Soft Matter. Volume:13. Number: 16. Pages: 3042-3047. April 2017

# Front microrheology of the non-Newtonian behaviour of blood: scaling theory of erythrocyte aggregation by aging

C. Trejo-Soto, E. Costa-Miracle, I. Rodriguez-Villarreal, J. Cid, M. Castro, T. Alarcón, A. Hernández-Machado

**Abstract— We introduce a new framework to study the non-Newtonian behaviour of fluids at the microscale based on the analysis of front advancement. We apply this methodology to study the non-linear rheology of blood in microchannels. We carry out experiments in which the non-linear viscosity of blood samples is quantified at different haematocrits and ages. Under these conditions, blood exhibits a power-law dependence on the shear rate. In order to analyse our experimental data, we put forward a scaling theory which allows us to define an adhesion scaling number. This theory yields a scaling behaviour of the viscosity expressed as a function of the adhesion capillary number. By applying this scaling theory to samples of different ages, we are able to quantify how the characteristic adhesion energy varies as time progresses. This connection between microscopic and mesoscopic properties allows us to estimate quantitatively the change in the cell–cell adhesion energies as the sample ages.**

**Index Terms—**



**Citation:**
*Trejo-Soto, C.; Costa-Miracle, E.; Rodriguez-Villarreal, I.; Cid, J.; Castro, M.; Alarcón, T.; Hernández-Machado, A.; "Front microrheology of the non-Newtonian behaviour of blood: scaling theory of erythrocyte aggregation by aging", Soft Matter, vol.13, no.16, pp.3042-3047. April, 2017.*