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RBC membrane as carriers of nanodiamonds: effects of temperature

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The detection of the ability of ultradispersed diamonds of detonation synthesis (UDD) in an aqueous medium to form the hydrate shells around individual particles may have a physiological significance when nanodiamonds are contacted with the living environment. It was important in this regard to evaluate the properties of RBC membrane in the conditions of pathology under the influence of the temperature.

The problems have been solved by studying the temperature dependences (T=0-47 °C) the complex dielectric permittivity by the method by the ultrahigh frequency (UHF) dielectrometry at the operating frequency f = 9.2 GHz. The venous blood erythrocytes of healthy donors and patients with the tumour of lung, mammary gland and stomach were used as the object of the study. Membranes of erythrocytes were obtained by the method of J. Dodge.

Increased dielectric permittivity of RBC membrane in oncology conditions can be explained by change the absorption capacity of RBC membrane which to involve in the neutralization of different endogenous toxins of tumour's in blood. The given fact indicates the toxic load increase and correspondingly to increase in the extent of RBC membrane damage during tumour progression and toxins production. The sorption capacity of erythrocytes increases which leads to an increase in the electrical conductivity of the cell.

Using the Debye equations the values of static permittivity of the samples which used for the calculation of hydration were determined. At low temperatures the contribution of UDD intermolecular interactions is insignificant, hydration decreases. Several sites with increased hydration at T=15-20°C, 20-23°C, 28-32°C are observed. The increasing can be caused by loosening the surface of the particle conglomerates under the influence of the temperatures that can lead to an increase in the amount of water bound in RBC membrane by nanodiamonds.

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