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FROM MOLECULES TO MOLECULAR MATERIALS,
BIOLOGICAL MOLECULAR SYSTEMS AND
NANOSTRUCTURES



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Dielectric Properties of Hemoglobin in Microwave Region: Influence of Oncology and Radiation Therapy

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Despite the successes achieved in the prevention and treatment of cancer diseases, at the moment there are practically no experimental studies devoted to the dielectric analysis of states blood cells in patients with postoperative radiation therapy [1], [2]. The dielectrically permittivity of red blood cells has been found to depend on the hemoglobin and water content, temperature and the frequency relaxation of molecules of water in cells. The aim of this work is to define the character of influence of oncology and x-ray radiation therapy on the dielectric properties of aqueous hemoglobin solutions in diapason of ultrahigh frequencies (UHF).

Examination of dielectric characteristics of aqueous hemoglobin solutions of erythrocytes in temperature area from 15 to 36 °C was carried out on UHF-dielectrometry of resonator type on frequency 9.2 GHz [3]. For research there were used aqueous hemoglobin solution from 15 healthy donors and 30 patients with breast and lung cancer (an average age 40±4 years). The groups of patients received postoperative radiation therapy in the mode of classical fractionation. The total focal dose was 45-50Gy. Transition from complex dielectric permittivity measured in experiment to the dielectric relaxation frequency was realized with a help of Debye equation. The activation energy of dipole relaxation ΔF of the molecules in studied systems was get from the ratio [4].

The temperature dependencies of dielectric permeability for aqueous hemoglobin solutions in cancer patients in temperature area at 12-17 , 23-25 and 32-35°C, it were observed the deviation of dielectric indicators from the monotonous growth that was attended by the reliable growth of the dielectric relaxation frequency. It was revealed that postoperative radiation therapy leads to decreases of the dielectric permittivity in hemoglobin solutions of erythrocytes of cancer patients in all temperature interval compared to the dielectric permittivity of hemoglobin solutions of the healthy donors. There were calculated the values of energy of time activation of dielectric relaxation of the water molecules in given systems.

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