Nanostructured surfaces

Investigation of dielectric properties of the erythrocyte membranes as nanolayered surfaces

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The dielectric properties of biological cells are determined by their complex structures. There electric and magnetic properties are highly frequency, temperature and age dependent. The real and imaginary parts of the dielectric permittivity $\varepsilon = \varepsilon_r - i\varepsilon_i$ are good indexes of the tumor, diabetes and some other diseases [1,2]. The dielectric relaxation frequency $f_d = f(\varepsilon' - \varepsilon_\infty)/\varepsilon''$ of the red blood cells (RBC) has been measured at different temperatures T=1–46 ℃ using UHF-dielecrometer of resonator type with f=9.2 GHz. It was shown, the differences between the normal and pathological RBC are determined by the membranes only, because the effect is proper to both native cells and RBC ghosts.

The model of erythrocyte surface as a number of layers correspondent to cellular membrane (1), cytoskeleton (2), glycocalix (3), organic and inorganic molecules and their structures (4), adsorbed and structurized water (5) with different dielectric properties is developed here to explain the obtained experimental dependencies $f_d(T)$, $\varepsilon'(T)$ and $\varepsilon''(T)$. The input of the layers (1)-(5) into the dielectric parameters of the cells has been estimated. The modeling results demonstrated good correspondence to the measured data.

1. *Batyuk L.* Influence of cancer disease on dielectric characteristics of structural-functional state of erythrocyte membranes // Science Rise J. – 2015. – **7/4**, N12. – P.11–17.
2. *Farsaci F., Ficarra S., Russo A., Galtieri A., Tellone E.* Dielectric properties of human diabetic blood: Thermodynamic characterization and new prospective for alternative diagnostic techniques // J Adv Diel. – 2015. – **5**, 1550021.