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# Ultrasonic release of magnetic nanoparticles from modified textile

**Author:** Edyta Prajwos[1]

**Co-authors:** Arkadiusz Józefczak [1]; Ivo Šafařík [2]; Michal Rajňák [3]; Rafał Bielas [1]

[1] *Chair of Acoustics, Faculty of Physics and Astronomy, Adam Mickiewicz University in Poznań*

[2] *Department of Nanobiotechnology, Biology Centre, ISBB, Czech Academy of Sciences*

[3] *Institute of Experimental Physics, Slovak Academy of Sciences*

Commonly used materials can serve as platforms for new technological solutions, provided that their functionality is enhanced. Textiles are an example of such materials. Owing to their inherent flexibility, textile structures can be functionalized using magnetic fluids. The spaces between individual fibers, as well as their surfaces, can accommodate additives with diverse functionalities, such as magnetic nanoparticles. After modification, textiles become responsive to external stimuli —for example, magnetic fields or high-intensity ultrasound. These newly imparted properties open pathways to applications such as non-invasive heating treatments, and controlled drug release for topical applications.

In this work, we propose the use of ultrasound to trigger the release of magnetic nanoparticles from modified textiles through both thermal and mechanical effects. Controlled release of (nano)materials from textile substrates into phantoms was achieved using high-power, planar ultrasonic waves in the megahertz frequency range. Agar-based phantoms, mimicking soft tissue, were used to assess nanoparticle detachment from the textile matrix and their subsequent penetration into the surrounding medium. Following release, the magnetic nanoparticles acted as nano-heaters within the phantoms, increasing their temperature. The release was verified by comparing the magnetic hyperthermia response of the phantoms before and after exposure, as well as through optical and electron microscopy analyses. The results confirmed the successful deposition of iron oxide nanoparticles onto the modified textiles, as well as their effective ultrasonic release. Following release, the magnetic nanoparticles acted as nano-heaters within the phantoms, causing an increase in their temperature.

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