КОЛОКВИУМ „АЛЕКСЕЙ ШЕЛУДКО”
СЕКЦИЯ „ПОВЪРХНОСТИ И КОЛОИДИ”
ИНСТИТУТ ПО ФИЗИКОХИМИЯ НА БАН

С Ъ О Б Щ Е Н И Е

На **07 октомври 2016 г. (петък) от 11:00 часа в зала „Болцман” на ИФХ-БАН,** ще се проведе заседание на Колоквиума със следния дневен ред:

1. Доклад на тема:

„PARTICLE LADEN STABILISATION OF THE BIOLOGICAL FOAMS”

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Aqueous foams are extremely complex systems with a cellular internal structure, consisting of polydisperse gas bubbles separated by thin liquid films. Foam evolution and its transient stability are functions of drainage and rupture of liquid films between air bubbles. The rate of foam drainage depends also on the surface rheological properties of the adsorption layers at the liquid interfaces.

Our aim was to develop a new bio-inspired, easy degradable, biopolymer based aqueous foams for various, industrial and biomedical application. The specific objective is to find correlations between surface activity, surface elasticity and foaming properties of biopolymers solutions and biopolymers/surfactant mixtures. The foams of pure chitosan and their mixtures with cationic surfactant lauroyl ethyl arginate (LEA) were studied. The colloidal silica nanoparticles (Levasil) were added for studied solutions to obtain the additional foam stabilisation effects.

The classical 3D foaming test in the glass foam column showed that chitosan mixtures containing cationic surfactant (LEA) and various nanoparticles present interesting long-term foaming properties. The foaming potential of the studied

solutions was connected with the surface active properties of LEA. In contrary the foam stability varied strictly with sizes and volumes of nanoparticle fractions. We believed that effect is connected with partial hydrophobization of negatively charged silica particles by cationic chitosan and/or LEA. We did the series of various additional tests to verify the mechanism of foam stabilization.

2D foaming stability measurements in rotating Hele-Shaw (2D) cell proved that the presence of colloidal nanoparticles practically stopped the coarsening and gas diffusion in the foam. The foam film thickness constantly diminished due to the drainage. The foam collapsed in the whole volume immediately after minimum film thickness was reached.

The Scheludko-Exerowa micro-interferometric thin liquid film studies allow us to describe the critical foam film thickness in chitosan solutions (52.4 nm) and corresponding disjoining pressure (90-105Pa, ΔP ~15Pa).

Drop profile analysis tensiometer (PAT-2, Sinterface) measured the time evolution of surface tension and surface dilatational viscoelasticity. The experiments suggested that the addition of 0.9%wt. Levasil 100/45% nanoparticle to the chitosan / LEA mixture increased the dilatational elasticity of the interface.

The most recent confocal microscopy experiments allow us to understand all process happen in the foam fraction. It was proved that presence of small silica particles (size below 10μm) blocked the Plateau borders (as it was suggested after the 2D foam measurements). In similar foams the ageing progress due to the film coarsening and gas diffusion. What was surprising, the larger particles (ca. 40μm) were floated in large amount into the foam fraction. In the result it creates there a great solid matrix with dispersed therein gas bubbles. In this way almost no direct contact between neighboring bubbles exists. In the consequence in similar “foam” no ageing processes could be noticed in reasonable time of the experiment. The foam fraction was solid and rigid.

It could be suspected that small nanoparticles allow as to obtain foams with reasonable stability (ca. hours) and good rheology (visco-elastic) properties. In contrary, the larger particles could be used for the solid foams formations from the well-defined aqueous mixtures.

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