

Critical examination of particle swelling during wetting of ground coffee

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Introduction

- Physical changes to coffee during wetting are of interest for understanding extraction
- Coffee swelling during extraction has been widely reported, and it has been hypothesized that swelling could restrict water flow through the bed, impacting extraction kinetics
- This study investigated swelling on a time scale typical of common brew methods (0.5 – 10min)

Materials/Methods

- Digital microscopy (still images and video)
- Laser diffraction
- The full study examined variety of origins, degree of roast, decaffeination and water chemistry¹

Results and Conclusions

- Bubble formation during immersion creates challenges for in-situ observation.
- In laser diffraction, large particles float and are initially underrepresented in the size readings until they become entrained in the flow
- If particles were swelling, the relationship between volume concentration and a fixed number of particles would increase cubically with diameter
- During the timescales investigated (<10min), no particle swelling was observed by any of the measurement techniques

References:

¹Maille, M. J., Sala, K., Scott, D. M., & Zukswert, H. (2021). Critical examination of particle swelling during wetting of ground coffee. *Journal of Food Engineering*, 295, 110420

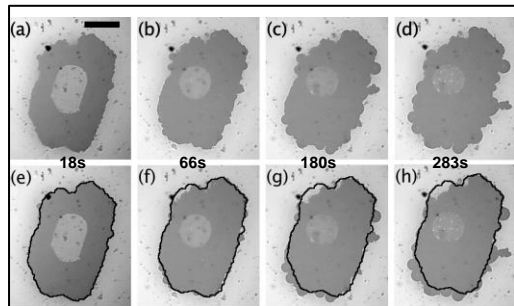


Figure 1: Single particle in water over time. Black outline represents particle at initial time

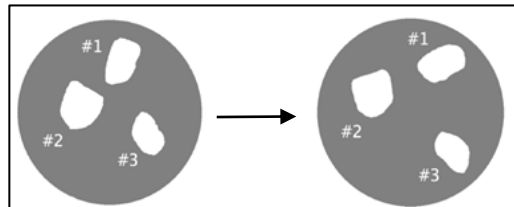
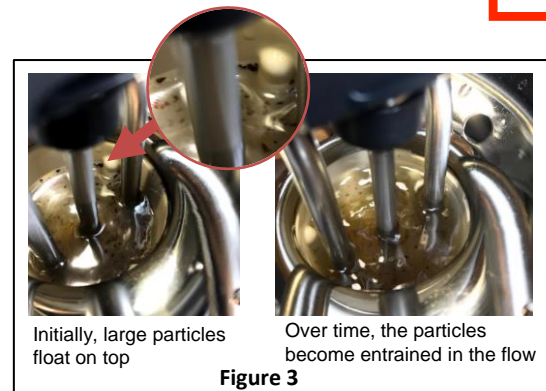


Figure 2: Three particles before and after 10 minutes of hot water immersion in a beaker



Initially, large particles float on top

Over time, the particles become entrained in the flow

Figure 3

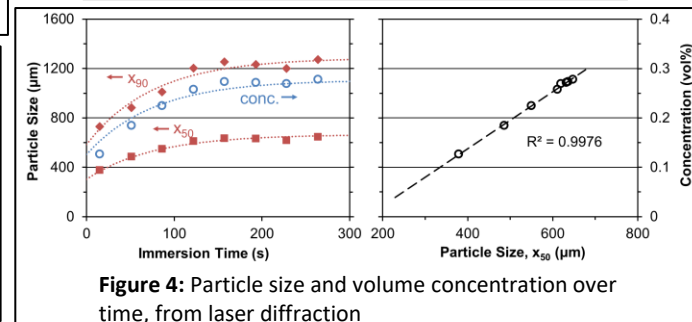


Figure 4: Particle size and volume concentration over time, from laser diffraction