

# L-glutamic acid crystallization in a continuous mesoscale oscillatory baffled crystallizer

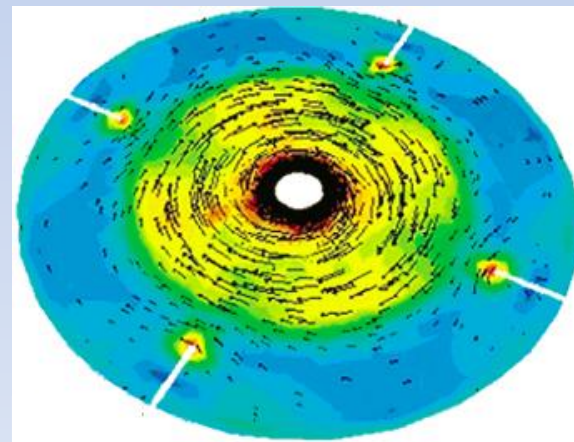
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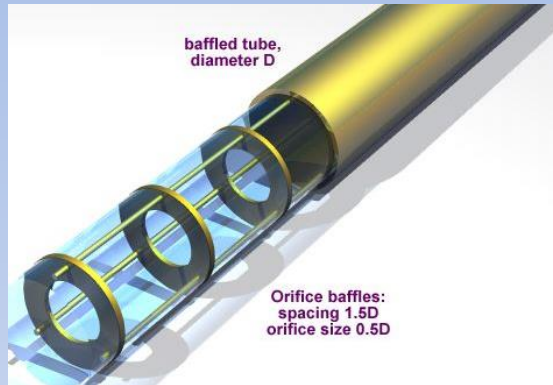
# Crystallization

- Can produce very pure products
  - >80% of pharmaceuticals and >60% of fine chemicals are produced in crystalline form
- Crystallization commonly carried out in STRs
  - Non-uniform mixing
  - Heat transfer issues
  - Complex scale up

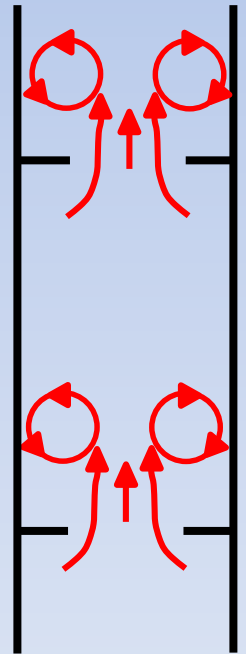


# Oscillatory Baffled Reactors

- Tubular reactor with periodically spaced orifice baffles

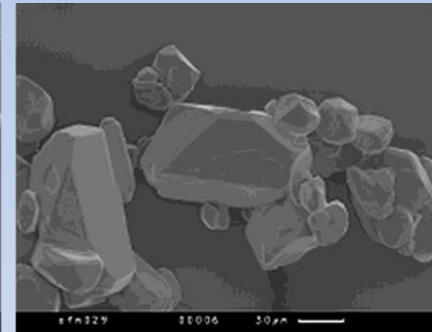
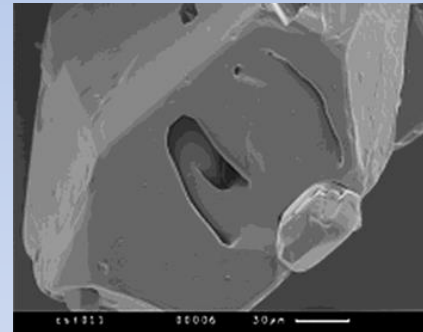


- Fluid is oscillated, generating eddies around baffles
- Provides uniform mixing
- Plug flow at laminar net flow conditions



# OBRs for Crystallization

- Enhanced mixing
  - Better distribution of supersaturation, additives and impurities
  - More uniform particle size distributions
  - Better quality crystals
- Enhanced heat transfer
  - Faster cooling rates
  - Better temperature control
- Plug flow
  - Consistent product properties over time

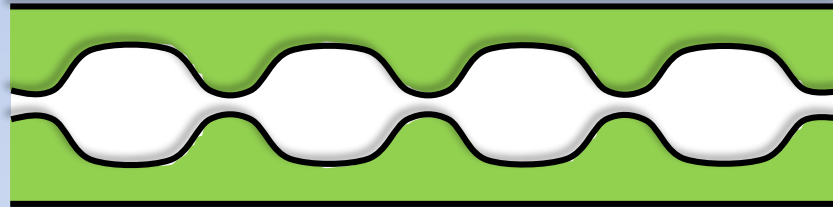


# Mesoscale OBRs

- Scaled down OBR with 5 mm i.d.

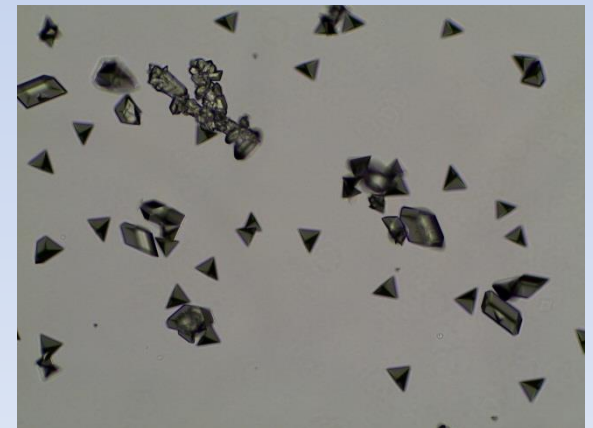
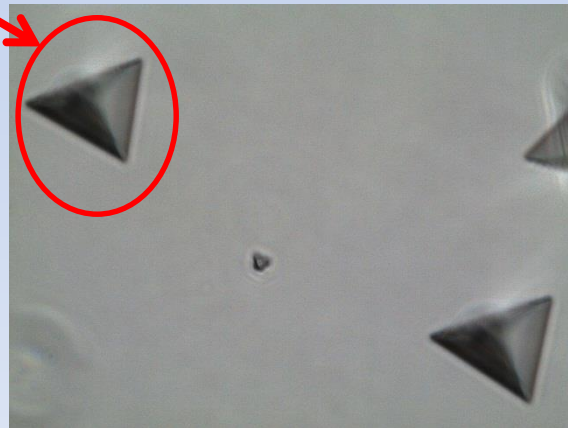
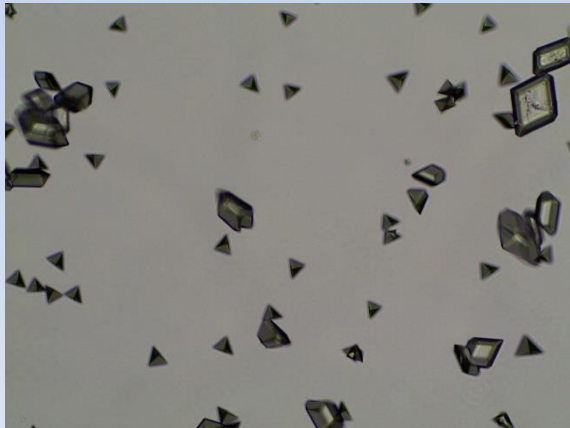
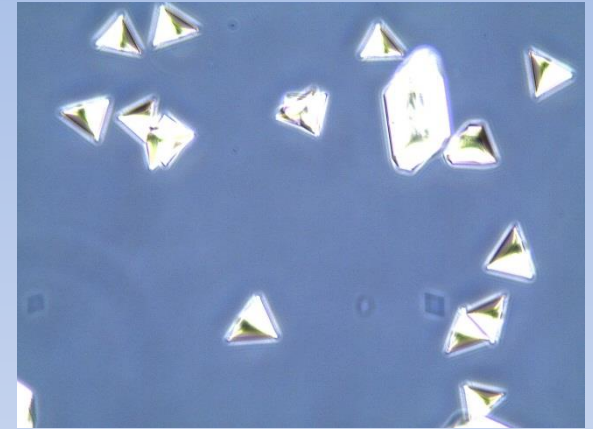
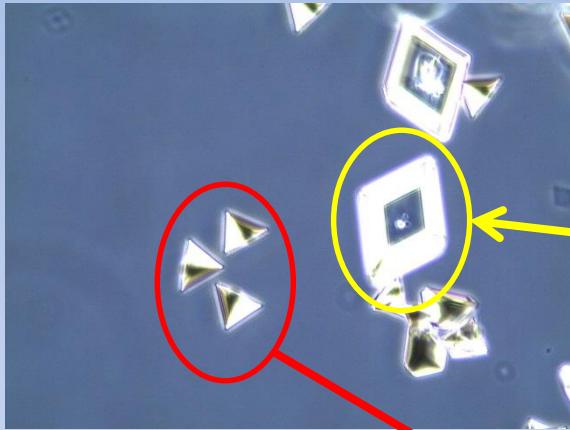


- Smooth periodic constrictions

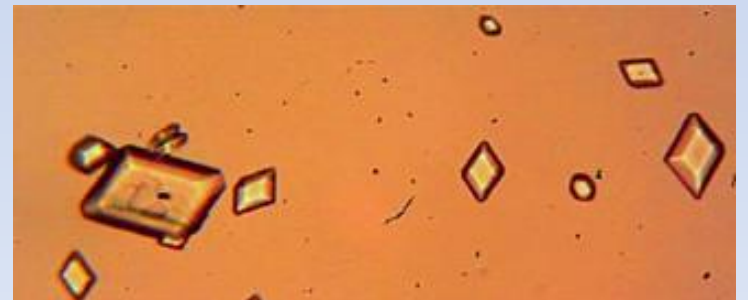
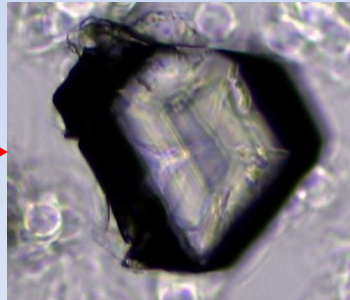


- Ideal for high throughput screening and low volume production

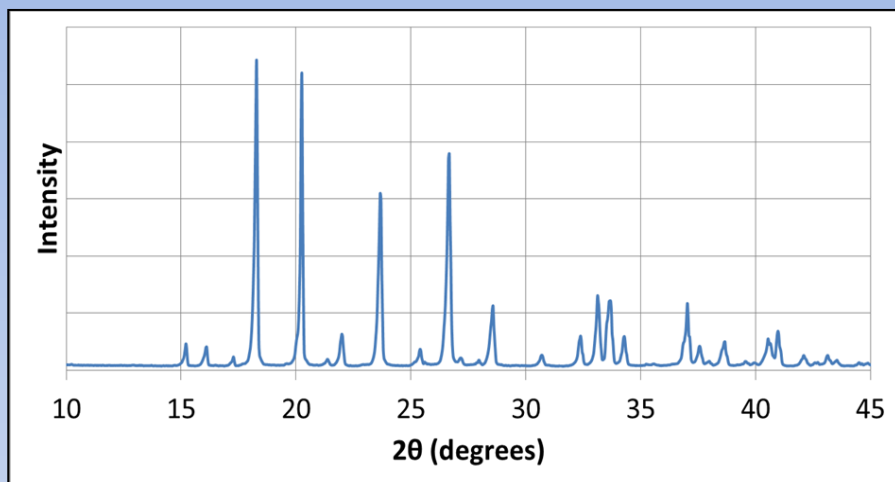
# Microscope Observations



# Crystal Habit Transformation

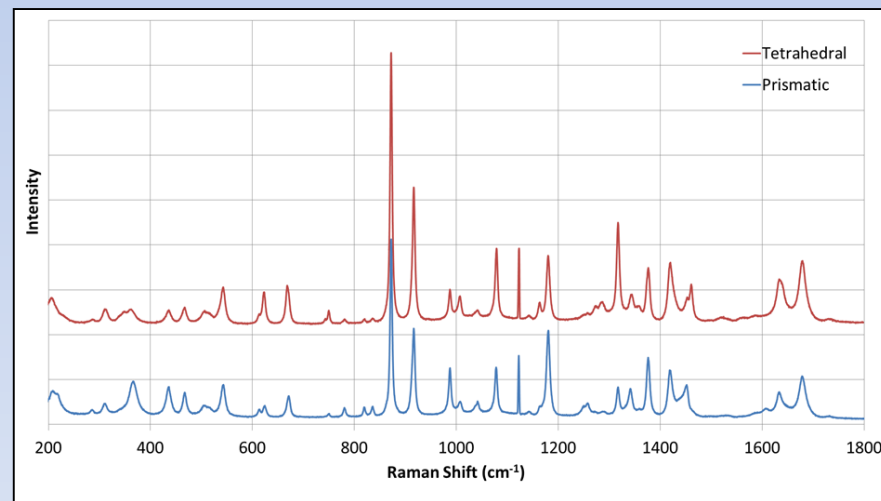


# Crystal Characterisation



XRPD pattern of a tetrahedral crystal sample matches  $\alpha$  polymorph pattern in literature

Raman spectra of tetrahedral crystal matches that of prismatic  $\alpha$  polymorph crystal

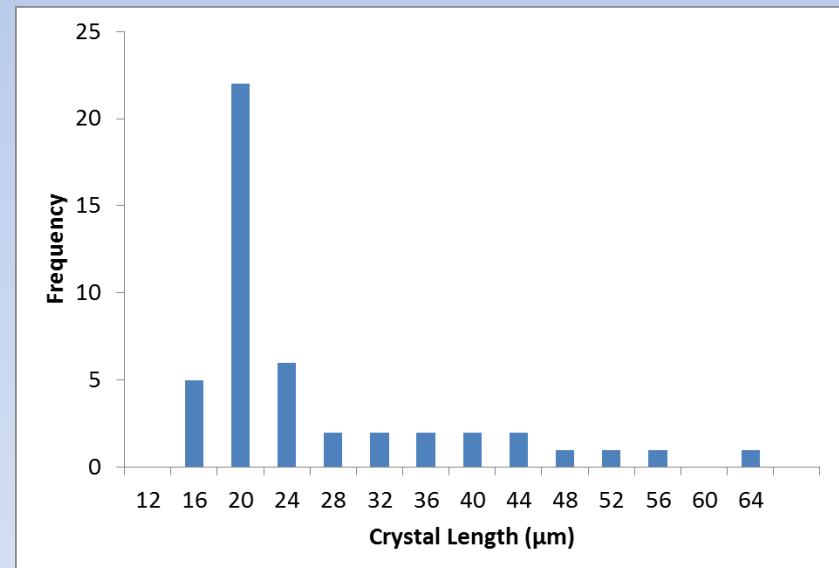
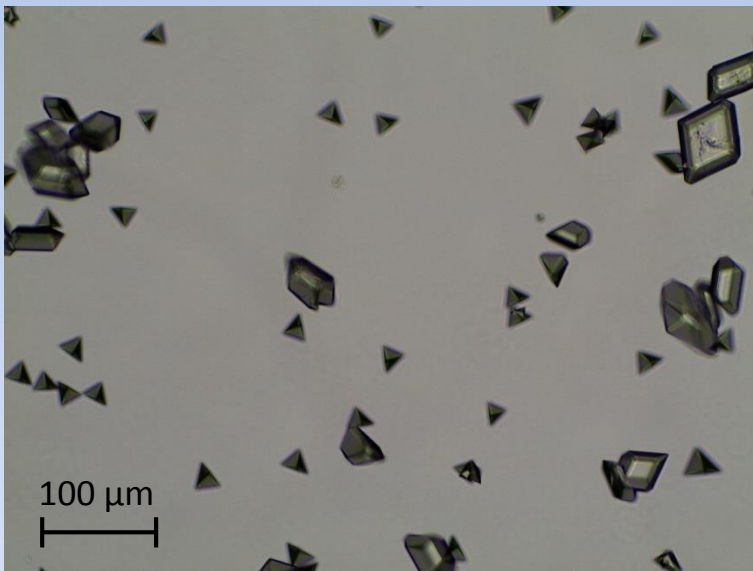


Therefore this is confirmation that the tetrahedral crystal habit is of the  $\alpha$  polymorph



# Crystal Size Distribution

- Narrow size distributions obtained in experiments
- Tetrahedral crystals appear to have a 'critical size' of approximately  $19\text{ }\mu\text{m}$



# Conclusions

- Mesoscale OBRs can be utilised for cooling crystallization
- Previously unreported tetrahedral crystal habit has been observed
  - Characterisation shows it is early stage  $\alpha$  polymorph
  - Transformation of habit has been witnessed