# Speeding up evaluation of physical stability of beverage dispersions

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## Scope

Fading of turbidity and phase separation are important problems for the beverage industry.

Traditional methods are visiual observations over several month, measurement of opacity, droplet size index or particle size analysis during storage.

The use of high resolution photometric detection of transmission profiles (STEP-Technology, LUMiReader at earth gravity / LUMiSizer at centrifugal acceleration) and of bottom focussed backscattering (LUMiCheck) is proposed for accelerated automatic study of dispersion demixing.

## Methods

High resolution photometric detection of transmission profiles measures direct data on the extent of phase separation but also on the kinetics of the underlying processes in-situ. The application of multisample analytical centrifugation can also provide the distribution of the sedimentation and creaming velocity, a direct measure of separation stability.
A novel measurement setup (LUMiCheck) is used to measure sedimentation and creaming with high sensitivity by focussing on changes in particle/droplet concentration right at the sample bottom, i.e. the very first changes of destabilization can be detected.

## Investigation on two beverage emulsions

**emulsion concentrates**

**emulsion A - lemon oil in water,**
**density dispersed phase: 0.93 g/cm³**

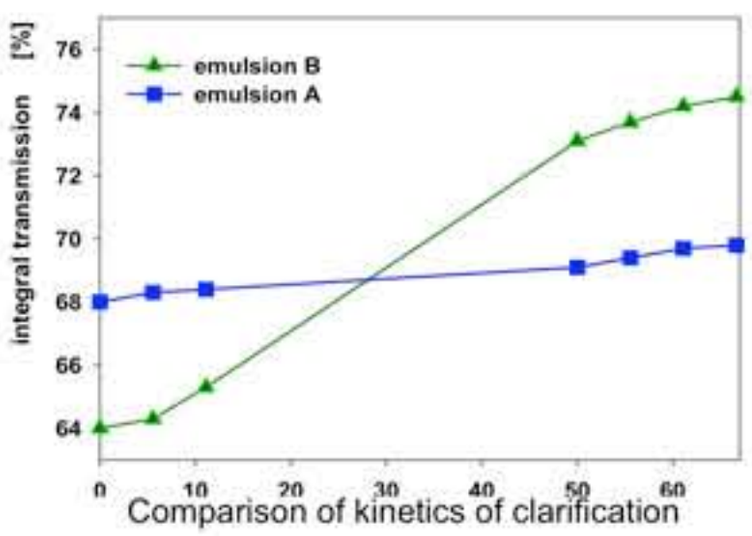
**emulsion B - lemon oil + weighing agent in water,**
**density dispersed phase: 1 g/cm³**

**diluted beverage emulsions**

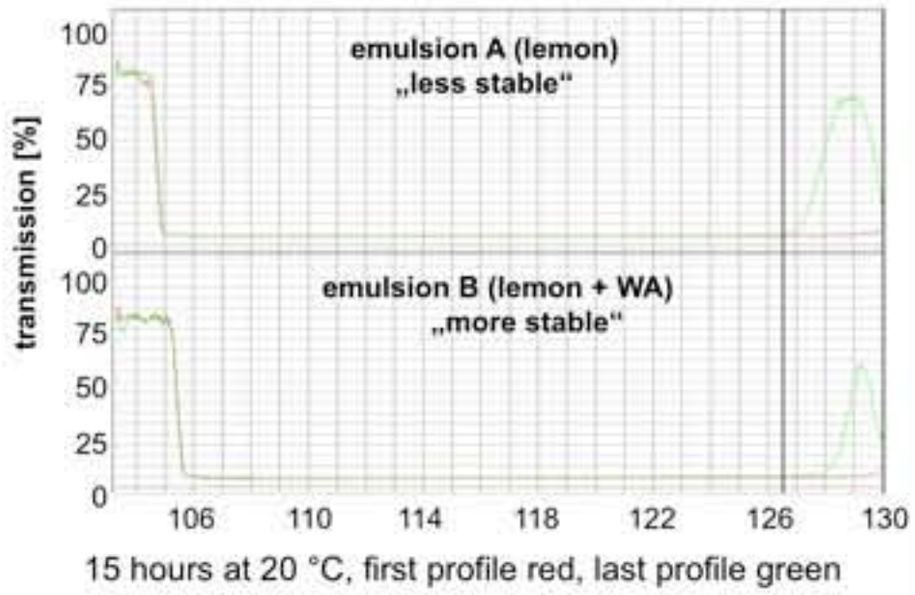
**(ready to use)**

**dilution 1/100**

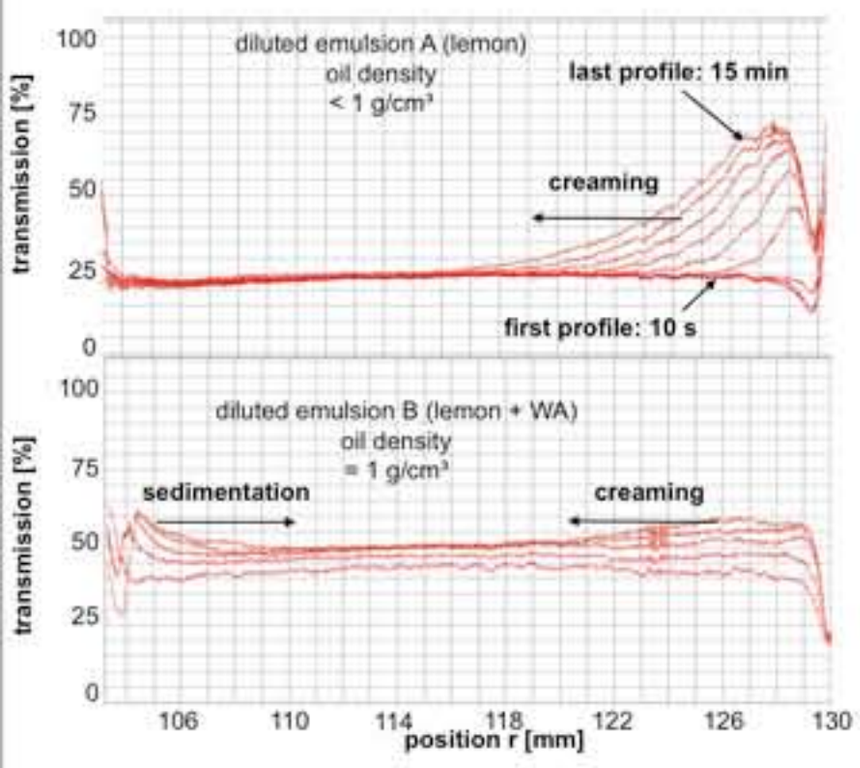
**diluted at 1 *g***

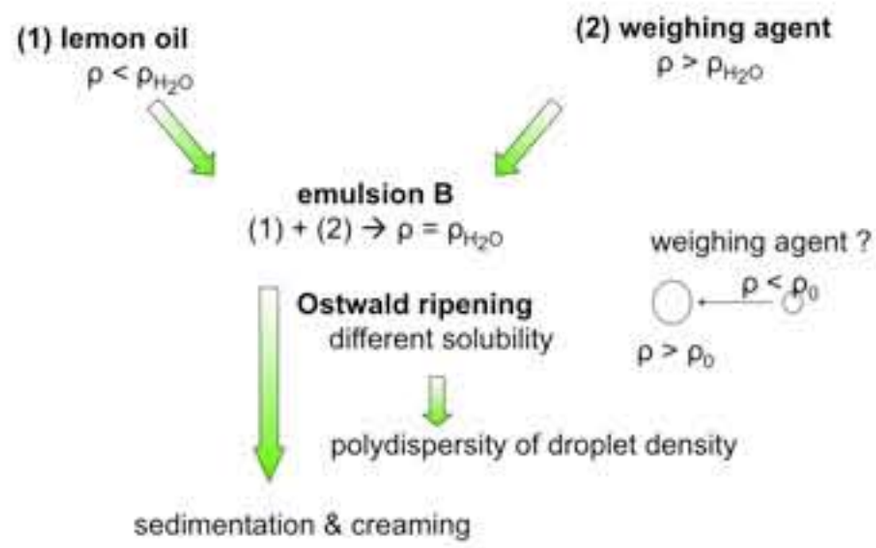



**concentrated at 328 *g***

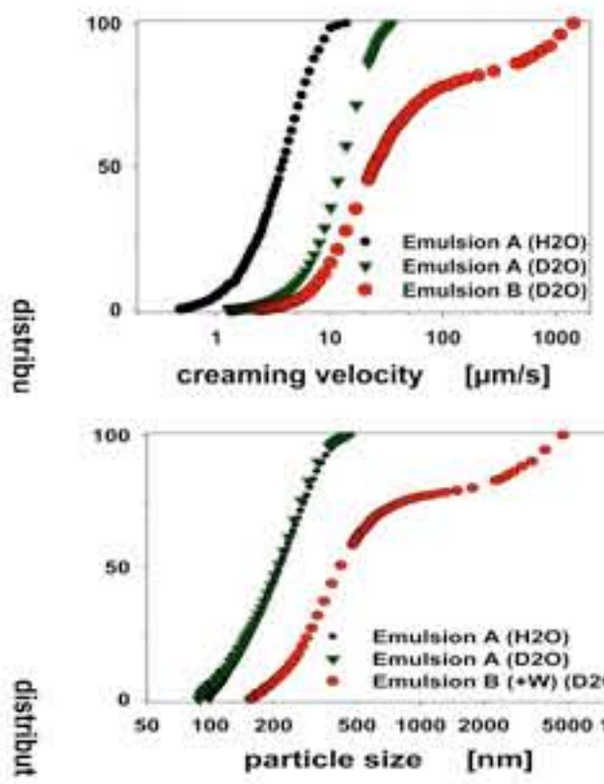



15 hours at 20 °C, first profile red, last profile green



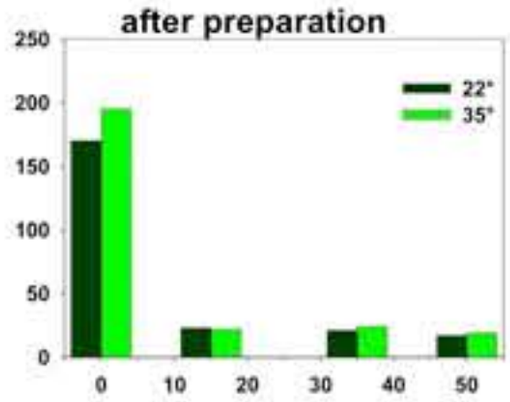

Vulnerability towards Ostwald ripening leads to lower stability of the dilute beverage (B) and a coarse droplet fraction




**visual observation** ⟷ **analytical centrifugation**

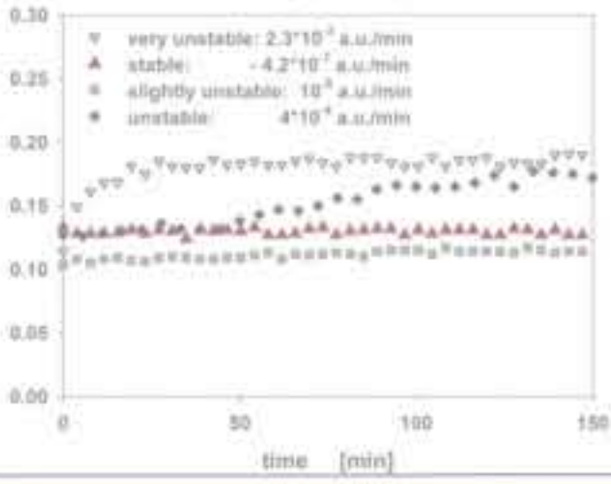
**after 4 weeks**

**after preparation**




Citrus beverage emulsions with variable content of weighing agent

**tracing settling with LUMiCheck**
**differently stabilized beverage dispersions containing pulp**




## Conclusion

- High resolution photometric detection of transmission profiles and bottom focussed backscattering are versatile tools for characterization of the separation stability of beverage dispersions and can therefore be used for rapid screening of different formulations and for quality control.
- High resolution detection of transmission profiles allows for an automatic accelerated study of beverage destabilization by direct data on the extend of phase separation and turbidity changes, but also on the kinetics of the underlying processes in-situ.
- The application of multisample analytical centrifugation can additionally provide the distribution of the sedimentation or creaming velocity as a direct integral measure of separation velocity. Size distributions can also be determined.

***Acknowledgement*** *We thank the Bundesministerium für Wirtschaft und Technologie (grant number KA0248303FK6) for financial support*

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