

Stofftransport an Einzeltropfen mit Konzentrationsprofil in der kontinuierlichen Phase

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Outline

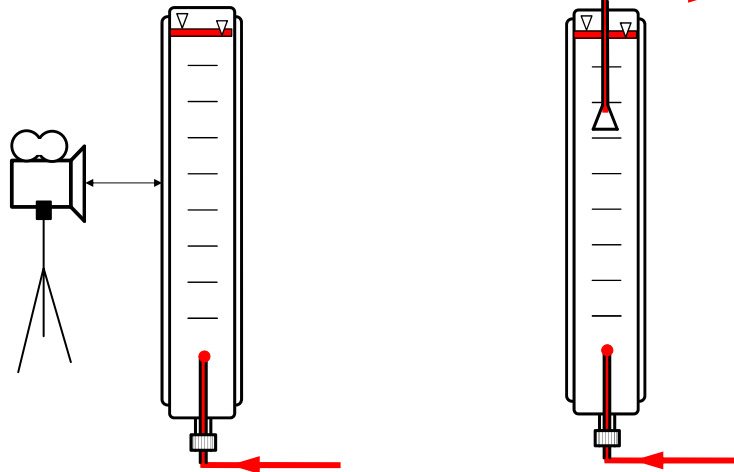
- Single-drop measurements
 - Standard sedimentation and mass-transfer cells
 - Cell with concentration profile
- Experimental setup
- Results
- Summary and Outlook



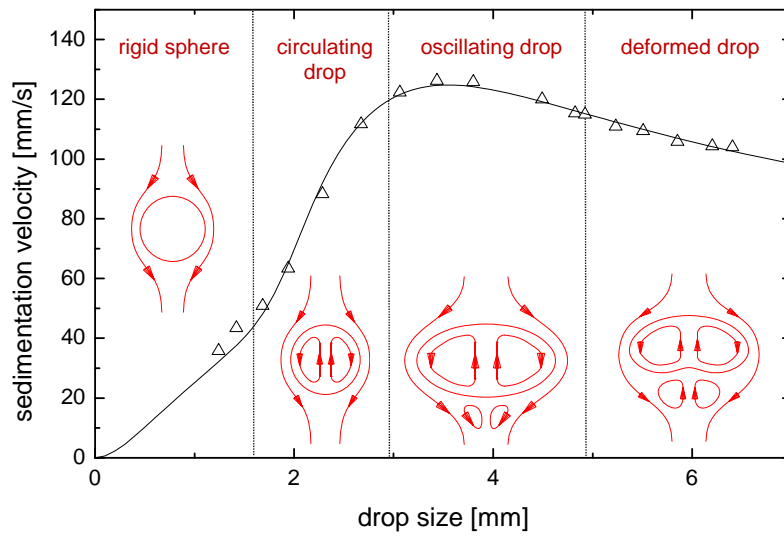
Single-drop measurements

Sedimentation

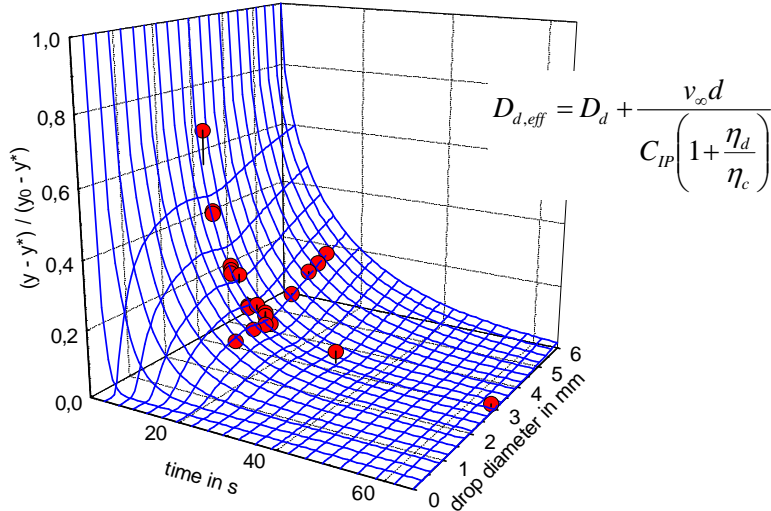
Mass Transfer



Single-drop sedimentation

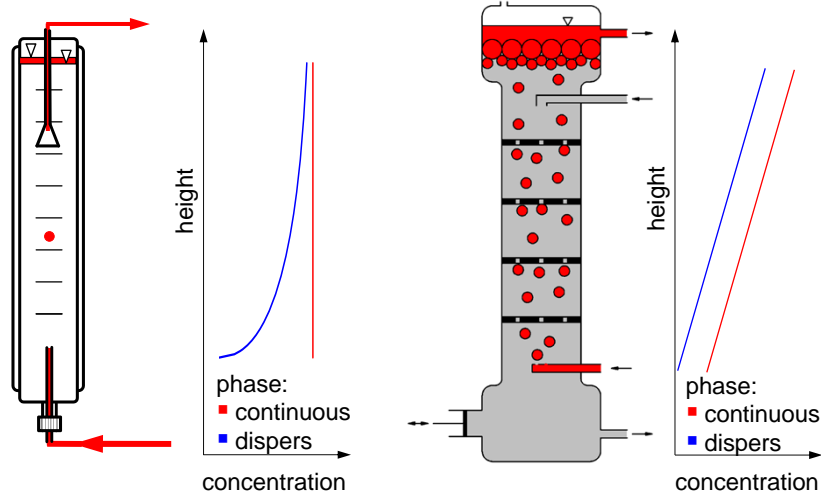


Modelling of mass transfer

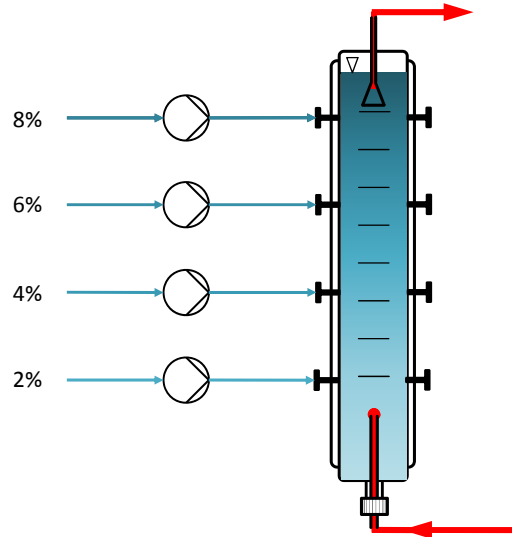


Henschke, Pfennig, AIChE J, 45, 10: 2079-2086, 2010

Concentration profile Measurement cell vs. extraction column

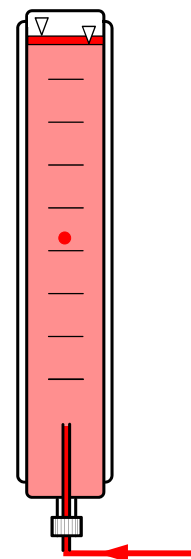
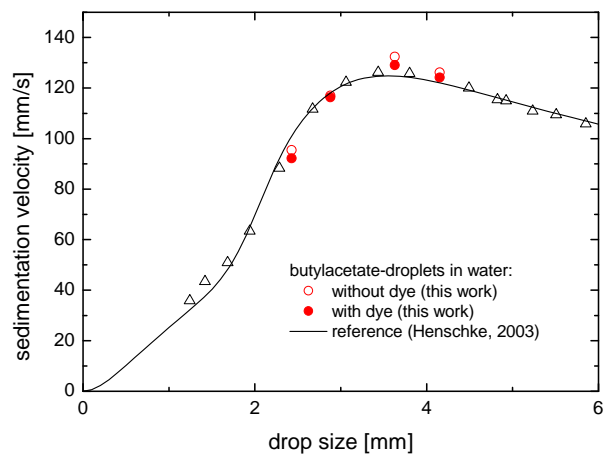


Single-drop cell with concentration profile

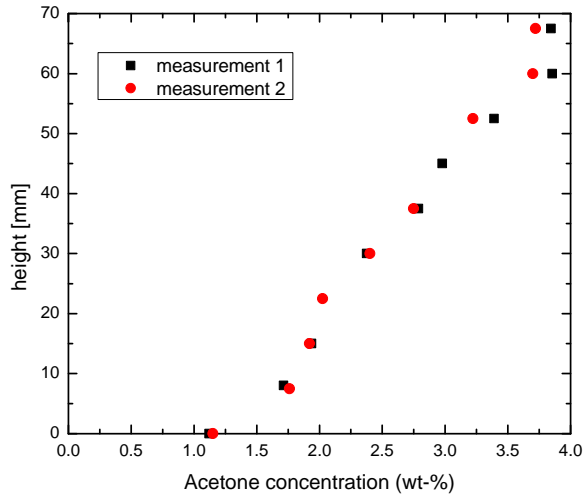


Material system:
butylacetate +
water +
acetone

Validation – Sedimentation



Reproducibility Concentration profile



Experimental conditions

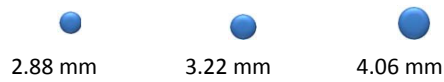
Material system

butylacetate + water + acetone

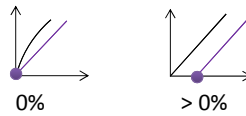
Concentration gradient



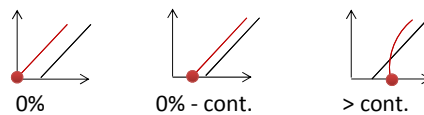
drop diameter



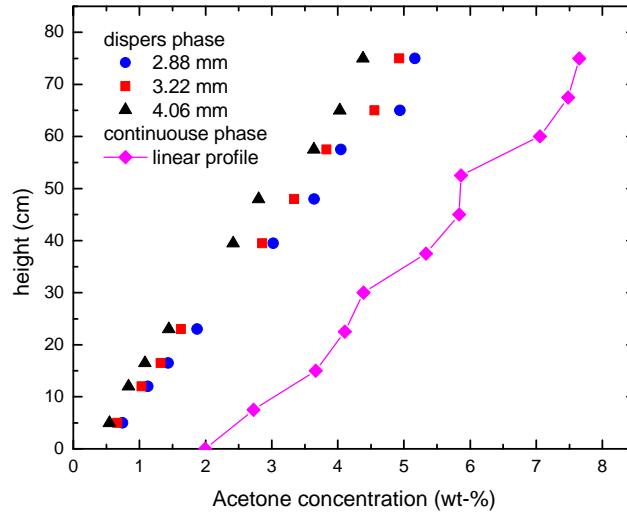
start concentration in continuous phase



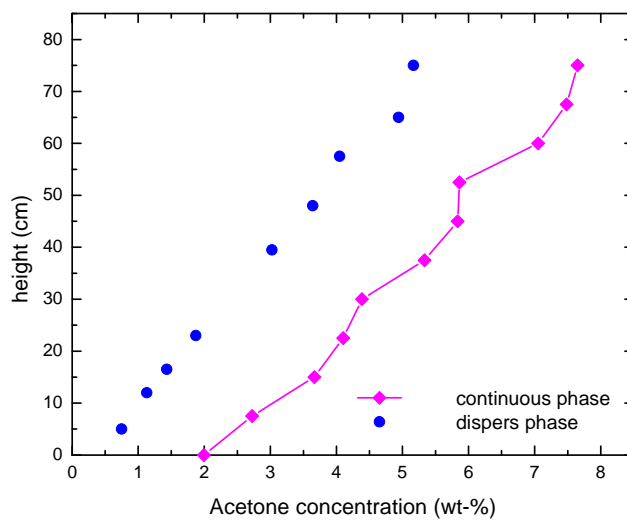
start concentration in dispers phase



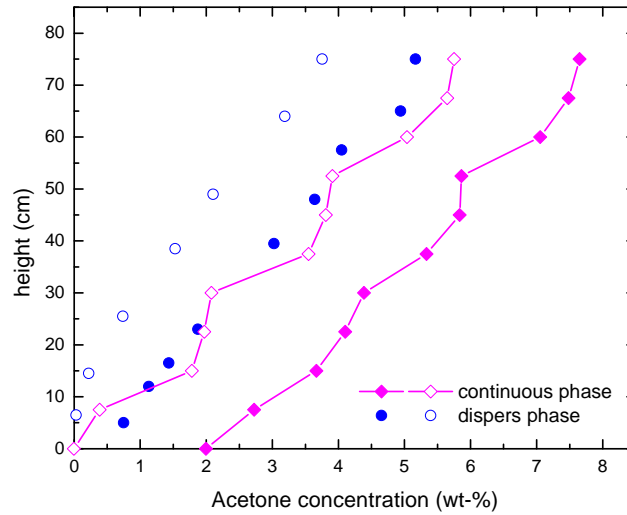
Linear profile: different diameters



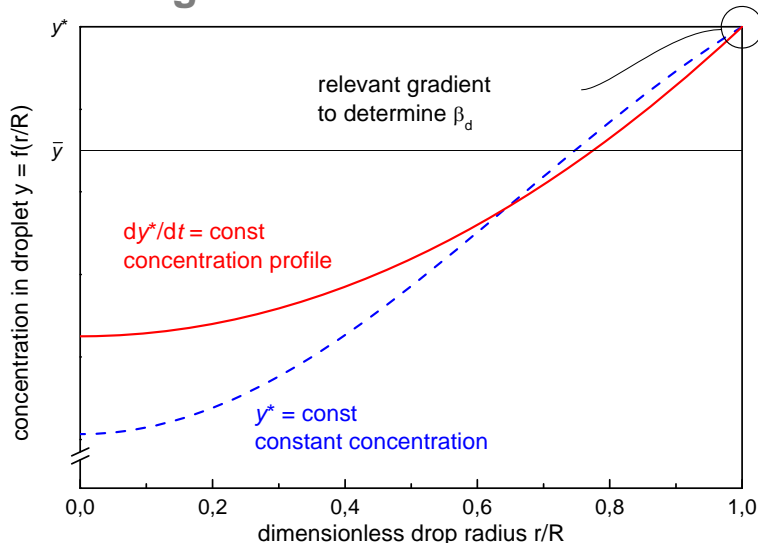
Linear profile: different starting conditions



Linear profile: different starting conditions



Modelling

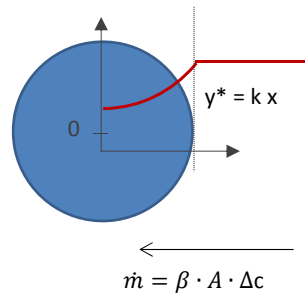


Modelling

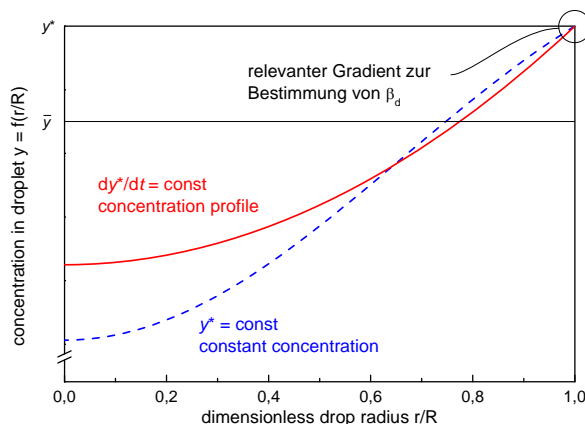
$$Sh_d = \frac{\beta_d \cdot d_{drop}}{D_{d,eff}}$$

$$Fo_d = \frac{4 \cdot D_{d,eff} \cdot t}{d_{drop}^2}$$

$$D_{d,eff} = D_d + \frac{v_\infty \cdot d_{drop}}{C_{IP} \cdot \left(1 + \frac{\eta_d}{\eta_c}\right)}$$



Modelling



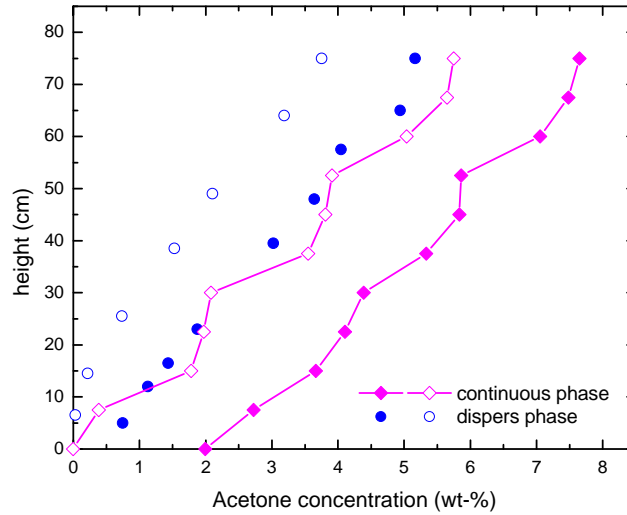
Constant concentration:

$$Sh_d = \sqrt{\frac{4}{\pi \cdot Fo_d} + \frac{4 \cdot \pi^4}{9}}$$

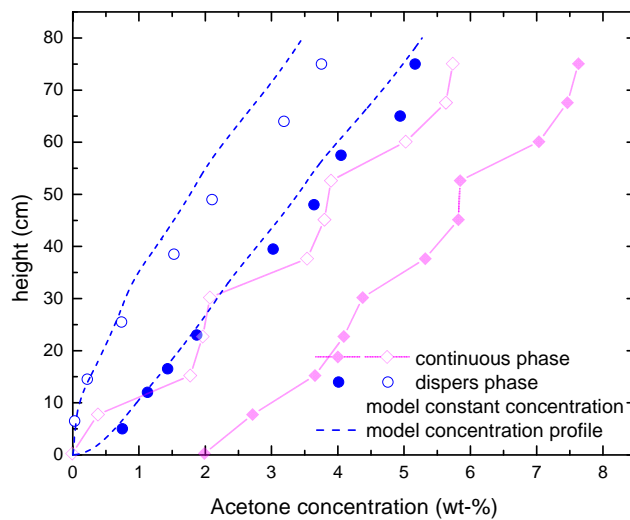
Concentration Profile:

$$Sh_d = \sqrt{\frac{16}{\pi \cdot Fo_d} + \pi^4}$$

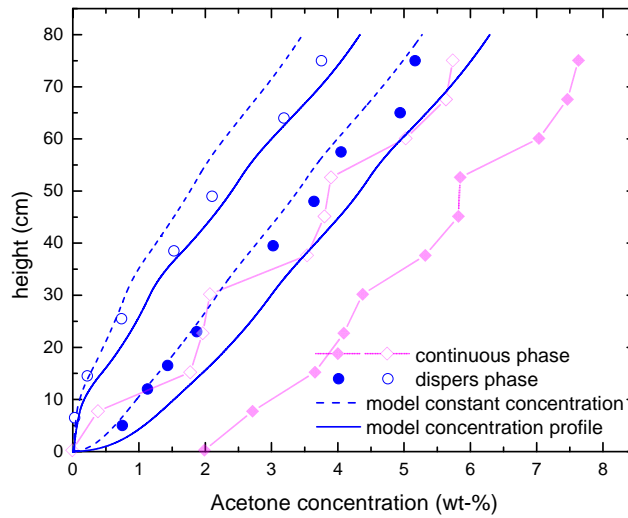
Linear profile: different starting conditions



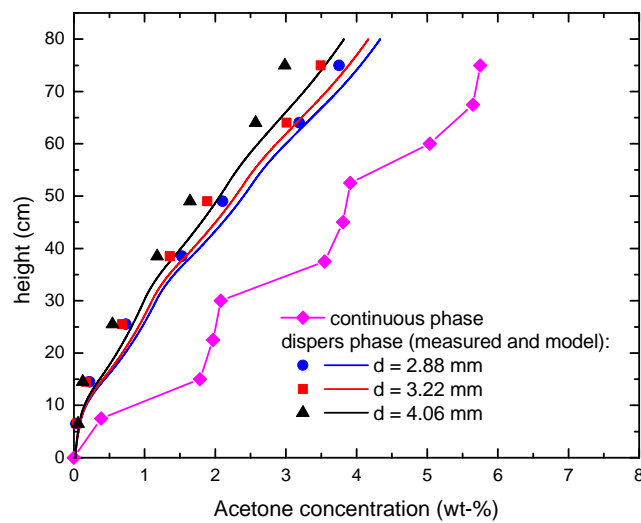
Linear profile: different starting conditions



Linear profile: different starting conditions



Linear profile: different diameters



Zusammenfassung und Ausblick

Zusammenfassung

- Aufbau einer Messzelle zur Messung von Stofftransport mit Konzentrationsgradienten in der kont. Phase
- Validierung der Messungen
- Gute Übereinstimmung mit Modellierung für längere Zeiten
- Schlechte Übereinstimmung für kurze Zeiten

Ausblick

- Weiterführende Messungen
- Optimierung des bestehenden Modells vor allem für kurze Zeiten

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