Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A CFD-based design of a microfluidic platform for separating blood cells[1] ANOOP KANJIRAKAT, Texas A&M University at Qatar, ZHANG HAN, REZA SADR, ARUM HAN, Texas A&M University College Station, TEXAS A&M UNIVERSITY AT QATAR COLLABORATION, TEXAS A&M UNIVERSITY COLLEGE STATION COLLABORATION — Point-of-care (PoC) diagnostic systems utilizing microfluidic platforms are becoming popular in the detection of biomarkers in blood samples. In this work, we aim to develop a passive plasma separator that can be effectively integrated into a blood diagnosis system for detecting cardiovascular biomarkers. A single-step process of creating a cell-free region in the flow without the plasma being actively extracted from the whole blood is envisaged. Sensors are proposed to be placed in the cell-free zones for biomarker detection. A two-phase numerical study to investigate the various geometrical factors affecting the development of a cell-free zone in the backward-facing step of an expansion chamber is made. The cellular particle interactions in the blood are modeled using a discrete element method (DEM). The sizes of the cell-free zones in the microfluidic system are studied for 18 different geometric configurations. Cell-free radius is estimated with an accuracy of 10 micrometers. An expansion chamber with a larger aspect ratio together with a low Reynold number flow entering it is observed to create a larger cell-free zone. The numerical observations are initially validated with the flow of fluorescent beads and later using diluted blood samples.

[1]This publication was made possible by NPRP grant # 10-0101-170076 from the Qatar National Research Fund (a member of the Qatar Foundation).

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Date submitted: 31 Jul 2019 Electronic form version 1.4