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програмного забезпечення для аналізу та візуалізації в режимі реального часу виміряних даних буде створено прототип комерційного зразку компактної СРМ на основі металево фольгових сенсорів.

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4. Біомедична інженерія
Biomedical engineering

WATER DYNAMICS IN RED BLOOD CELLS: MODELLING OF HYDRATION

<u>Liliya V. Batyuk</u>[1*], Natalya N. Kizilova[2]

[1*]*Department of Medical and Biological Physics and Medical Information Science, Kharkiv National Medical University,*
61022, Ukraine, Kharkiv, 4Nauky av., liliya-batyuk@ukr.net
[2]*Department of Applied Mathematics, Kharkiv National University,*
61022, Ukraine, Kharkiv, Svobody sq., n.kizilova@gmail.com

As known, the biological systems of organism cannot function without water [l]. Most of this water is confined in cells and blood vessels [2, 3]. Investigations connected with observations of membrane hydration are indispensable for understanding the structure and function of membrane of RBCs depends of pathology state organism [4, 5]. Microwave dielectric relaxation measurements present important information on the structure of water. Water exhibits a dielectric relaxation peak at 18 GHz at 25°C [6 -8]. Study of the dielectric properties of biological systems can be carried out from a theoretical and experimental point of view. The experimental approach is fundamental because it is the first interaction with the biological environment and provides quantitative and qualitativeanalysis of the object of study. The results of studies aimed at revealing mechanisms of the pathogenesis of cardiovascular and cerebrovascular diseases or oncology diseases convincingly testify to the leading role of the imbalance in the regulation of the neurohumoral system [9 -11]. Since the realization of the stress reaction of the organism is directly related to the functional state of the membrane-receptor complex of cells, it is the changes in the functions of this complex that are regarded as the main defect that causes a whole cascade of biological reactions in response to the action of various information signals (biologically active substances, hormones, allergens , microorganisms, etc.), because the first events unfold at the level of cell membranes and their receptors. Investigation of the relationship of disorders with the features of the membrane complex will allow personifying approaches to the prevention of development and progression of cerebral circulation or oncology disorders. Evaluation of hydration was carried out according to the formula $\Delta\varepsilon_S = \varepsilon_S^W - \varepsilon_S^S$, where $\Delta\varepsilon_S$ is the decrement of the static permittivity of the solution with respect to the solvent, ε_S^W and ε_S^S are the static permittivity of the solvent and solution, respectively [11].The static permittivity and conductivity in this work were measured via the impedance and conductance, respectively.The detected temperature-dependent changes in the dielectric parameters ε_S and f_d (the static dielectric constant and the frequency of the dielectric relaxation of water in the solution)of the shadows and suspension of the blood erythrocytes of patients, together with the structural and functional properties of the erythrocyte membranes interconnected with this change, can be considered as one of the important aspects the relationship between the organism and disease.For a suspension of erythrocytes of healthy donors, in which systems dipole-dipole interactions predominate or is initiated the formation of additional H-bonds is initiated, the layer of disordered water is very small or absent altogether. Since the activation energy of the hydrogen bond is estimated at 12.5 kJ/mol [5, 12], in the system the suspension of erythrocytes of donor, each water molecule forms 1.5 to 2.5 H bonds with neighboring molecules. In the system the suspension of erythrocytes of ischemic/ of oncology patients each water molecule forms 1.2 to 2 H / forms 1.3 to 2.1 H bonds with neighboring molecules. This information is used to develop models that are in agreement with experimental data. Obviously, to formulate these models, it is necessary to determine the variables that describe these phenomena. In this work, thermodynamic models of hydration of red cell membranes have been developed based on a two-state structural presentation of liquid water. In this model, we assume that all structural changes in the membrane cells can be accounted by solute-solvent water interactions.We calculate the configurational of the potential energy collected over Monte Carlo method at temperature range 2-12°C, 12-20°C and 26-36°C, 36-45°C, where breaks occur, with increasing activation energy. The structural transition is preceded by the dehydration of the membrane components, which results in a decrease in the mobility of the water molecules in the erythrocytes.

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НОРМАЛЬНЫЕ ВОЛНЫ, ВОЗНИКАЮЩИЕ ПРИ ДВИЖЕНИИ КРОВИ В АРТЕРИИ

В.И. Ковальчук[1], Б.В. Бацак[2], Ю.Ф. Забашта[1], Л.А. Булавин[1]
[1]Киевский национальный университет, Киев, 01601, Украина
[2]Институт сердца МОЗ Украины, Киев, 02660, Украина

В механике кровообращения – гемодинамике [1] на протяжении уже многих лет актуальна задача о медленных пульсовых волнах, которые возникают в момент выброса порции крови из левого желудочка сердца в аорту и сопровождают процесс движения крови по сосудам. Особенности поведения пульсовой волны в артериях исследованы в данной работе (см. также [2,3]). Своим существованием пульсовая волна обязана упругости стенок сосуда, которые деформируются при прохождении волны по сосуду. Соответственно, традиционной расчетной моделью сосуда является цилиндрическая оболочка с упругими стенками, окруженная упругой средой и заполненная жидкостью.

Нами рассмотрен трехмерный вариант этой задачи. На рис. 1 представлены результаты проведенного расчета.

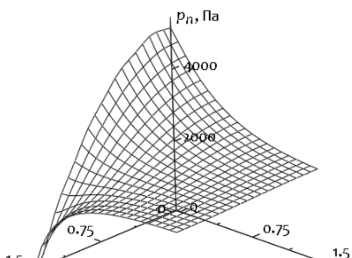

Рис. 1. Распределение давлений в переходной зоне артерии (цилиндрическая система координат, в которой z-ось направлена вдоль оси симметрии сосуда).

Как видно из этого рисунка, размер переходной зоны по порядку величины равен радиусу артерии. Анализ результатов работы позволяет