MEMBRANOTROPIC AND RELAXATION PROPERTIES OF NEW WATER SOLUBLE ENDOMETALLOFULLERENS

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The problem of creating contrast agents is of current interest now, because magnetic resonance imaging (MRI) is widely used in medicine for diagnosis of diseases of man. The Institute of Problems of Chemical Physics has developed a method of synthesis of gadofullerenes $Gd@C_{82}$ in the anionic form, from which new of new water-soluble endometallofullerenes (EMF): $Gd@C_{82}(OH)_x$, $Gd@C_{82}$-H Pro, $Gd@C_{82}$-Hydroxyethyl Pro and Gd $@C_{82}$-Maleimide Pro were obtained by selective modification. This work reports on an investigation of their membranotropic and relaxation properties.

An important task of modern physical in chemical biology and pharmacology is the study of the mechanisms of interaction of potential drugs with biological membranes in the body. Localization of exogenous compounds in the membrane and resulting structural changes can be determined by recording the changes of fluorescence parameters of hydrophobic probe pyrene embedded in the structure of model membranes phosphatidylholine liposomes. With the introduction of pyrene in liposome structure fluorescence spectrum of the probe was detected, the spectrum consists of several peaks in the range 350-400 nm, to the monomeric form of pyrene, and the peak in the range of 430-500 nm, related to the excimer form. During the titration of pyrene by EMF efficient fluorescence quenching of the probe was observed. To analyze the data we used the equilibrium constant of the complex EMF-pyrene k_p. K_p values are in the range 10^5-$3x10^5$ M^{-1}, such values indicate that there are effective interaction between EMF and molecules pyrene in the membrane structure. It should also be noted that during the titration of pyrene by EMF, increasing of excimerisation coefficient was observed, values of the coefficient are inversely proportional to the membrane's microviscosity. Thus, it was shown that the investigated EMF incorporate into the membrane of phosphatidylholine liposomes, reducing its microviscosity.

Relaxation properties of the EMF determined by the ability of gadolinium atoms to interact with the fullerene spheroid and thus reduce the relaxation times of protons in contact with the compound of water environment. The relaxation ability of low-toxicity (in vivo) EMF determined by their effect on the spin-lattice relaxation time of water protons. The relaxation of coefficients R for aqueous $Gd@C_{82}(OH)_x$, $Gd@C_{82}$-H Pro, $Gd@C_{82}$-Hydroxyethyl Pro, $Gd@C_{82}$-Maleimide Pro were: 3.695 $mM^{-1}c^{-1}$, 0.945 $mM^{-1}c^{-1}$, 0.757 $mM^{-1}c^{-1}$ and 1.091 $mM^{-1}c^{-1}$ respectively.

Therefore, these EMF integrates into the structure of model membranes have low toxicity (in vivo) and its relaxation properties comparable with contrasting drug "magnevist," $Gd@C_{82}(OH)_x$ in the number of studied EMF has the highest rate of relaxation.

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