Flow behaviour in microchannels of an innovative blood analogue fluid based on giant unilamellar vesicles

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The development of blood analogue fluids continues to draw much attention from researchers around the world, in order to mimic the physical and rheological characteristics of the real blood [1, 2]. One of the biggest challenges in blood analogues is to incorporate cellular-like components able to perform fundamental functions, such as the transport of gases and nutrients, and the ability to deform under flow when they pass through a narrower capillary.

This work focused on the development of an innovative blood analogue, containing giant unilamellar vesicles (GUVs), to mimic the flow behaviour of red blood cells (RBCs). The GUVs were prepared using soybean lecithin by hydration of a lipid film followed by extrusion through polycarbonate membranes of 8 μm. The rheological characterization of different blood analogue solutions was performed in a stress controlled rheometer (Bohlin CVO, Malvern) and the results have shown a good agreement when compared with a sample containing 5% of RBCs (see Figure 1).

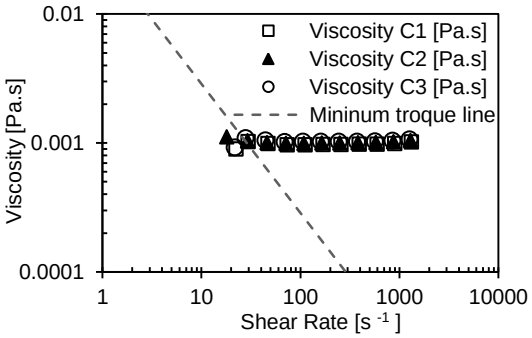

Figure 1. Viscosity of GUVs solutions with different concentrations of soybean lecithin as a function of shear rate.

In addition, flow visualizations were performed in a hyperbolic constriction microchannel, where a cell free layer was formed at the constriction downstream. At this region of the microchannel, the deformation of GUVs was also measured and it was also found that the deformation index increases with the flow rate. Overall, our results show that the proposed blood analogue has a close rheological behaviour to *in vitro* blood samples with low hematocrits.

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