



Without nanoparticles

With nanoparticles

SELECTED RESEARCH RESULTS AND APPLICATIONS
BIOPROCESSING & BIOANALYTICS

PROJECT EXAMPLE: NANOUMWELT – RISK ASSESSMENT OF NANOMATERIALS IN THE ENVIRONMENT

Starting situation

Many of the products we use on a daily basis would not be possible without a wide range of industrially manufactured nanomaterials (NM). NM (Greek nanos = dwarf) are interesting due to their small size and associated altered physical and chemical properties and thus new functionality. For example, clothing, cosmetics and household goods increasingly contain NM to make the products dirt-repellent or more effective. But where do the tiny particles and fibres measuring just a few millionths of a millimetre end up? What effect do they have on humans and the environment? Due to the many gaps in our knowledge, we are unable to adequately assess the risks proceeding from NM. The influence on humans and the environment, as well as the end of the life cycle of the NM is still unclear.

Solution

In the interdisciplinary research project "NanoUmwelt" – risk analysis of synthetic NM in the environment, (BMBF KFZ 03X0150) the Fraunhofer IBMT is working with 10 partners from industry, science, state and federal authorities to develop new innovative methods in order to precisely and reliably evaluate the NM exposure and the resulting risks for environment and humans.

The aim is to develop highly sensitive methods for the detection of the tiniest NM quantities in environmental and human samples. Alongside soil, sewage sludge and water, soil organisms, shellfish and fish, but also the human organism, are being investigated in terms of their NM exposure. For this purpose the scientists at the Fraunhofer IBMT collect environmental samples from representative ecosystems and develop meth-

ods for the standardized preparation of the organic material for analysis and for conservational long-term storage. To identify a possible NM exposure of humans, the Fraunhofer IBMT, in close cooperation with the Federal Environment Agency, collects blood and urine samples from young adults to be examined within the project in terms of NM exposure. In addition to this, by means of a questionnaire developed at the Fraunhofer IBMT, the product behavior of the test persons is determined and included in the NM exposure analysis. The Fraunhofer IBMT is also developing new models for the investigation of human-toxicological NM effects in the low-dose range, and investigating the barrier permeability of NM (overcoming the lung and the intestine barrier) in order to make statements about the intake of nanomaterials in the body.

Potential

"NanoUmwelt" is aimed at detecting and quantifying not only NM at various points of functionally relevant ecosystem compartments, but is also investigating the interactions of NM with biological interfaces including, for example, the lung, as well as barriers such as the human placenta and the gastrointestinal tract. The project is realizing the development of the urgently required strategies and technologies for the analysis of the life cycle of NM, their accumulation in the environment and the nanotoxicology which are essential for a precise and reliable assessment, prediction and evaluation of the risks.

1 Transmission electron microscopic image of an adipogenic differentiated stem cell. Left: untreated cell (= without nano-

particles). Right: Cell after exposure to gold nanoparticles. The nanoparticles accumulate in the lipid droplets of the cell.