

Description for the general public

Tens of thousands tones of nanomaterials are annually produced worldwide. These substances consist of various elements and chemical compounds, composed of silica, copper, titanium, silver, or carbon. These substances are used in many areas of life including electronics, buildings, and even in cosmetic and food products. These substances usually do not exceed 100 nm, which means that they can be even smaller than viruses. Graphene modified with metal nanoparticles can be an example of nanocomposite, while graphene oxide modified with carbon nanotubes and titanium dioxide nanoparticles can be named a hybrid structure. Recent scientific data show that there is a possibility to stimulate bacteria with nanomaterials to produce useful substances. Biotechnology uses many kinds of microorganisms to produce substances that are used in medicine. Among them are bacteria from genus *Pseudomonas* and *Streptomyces*. These bacteria can be possibly stimulated by the hybrid structures. Knowing the mechanisms of such stimulation can help to understand how we could use nanomaterials to produce antibiotics, surfactants and pigments. These substances are of great importance for modern civilisation.

This project is aims to evaluate the process of bacterial stimulation caused by hybrid nanomaterials. Studies will be performed in fours tasks that will describe the stimulation process from active dose selection, through the analysis of the changes caused by the materials to cells and the stability of materials, to quality and quantity of gained substances. Standard microbiological methods, molecular methods (based on the expression of selected genes) as well as modern scientific techniques used in nanotechnology such as electron microscopy, and biochemical methods based on chromatography will be used in scope of the project. The microorganisms will be cultured in presence of nanostructures and thoroughly evaluated in terms of viability, morphology, metabolic activity and acquisition of resistance. Project will be carried out in the international cooperation with Ecole Nationale Supérieure de Chimie de Rennes in France and Technische Universitaet in Berlin.

Planned experiments will bring a considerable amount of data on activity, stability and toxicity of the hybrid structure in the process of bacteria stimulation to secrete useful substances. Results will allow in farther perspective evaluate whether studied nanostructures may have application in processes that will involve microorganisms. This aim can be achieved only by the detailed study of the mechanisms of the nanomaterial-microorganism interaction, beginning from its elementary levels.