been assessed and preliminary results suggested that in its current form the load of iodine in the shell is not sufficient to perform contrast specific investigation using clinical CT scanner.

Collaborations

This is a collaboration project between KTH STH, Div. of Medical Engineering, KI CLINTEC, Div. of Medical Imaging and Technology, and Karolinska Universitetssjukhuset, Röntgenkliniken, Huddinge. The project currently received seed funding from the Medical and Biomedical Technology (MBM) platform.

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Search words

Ultrasound, microbubbles, contrast agent, CT, iodine, polymer

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