Characterization of Pickering emulsions

- Physical stability evaluation-

PHARMACEUTICAL

Introduction

The use of pickering emulsions is of high interest for applications in a large range of fields like drug delivery, vesicle and responsive materials, porous materials, catalytic facilitation, safer formulation in cosmetic, due to their strong stability compared to systems stabilized by surfactants. They also provide many beneficial properties: less irritability, environmentally friendly behaviour, carbon foot print decrease.
This note will present the results of a study of such emulsions on an example of pickering emulsions used in pharmaceutical field with an antifungal medication stabilized with biocompatible component. In pharmaceutical field, surfactant free emulsions are of great interest to avoid skin irritation, hemolysis and protein denaturation.

KEY **BENEFITS**

FAST

NO DILUTION

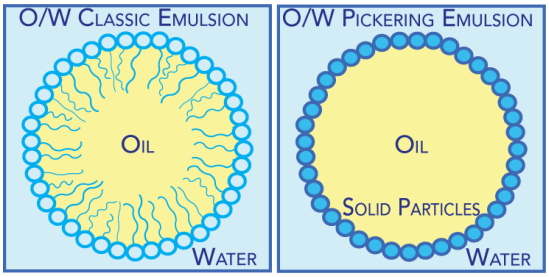
SENSITIVE

Reference

L. Leclercq, V. Nardello-Rataj, Pickering emulsions based on cyclodextrins : A smart solution for antifungal azole derivatives topical delivery. European Journal of Pharmaceutical Sciences 82 (2016) 126-137

Definition

A Pickering emulsion is an emulsion that is stabilized by solid particles (in the range 50-500nm) which adsorb onto the interface between the two phases.



The emulsion properties can be tuned in function of the particle affinity with water.
Particles show irreversible adsorption, in contrast to surfactant molecules, which exist in a dynamic equilibrium at the oil water interface and can adsorb and desorb on a rapid timescale. This strong adsorption of particles at the interface may also explain their stability over extended periods of time (even with large droplet sizes).
Therefore, pickering emulsions are extremely stable against destabilization phenomena such as coalescence and Ostwald ripening and the potential to enhance oxidative stability compared to systems stabilized by surfactants. But several authors reported aggregation or flocculation when diluting samples for example for oil droplet size by laser diffraction (*C. Linke, S. Drusch, Pickering emulsions in food – opportunities and limitations. Critical reviews in food science and nutrition 58(12) (2018) 1971-1985).*

Reminder on the technique

Turbiscan® technology, based on Static Multiple Light Scattering, consists on sending a light source (880 nm) on a sample and acquiring backscattered (BS) and transmitted (T) signal all over the height of a sample in its native state.
By repeating this measurement over time at adapted frequency, the instrument enables to monitor physical stability of a sample without dilution.
The signal is directly linked to the particle concentration (φ) and size (d) according to the Mie theory knowing refractive index of continuous (n_f) and dispersed phase (n_p): $\boldsymbol{BS} = \boldsymbol{f}(\varphi, \boldsymbol{d}, \boldsymbol{n_p}, \boldsymbol{n_f})$.

Method : Pharmaceutical application

The most commonly used pickering particles are silica, clays, calcium carbonate, titanium oxide or latex. This study focuses on biocompatible native cyclodextrins (CD) for antifungal medication based on econazole nitrate salt to treat superficial skin infections.