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Acoustic Blood Plasmapheresis in Polymeric Resonators

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Abstract : Acoustophoretic separation of plasma from blood is based on a collection process of the blood cells, driven by an acoustic radiation force. The number of cells, their concentration, and the sample hydrodynamics are involved in these processes. However, their influence on the acoustic blood response has not yet been reported in the literature. Addressing it, this paper presents an experimental study of blood samples exposed to ultrasonic standing waves at different hematocrit levels and hydrodynamic conditions. The experiments were performed in a glass capillary (700µm-square cross section) actuated by a piezoelectric ceramic at 1MHz, hosting 2D orthogonal half-wavelength resonances transverse to the channel length, with a single-pressure-node along its central axis where cells collected driven by the acoustic radiation force. Four blood dilutions in PBS of 1:20, 1:10, 1:5, and 1:2 were tested at eight flow rate conditions Q=0:120µL/min. The 1:5 dilution (H=9%) demonstrated to be optimal for the plasmapheresis at any of the flow rates analyzed, requiring the shortest times to achieve plasma free of cells. The study opens new possibilities to optimize processes of plasmapheresis processes by ultrasounds at different hematocrit conditions in future personalized diagnoses/treatments involving blood samples.

Keywords : ultrasounds, microfluidics, flow rate, acoustophoresis, polymeric resonators
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