Aspects of applicability King-St. Clair approximation in a non-Newtonian fluid mechanics

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ABSTRACT

This study is a contribution to research in the biomedical and clinical applications of ultrasound. Ultrasonic waves can be used for the separation cells in human blood. From a physical point of view, the human blood is a suspension or a mixture of liquids and solids cell elements), and behaves as a non-Newtonian fluid .
Our work is devoted to the problem of the motion of cells in human blood under the influence of ultrasonic wave. It defines the applicability range of the approximation consisting in neglecting the nonlinear term in the friction force. It also analyzes the general properties of the equation of motion of the cell in the case of large attenuation constants, corresponding for values of the drift forces to cells with radii a few micrometers. Finally, it defines the applicability criterion of the so-called King-St Clair approximation consisting in the assumption of equilibrium between the drift and the Stokes viscosity forces, neglecting the term representing inertia. This approximation makes possible analytical estimation of the time constants of the cell transport to points of stable equilibrium in a ultrasonic standing wave field.

References

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