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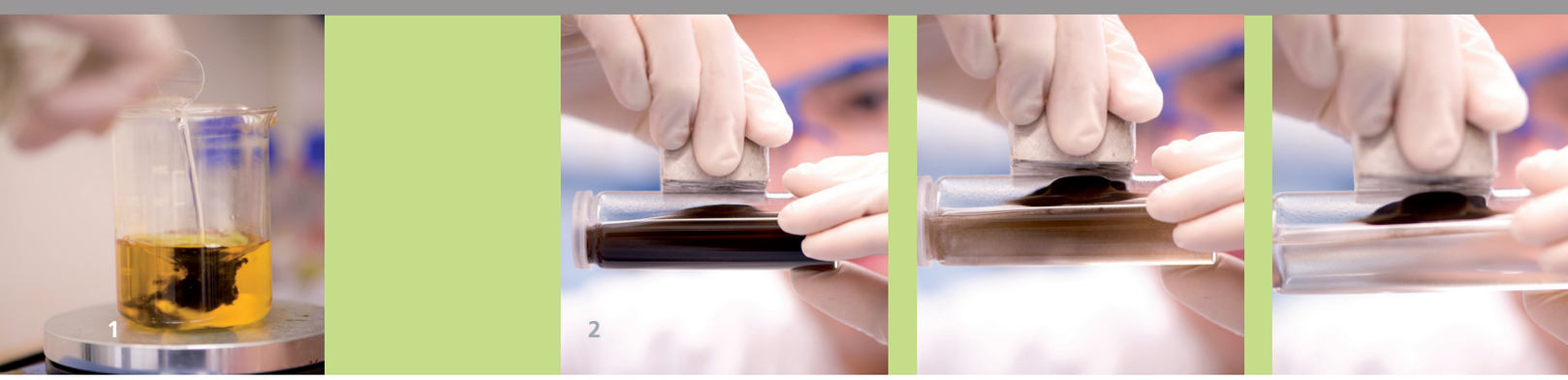

1 *Fabrication of magnetic nanoparticles approx. 10 nm diameter*
2 *Separation of superparamagnetic microparticles from water*

SUPERPARAMAGNETIC MICROPARTICLES

FOR WASTE WATER CLEANING AND RECYCLING OF RESOURCES

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The idea

Magnetite – as the name already suggests – is well known to be a good magnetic material. On the nanoscale, however, the material loses its remanent magnetization already at room temperature if no external magnetic field is applied. This is called the superparamagnetic effect. The Fraunhofer ISC is utilizing this effect for a novel process to recycle resources from waste water.

The development

Gathering the 10 nm sized superparamagnetic nanoparticles together to form 10 µm sized composite particles, these micro objects can be separated magnetically with ease from a fluid such as water. What makes the process special is that it is possible to transfer the nano-attribute superparamagnetism to the micro scale. Thus, the composite particles can be switched on and off via an external magnetic field. Unlike it is the case for permanent magnets, there is no magnetic agglomeration of the particles but they rather behave like normal suspended matter in water. A surface modification of these particles allows the reversible adsorption of dissolved substances so that the particles and a target load can be magnetically separated from the water. The loaded substance is subsequently washed off and the particles can be re-used for the process.

The first objective: Recycling of phosphate

The Fraunhofer ISC currently develops a modification of the particles to selectively adsorb phosphate in order to harvest this valuable resource from waste water. But phosphates are not the only target: by variation of the process, even harmful substances such as toxic heavy metals can relatively easy be magnetically removed.