1. Motivation

Emulsion-filled gels are used in many commercial products such as cosmetics. Mainly used for component incorporation (pharmaceuticals or scents) and enhancing sensory performance.

2. System: Oil-in-Water Emulsion Gel

All components were combined using a rotor stator

- **Oil Phase**: Caprylic/Capric Triglyceride (CCT)
- **Continuous Gel Phase**: Water and Sepimax Zen (associative thickener). Basic structure is shown below.

3. Rheology of Emulsion-filled gel

Results show that the rheology cannot be explained solely by Krieger-Dougherty oil fraction scaling [1]. Significant adsorption of polymer to the oil, with depletion from the aqueous continuous phase, is indicated.

4. Estimating adsorption densities of polymer at oil-water interface

To estimate adsorption, emulsions were combined on a rollerbank and then centrifuged at approx. 1500g to separate off the oil phase.

Subsequent viscosity measurements, performed on subnatant, indicates polymer adsorptions > 10 mg/m².

Although further development is required to improve the centrifugation method the adsorption is consistent with microgels adsorbing to the oil-water interface [2].

5a. Rheology of Aqueous Gel Phase

There is a clear transition in the increase in viscosity around 0.15 wt% suggesting that the polymer is crowding and that it may have formed microgels [3].

5b. Probing the Structure of the Gel Phase

The storage modulus in the linear viscoelastic regime (LVR) provides information on the elasticity. The increase in elasticity from 0.1 wt% to 0.2 wt% is an indicator of the formation of a crowded microgel system [3]. Additionally the slope between 0.2 wt% and 1 wt% can be linked to the deformability and structure of the microgels [4].

6. Conclusions

Emulsion stabilisation experiments show that Sepimax Zen is a surface active polymer as well as a rheology modifier.

Rheological measurements suggest that the polymer acts as a microgel that crowds at high concentrations.

Elasticity of the gel indicates the microgels become compressed at high concentrations.

7. Future Work

More exact characterisation of polymer i.e. charge and size measurements.

Investigate emulsion-filled gel system under high shear and drying processes which occur during the application of topical creams.

Acknowledgements

We would like to thank Dr. David Moore and Dr. Michael Thompson at GSK for their support and enlightening discussions throughout this work.

References


