Magnetic nanoparticles: Suitable for cancer therapy?

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A measuring procedure developed in the Physikalisch-Technische Bundesanstalt (PTB) can help to investigate in some detail the behaviour of magnetic nanoparticles which are used for cancer therapy.

Magnetic nanoparticles (with a size of some few to several hundred nanometres) are a new, promising means of fighting cancer. The particles serve as a carrier for drugs: "loaded" with the drugs, the nanoparticles are released into the blood stream, where they move until they come under the influence of a targeting magnetic field which holds them on to the tumour – until the drug has released its active agent.

Besides this pharmaceutical effect, also a physical action can be applied: an electromagnetic a.c. field heats up the accumulated particles so much that they destroy the tumour. Both therapeutic concepts have the advantage of largely avoiding undesired side effects on the healthy tissue.

These procedures have already been successfully been applied in the animal model and have, in part, already been tested on patients. Here it is important to know before application whether the particles tend to aggregate and thus might occlude blood vessels.

Information about this can be gained by magnetorelaxometry developed at the PTB. In this procedure, the particles are shortly magnetised by a strong magnetic field in order to measure their relaxation after the switch-off of the field by means of superconducting quantum

interferometers, so-called "SQUIDs".

Conclusions on their aggregation behaviour in these media can be drawn from measurements of suspensions of nanoparticles in the serum or in whole blood. As an example, it could be shown in this way that certain nanoparticles in the blood serum form clusters with a diameter of up to 200 nm – a clear indication of aggregation, so that these nanoparticles do not appear to be suitable for therapy.

At present, the high technical effort connected with the use of helium-cooled magnetic field sensors is still standing in the way of using this method routinely in practice. In a joint project with Braunschweig Technical University supported by the Ministry of Education and Research (BMBF), the procedure is currently being transferred to a simpler technology based on fluxgate magnetometers.

Source: Physikalisch-Technische Bundesanstalt