ABSTRACT FOR THE GENERAL PUBLIC

Flotation is a solid particle separation process based on phenomena occurring in the solid-liquid-gas three-phase system. During flotation, hydrophobic solid particles attach to gas bubbles, while hydrophilic particles remain dispersed in the liquid. In order for the bubble to adhere to the surface of the solid, a thin film of liquid separating these objects, forming when they approach each other over a sufficiently short distance, must rupture. The stability of this film is determined by the surface forces acting between the bubble and the particle, which depend on the properties of the liquid-gas and liquid-solid interface. During flotation, these properties are controlled through the use of various flotation reagents, which mainly include surface active compounds (surfactants). Studies to replace synthetic flotation reagents with natural, biodegradable products, such as those produced by microorganisms, have been ongoing for some time.

The aim of the project is to carry out systematic fundamental research to determine the effect of new lipopeptide biosurfactants on the stability of a thin liquid film, i.e. a nanometre-thick liquid layer located between the surface of a solid and an air bubble.

An innovative aspect of the project is the use of a new class of biosurfactant compounds not previously used in the flotation of naturally hydrophilic particles and metal sulphides. The biosurfactants used in the research will be lipopeptides produced by new strains of *Pseudomonas fluorescens* bacteria. In addition, the biosurfactant production process itself will be optimised using statistical experimental design.

The adsorption of biosurfactant molecules on the surface of a bubble in aqueous solution and on the surface of solid particles in suspension will be characterised first. The three-phase system will then be investigated by observing the gas bubble as it approaches the surface of the solid in the biosurfactant solution. Stability studies of the thin film in such a system will be conducted on a unique research setup that allows observation of dynamic interactions between the bubble and the surface of the solid in solution, the time interval of which is often of the order of fractions of a second. The results of the interaction between the bubble and the surface of the solid in the biosurfactant solution will be analysed in terms of the flotation efficiency of the mineral particles.

Computer simulations of the behaviour of biosurfactant molecules at the solid-liquid and gas-liquid interface using molecular dynamics will be carried out to explain the process of bubble adhesion to the solid surface, preceded by the leakage of the thin liquid film, its rupture and finally its displacement by air or the complete failure to form a three-phase contact. As a result of the project, the adsorption behaviour of these biosurfactants at the gas-liquid-solid interface will be elucidated.

A particular added value of the project is such a comprehensive approach to correlate experimental results with simulation results of the basic act of flotation, which is the attachment of an air bubble to the surface of a mineral particle in the presence of a new class of biomolecules that are just beginning to be used in flotation systems.

The research tasks planned under this project, although basic research in nature, aim to produce results of potential application significance. The use of biosurfactants in flotation can be considered environmentally friendly and can increase the economic efficiency of ore processing and provide a more ecological alternative to the synthetic surfactants already in use.