

Emulsification of viscous bio-based alkyd resin by catastrophic phase inversion

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The extensive use of alkyd resins in coating industry stimulates the studies to obtain O/W emulsions and understand the influence of different variables in the water fraction required to the inversion and the final droplet size. Highly viscous bio-based isosorbide polyester resin is used to formulate a O/W emulsion by catastrophic phase inversion. Water was added to 20g of the viscous resin which contains a hydrophilic polyethoxylated surfactant (Brij O20) until the water/oil weight proportion is approximately equal. Temperature was fixed at 50°C and agitation speed at 400 rpm. The inversion is followed by conductivity, torque (figure 1) and light backscattering in order to compare the different signals and their performance to track the inversion^{1,2}.

Carboxylic functions in the resin can be neutralized with KOH. For non-neutralized resin, a polydispersed distribution with an average diameter of 1µm was attained at 3wt.% Brij O20 final concentration and a flowrate of 0.5mL/min of water. At the same conditions, for neutralized resins the droplet size is lower (200-300nm) and the emulsion has a narrow distribution. When the percent of neutralization increases, the water fraction at which the inversion occurs also increases. Neutralization of the resin must incorporate some small amphiphilic anionic molecules at the interface increasing the hydrophilicity of the system and widening the hysteresis zone¹.

The increase of the water flow rate (0.05-0.5 mL/min) increases the droplet size and diminishes the “inversion point”. The increase of surfactant concentration allows get smaller droplets, but emulsions with concentrations higher than 4%wt show asymptotic behaviour¹. Different studied parameters allow optimize the final conditions and minimize the droplet size.

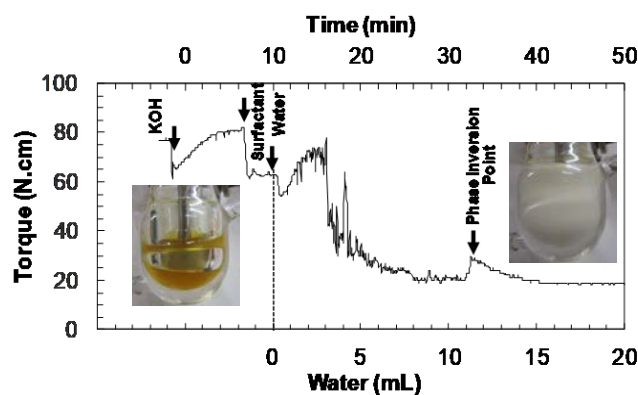


Figure 1. Torque of the BrijO20/isosorbide resin/0.01M NaCl_(aq) system as function of the time and the water added to the neutralized viscous resin.

- (1) Pierlot, C.; Ontiveros, J. F.; Royer, M.; Catté, M.; Salager, J.-L. Emulsification of Viscous Alkyd Resin by Catastrophic Phase Inversion with Nonionic Surfactant. *Colloids Surf. Physicochem. Eng. Asp.* **2018**, 536, 113–124.
- (2) Catté, M.; Ontiveros, J. F.; Aramaki, K.; Pierlot, C. Catastrophic Emulsion Inversion Process of Highly Viscous Isosorbide Biobased Polyester Monitored *in Situ* by Torque and Light Backscattering. *J. Oleo Sci.* **2018**, 67 (8), 925–931.