Title: Diffusing Wave Spectroscopy used for analysis of highly stable emulsions

Roland Ramsch[1], Emily Woodcock[1], Yassine Nagazi[1], Giovanni Brambilla[1], Gérard Meunier[1]
[1] *Formulaction, SAS, 3-5 rue Paule Raymondis, 31200 Toulouse, France*
Contact Email: roland.ramsch@formulaction.com

Stability analysis of highly concentrated or solid products are complicated and need long observation times and acceleration methods such as high temperature or centrifugation. Latter one may not be representative as samples are usually not submitted to centrifugal forces during storage. Consequently, samples may destabilize under centrifugation, which they would not do if stored at rest under realistic conditions. In cosmetic industry thermal cycle stress test are used. These tests are time consuming and highly subjective.

We propose a new way to analyze highly concentrated, solid or paste-like materials using Diffusing Wave Spectroscopy (DWS) [1,2,3]. This innovative and highly sensitive technique provides information about the microstructure evolution during thermal processing by analyzing the backscattered light.

In this work we analyzed highly concentrated emulsions (internal phase > 70 vol%) with stability of several months were studied with Rheolaser Crystal. This instrument uses Diffusing Wave Spectroscopy combined with a precise control and measurement of the temperature. A series of thermal cycles between 4°C and 40°C were applied. The evolution of the backscattered light gives information about the microstructure evolution of the emulsions. The high sensitivity of the technique allows to measure small variation in the microstructure (related to the droplet size or the droplet network). The results allowed a ranking of emulsion stability, which was in coherence with long term (several weeks/months) measurements.

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[3] Viasnoff, V., Lequeux, F., & Pine, D. J. (2002). Multispeckle diffusing-wave spectroscopy: A tool to study slow relaxation and time-dependent dynamics. *Review of scientific instruments*, 73(6), 2336-2344.

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