Experiments with a disc laser ektacytometer and measurement of the red blood cells distribution width in deformability

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This work is devoted to the measurement of a new rheological parameter—the Red blood cells Distribution Width in Deformability (RDWD). This value is introduced in analogy with the Red blood cells Distribution Width (RDW) included in the standard blood test. We believe that measuring RDWD can improve medical diagnostics, but the role of this parameter in the human organism remains to be clarified. For the first time, we measured RDWD by laser diffractometry in shear flow (ektacytometry) using a disk laser ektacytometer assembled in the Laboratory of Biomedical Photonics of the Faculty of Physics of Moscow State University. This type of ektacytometers implies pouring a highly diluted suspension of erythrocytes into the gap between two transparent disks: one of the disks is rigidly fixed, the other can rotate at a given angular velocity. We analyzed obtained experimental data (diffraction patterns) using previously developed algorithms for solving the inverse scattering problem. In this paper, the characteristics of the ektacytometer, the method of conducting experiments are discussed. The choice of the most suitable diffraction pattern area and the algorithm for analysis is also analyzed. In particular, the algorithm applicable to the analysis of the central part of the diffraction pattern is considered in detail. For a blood sample from a young healthy donor, we obtained an estimate of RDWD=15%. The results are compared with data obtained by rheoscopy and flow chamber methods. The possibilities of increasing the measurement accuracy are also discussed.

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