

A Study of the Effect of Mixing Mechanisms in Cooling Crystallisation of Adipic Acid

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Introduction

Solution crystallisation is one of the most widely used separation and purification techniques employed in the fine chemical and pharmaceutical industries. The latter has predominantly operated in batch mode that may appear superficially simple, however the underlying science and its control are highly complex, therefore problems in achieving consistent product specifications, e.g. crystal morphology and size distribution or desired polymorphic form, can be encountered [1].

Previous studies in oscillatory baffled crystallisers (OBC) show that higher nucleation temperatures and narrower metastable zone width (MSZW) were observed in OBC when compared with traditional stirred tank crystallisers (STC). The objective of this project is to find scientific answers for such findings.

Hypotheses

1. Different mixing mechanisms, i.e. oscillating vs stirring, could be responsible
2. Cavitation due to oscillation [2]
3. Surface renewal due to oscillation (see Figure 1)

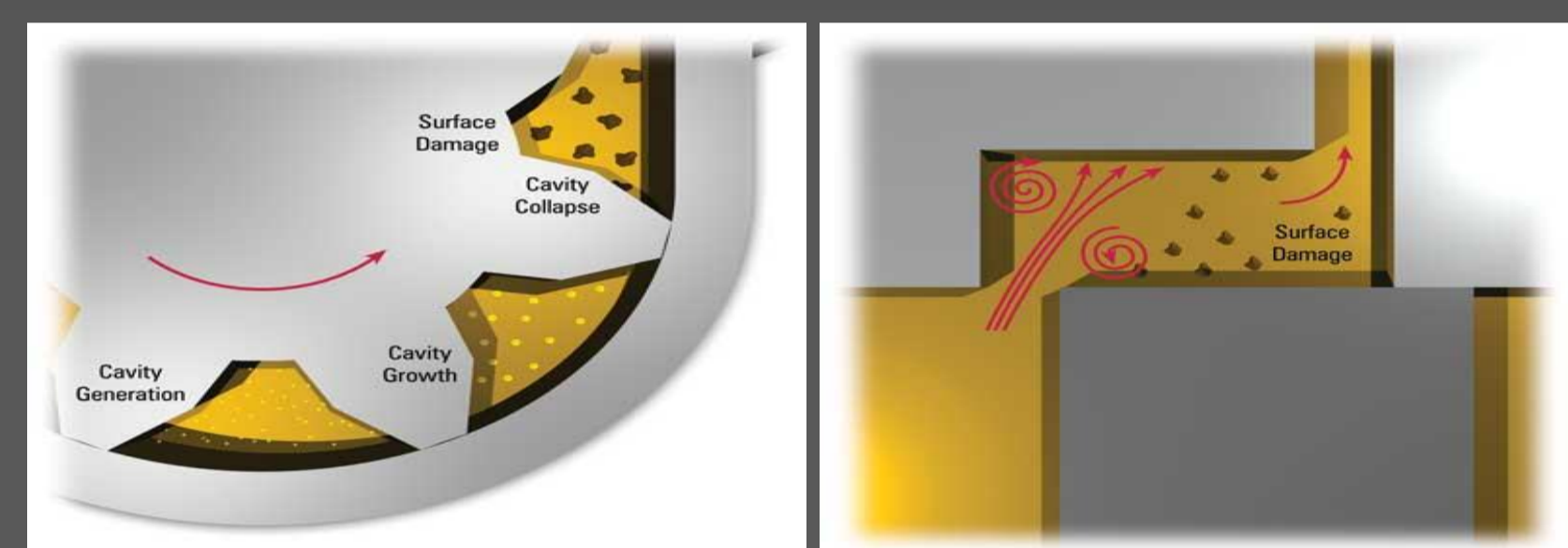


Figure 1 - Schematic of surface renewal in rapidly moving actuators [3]

Strategy

- Maintain the same mixing intensities in the 2 vessels
- To assess the effect of mixing, lower the mixing intensity in OBC
- To examine the effect of bubble cavitation, exaggerate cavitation effects by setting up different wave forms (see Figure 2)
- To investigate the effect of surface renewal, use baffle and fluid oscillation

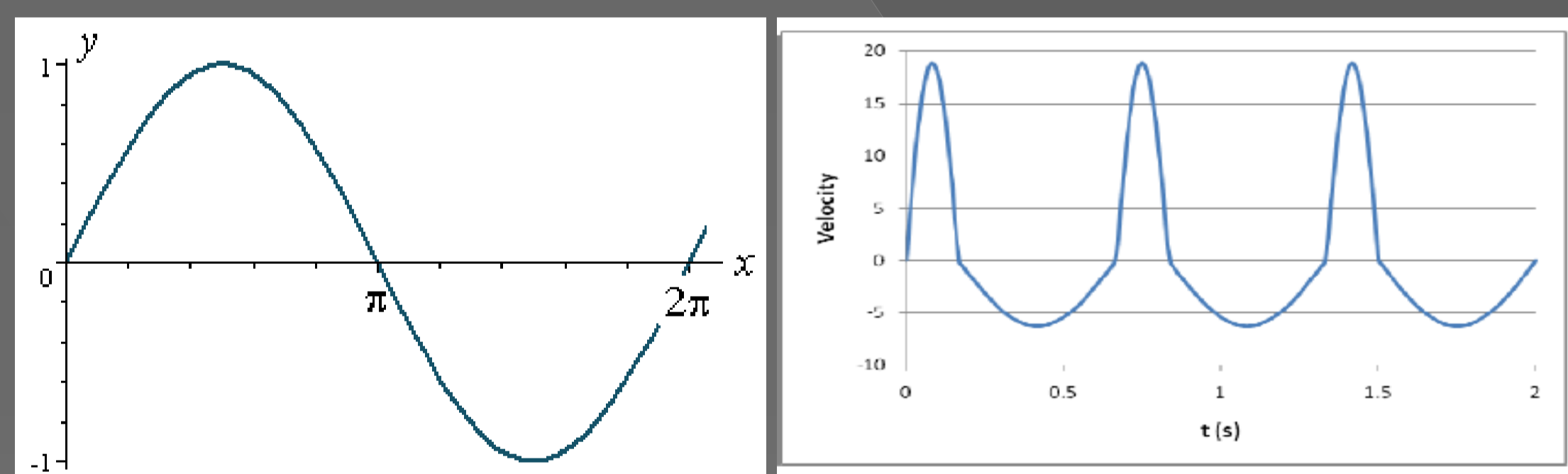


Figure 2 – Normal sinusoidal wave [4] (left) and an exaggerated wave form constructed from two sinusoidal sections (right)

Model Compound

- ✓ Adipic acid used in previous studies [5,6]

Ongoing Work

- Set up a STC as a benchmark (based on a background literature review)
- Construct an OBC with a moving baffle
- Fabricate an OBC with an oscillating fluid
- Learn and operate wave generating soft-/hardware
- Interface turbidity, thermocouples, chillers with PC

Work To Be Done In The 1st Year

Investigation of the effect of mixing mechanism as a function of:

- ✓ Different mixing intensities
- ✓ Various cooling rates
- ✓ Supersaturation

References

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