Processing MRI Images of Bubbles Injected into Liquid Suspensions

Daniela Ayala*, Alireza Bordbar**, Christopher M. Boyce*.
Department of Chemical Engineering

Introduction

- Natural processes such as volcanoes involve rising, splitting, and coalescing bubbles in magma.
- Jets of bubbles injected through a nozzle in liquid are common in various industries.
- Goal: process MRI images of bubbles in high-viscosity silicone oil with sesame seed percentages (0%, 10%, and 20%) to detect "regular coalescence".
- Image enhancement is required for better clarity of displayed bubble patterns.

Methods

- Experimental setup: 3D cylindrical system with 18 cm diameter, 38 cm height, and liquid filled up to 35 cm (Fig. 1).
- Bubble generation: air injected vertically through a one-way valve
- Air injection: 700ms wait time, 160ms injection time
- MRI image processing using MATLAB: rotating, brightening, normalizing, and binarizing the images (Fig. 2).

Results

- 0% and 10% sesame seed mixtures showed no visible pattern of bubble formation
- 20% sesame seed mixture displayed a distinct pattern of bubble coalescence consistently every 5th frame as seen in Figure 3.

Conclusion

- MRI imaging and processing revealed a clear coalescence pattern in the 20% sesame seed mixture.
- Future studies: explore additional sesame seed percentages' effects on bubble formation patterns
- Investigate external factors like temperature and pressure variations may enhance the understanding of bubble dynamics in different environments.

References