Characterisation of instability of concentrated dispersions by a new optical analyser: the TURBISCAN MA 1000

Olivier Mengual a,*, Gérard Meunier a, Isabelle Cayre a, Katia Puech a, Patrick Snabre b

a Formulaction, 10, avenue de l’Europe, 31525 Ramonville St Agne, France

b IMP, Avenue du Professeur Trombe, BP5, 66125 Font-Romeu, France

Received 23 January 1998; accepted 24 July 1998

Abstract

Emulsion or suspension destabilisation is often due to two physical phenomena:

1. particle size increase (coalescence) or particle aggregation (floculation);
2. particle migration (creaming or sedimentation).

Creaming or sedimentation are often considered as reversible while coalescence or flocculation spells disaster for the formulator. Therefore, it is of prime importance to detect at an early stage these phenomena in order to shorten the ageing tests and to improve the formulations.

This work thus concerns the optical characterisation of destabilisation of concentrated dispersions. It deals mainly with the independent and anisotropic scattering of light by a suspension or emulsion in a cylindrical glass tube in relation with the optical analyser TURBISCAN MA 1000. Indeed, in dense suspensions or emulsions, photons undergo many scattering events before escaping the medium and entering a receiver aperture. Multiple scattering thus contributes significantly to the measured transmitted and backscattered flux.

We present statistical models and numerical simulations for the radiative transfer in suspensions (plane or cylindrical geometry) only involving the photon mean path length, the asymmetry factor and the geometry of the light receivers.

We have further developed an imaging method with high grey level resolution for the visualisation and the analysis of the surface flux in the backscattered spot light.

We compare the results from physical models and simulations with those of experiments performed using the imagery method and the TURBISCAN MA 1000 analyser for dispersions of latex beads (variable size and particle volume fraction).

We then present a few examples of dispersion destabilisation analysis with the TURBISCAN MA 1000. We show that the instrument is able to discriminate concentration and particle or aggregate size variations and to detect those phenomena much earlier than the operator’s naked eye, especially for opaque and concentrated systems. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Dispersions; Optical analyser; Instability; Multiple light scatterings

* Corresponding author. Tel: +33 561 28 5652; Fax: +33 561 28 5677.

0927-7757/99 – see front matter © 1999 Elsevier Science B.V. All rights reserved.
PII: S0927-7757(98)00640-3