Effect of viscosity on the transport of fluorescent nanomessengers under microfluidic conditions

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Molecular communication is an alternative communication approach in which chemicals are used as messengers. Just as in biological systems, which have always used molecules or molecular aggregates to communicate, an artificial platform for molecular communication consists of a transmitter that enable the message to be encoded, a communication channel in which a carrier fluid transports the messengers, and a receiver that enables decoding. [1] We will present our recent findings about the investigation of the effect of viscosity gradients in the carrier fluid on the flowing of suspension of fluorescent carbon nanoparticles used as chemical messengers under microfluidic conditions. Firstly, we have simulated the information transport process by numerically solving the governing differential equation. It has allowed us revealing a peculiar phenomenon that occurs at the interphase between two miscible liquids having different viscosities, namely: water and glycerol. Then, we have undertaken an intensive experimental campaign by using a prototypal artificial molecular communication platform we made on purpose in our laboratory. With the vast number of hence obtained signals, it was possible to validate the theoretically predicted findings.

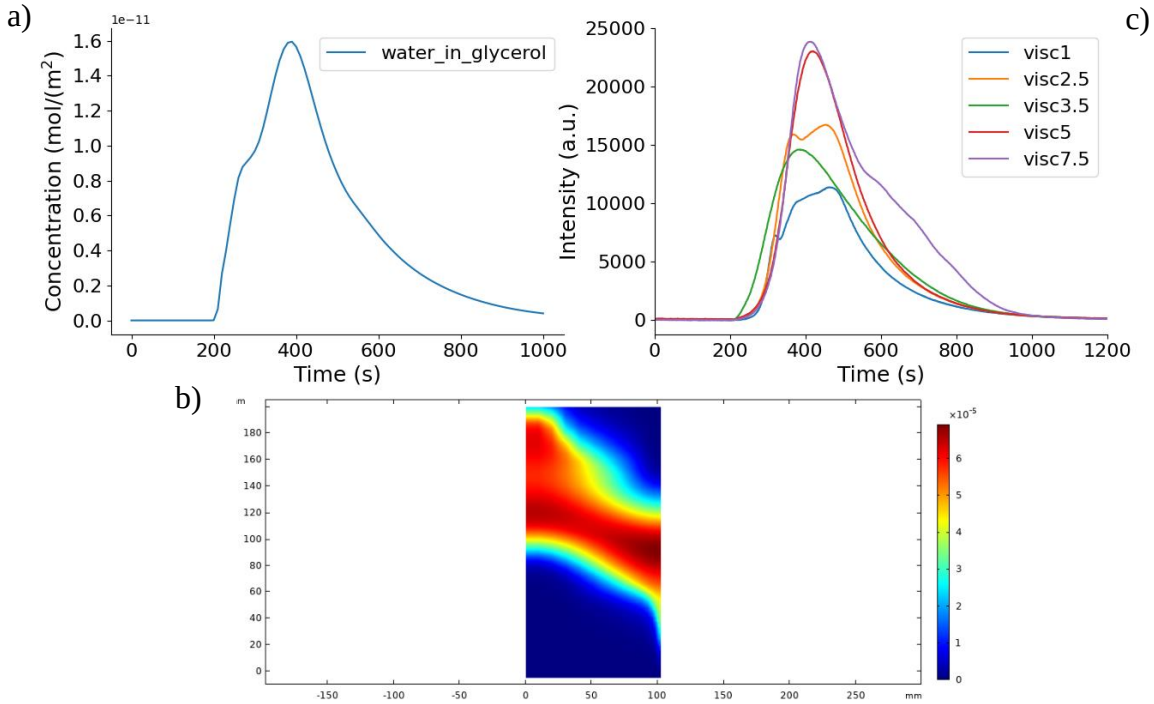

Figure 1. a) Simulated signal of diluted species in water transported by glycerol carrier and its related concentration 2D plot in b); c) experimental comparison between the signals obtained from five fluorescent carbon dots suspensions having different viscosity transported by a constant carrier with 3.5 mPa · s viscosity.

References

[1] N. Tuccitto, G. Li Destri, G. M. L. Messina, and G. Marletta, Phys. Chem. Chem. Phys., 2018, 20, 30312