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THEORETICAL INVESTIGATION OF FLOWS RATE OF CELLULAR FLUID THROUGH THE CAPILLARY OF DIELECTROMETER

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The phenomenon of capillary surface properties in contact with blood is associated with two factors, namely the energy factor, which is associated with interfacial tension and electrical factor. A number of assumptions accepted in many studies of electrokinetic phenomena in thin and ultrathin capillaries are based on the possibility of using the classical Navier-Stokes equation to construct a profile of flow velocities in narrow capillaries [1]. The conclusion of this equation does not take into account conditions where the effect of electrokinetic inhibition is maximum. The generalization of electrokinetic phenomena in thin capillaries during the leakage of inhomogeneous, non-Newtonian fluids, such as blood, the properties of which are due to macromolecules, organic compounds and proteins, is associated with finding a solution for the electrohydrodynamic system of equations. Blood is a dispersed medium and the description of flows, including electrokinetic ones, cannot be based only on the solution of the Navier-Stokes equation, it is essential for a smaller radius of the capillary. For a dispersed medium, the effective capillary radius may be an order of magnitude smaller than that corresponding to the primary measurements.

A large number of works are devoted to the rheological equation of blood, where you can find various functional approximations of blood flows. The actual hydrodynamic dimensions of the capillaries in which the blood flows may actually be smaller due to the tinning of the capillary surface due to the formation of a near-surface gel layer, which is characteristic of capillary materials in which the Copley-Scott Blair effect is observed (for some types of glass). It is necessary to take into account the stiffness and permeability of the surface and its effect on the electrokinetic fluid flow. Based on the viscoplastic properties of blood, for the hydrodynamic profile of the fluid flow rate in the capillary of the microwave dielectrometer [2], we can write

$$V = \frac{r}{\eta}\tau\left[(1-\frac{d}{2r})\cdot\left(\frac{d}{2r}-\frac{2}{3}\sqrt{\frac{\tau_o}{\tau}}\cdot(1-(1-\frac{d}{r})^{\frac{3}{2}}\right)+\frac{\tau_o}{\tau}\cdot\frac{d}{r}\right],$$

where η is the viscosity of the medium, τ is the friction voltage around the perimeter of the capillary section, τ_0 is a maximum shear stress, r is a capillary radius, d is the thickness of the adsorption layer of liquid particles. If $\tau_0 = 0$, the equation passes into the classical Poiseuille formula. Regarding the electrical component of velocity, it should be calculated similarly for a Newtonian fluid. The results of the calculations showed that in the capillary of the high-frequency dielectrometer there is an increase in the inhibition of fluid flow with increasing parameter τ / τ_0. The dependence of inhibition on the surface potential will be extreme. The point of minimum τ / τ_0 with increasing Kisan properties of blood during inhibition of the latter will increase.

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