# Physicochemical characterization of $TiO_2$/polysaccharide systems in terms of biocompatibility

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## Abstract:

The aim of the presented research was the physicochemical characterization of the biomaterial based on chitosan, hyaluronic acid and titanium dioxide(IV) in relation to biocompatibility and antibacterial character for application in cosmetic, medical and pharmaceutical industries. The chitosan and hyaluronic acid were chosen regarding to their potential application (e.g. artificial skin, wound dressings), and titanium oxide(IV) to increase mechanical stability. The parameters having the crucial meaning in stability and response from the biological environment and also responsible for antibacterial properties of the biomaterials were described. The physicochemical properties of two- and three-component dispersions based on chitosan, hyaluronic acid and/or titanium oxide(IV) of different mass ratio were described in relation to the energetic and topographic parameters. Knowledge of such parameters is necessary to predict and control the behaviour of cells which determines the proper functioning of the biomaterial in the living organism indirectly informing about biocompatibility.

The experimental data provided using the Langmuir technique coupled with the Brewster angle microscope, gave insight into the interactions existing between the individual dispersions constituents and phospholipids molecules forming the model biological membranes. In order to characterize the biomaterial-cell membrane interactions precisely, two kinds of phospholipids which differ in their structure: 1,2-dipalmitoilo-*sn*-glycero-3-phosphocholine (DPPC) and 1,2-dioleoilo-*sn*-glycero-3- phosphocholine (DOPC) were used. Besides, the 1,2-dipalmitoilo-*sn*-glycero-3-phospho-rac-(1-glycerol) sodium salt being the typical component of bacterial *Escherichia coli* and *Staphylococcus aureus* membrane as well as lipids extracted from these bacteria were used. The bactericidal capacity of the tested system was interpreted based on the colony forming the unit (CFU)-counting assay and Live/Dead staining shared with the fluorescence intensity measurements. The obtained results make a significant contribution to broader understanding the interactions of components of different polarity with biological membranes confirming the need for the multifaceted view using the biomimetic methods.