ON THE DIELECTRIC RELAXATION OF NANOPARTICLES IN SYSTEM OF RED BLOOD CELLS

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It was experimentally established that the ultradispersed diamonds of detonation synthesis (UDD) enveloping the red blood cells (RBC) membrane has a significant effect on the dielectric polarization ε' and the loss of thermal energy tg δ by the cell [1]. The source of losses in the samples is the pores and cavities of the cell membrane — stratifications of various sizes having noticeable surface conductivity in the presence of water. In the system under study, at the interphase boundaries between the surface charges of UDD and the adsorbed water layer, the polarization of the structure of the polar liquid matrix known as glycocalyx and the formation of a microscopic heterogeneity in it occur, accompanied by a rigid fixation of water molecules by UDD. A layer of structured bound water acquires the function of a potential barrier both for free molecules and for molecules oriented by an electric field. The description and interpretation of dielectric relaxation of nanoparticles through solution can be representation empirical the Cole-Cole function is which gives a power-law relation between permittivity and frequency. The processes of dielectric relaxation are always very sensitive to frequency of ac-electric field. Under the application of ac-electric field UDDs will adjust themselves in order to have minimum energies against the applied electric field. In this work we are considered a mathematical model describes as a most remorable relaxation time for the RBCs in surrounding of UDDs. Each nanoparticle has its own relaxation time and the particles of the same types have certain Gaussian distribution of their relaxation times. The obtained simulation results show that in the systems under study UDD-RBCs the relaxation time is described by the Debye equation and can stay in diapason from $\varepsilon_0\varepsilon_s/\sigma_s$ to $\varepsilon_0\varepsilon_\infty/\sigma_\infty$, where ε_0 is the permittivity of the system, ε_∞ and ε_s are the high-frequency and low-frequency (static) permittivities (the asymptotic values of the dielectric constant at frequencies correspondingly above and below the dispersion region), ε_∞ is assumed to be 5.6 (as the permittivity in the infrared range) [2].

1. *Kizilova N., Batyuk L., Cherevko V.* Human Red Blood Cell Properties and Sedimentation Rate: a Biomechanical Study // Springer Series: Advances in Intelligent Systems and Computing. - 2019. - **831**. - P. 3-22.

2. *Suzuki M., Shigematsu J., Kodama T.,* Hydration Study of Proteins in Solution by Microwave Dielectric Analysys // J Phys Chem. **-** 1996. **- 100**. **-** P. 7279-7282.