Theme B (WP4.4 Experimental): Investigation of Bed Structure and Breakage

An Investigation of Crystals Breakage during Bed Pressure Filtration

ADDOPT — ADVANCED DIGITAL DESIGN OF PHARMACEUTICAL THERAPEUTICS

UNIVERSITY OF LEEDS

Faiz M. Mahdi, Andrew Shier, Ioannis S. Fragkopoulos and Frans L. Muller

School of Chemical and Process Engineering, University of Leeds, Leeds, LS2 9JT, UK

RATIONALE

- Pressure filtration is widely used in the pharmaceutical industry to separate crystals produced during crystallisation from their mother liquor.
- Analysis of the crystallised material between filtration and drying is often overlooked and the effect of pressure filtration is not well understood.

METHODOLOGY

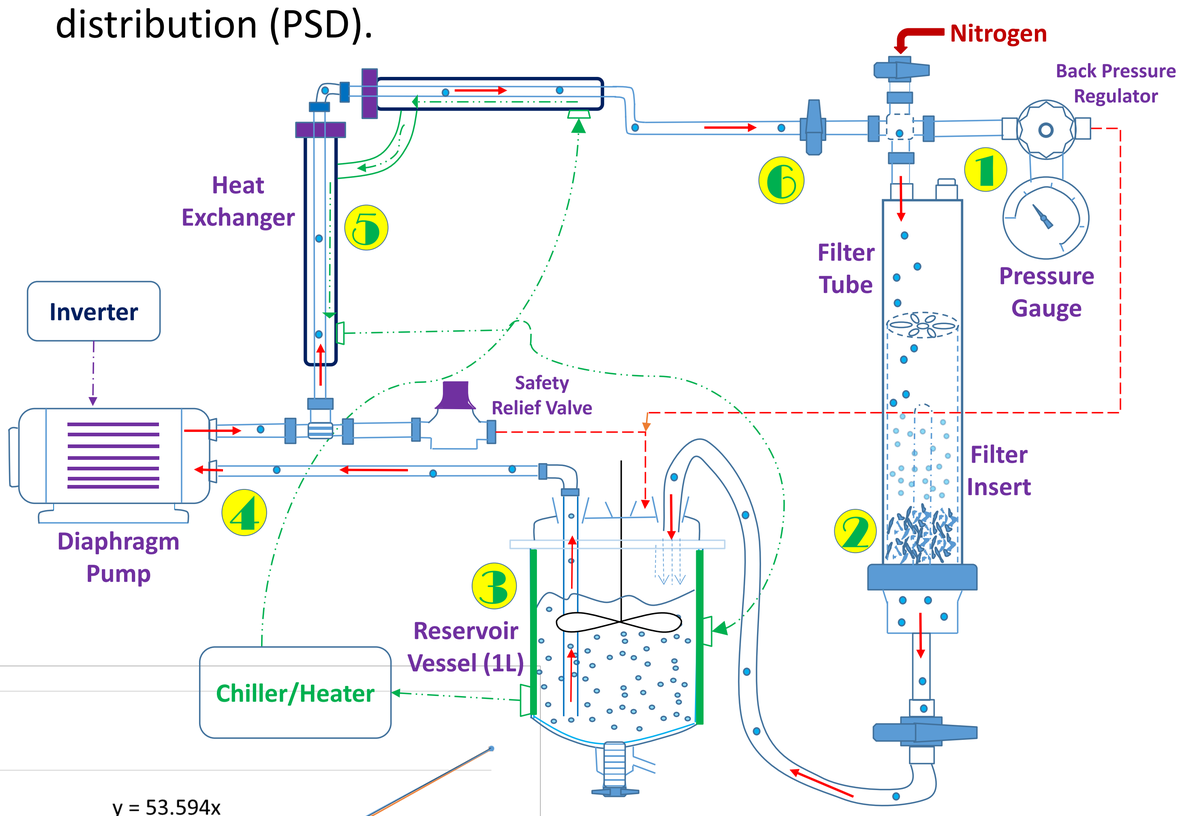
1. Charge slurry
2. Filter cake forms and liquid imparts force on crystals as it passes through
3. Liquid accumulates in reservoir vessel
4. Diaphragm pump recirculates vessel
5. Liquid passes through heat exchanger to maintain temperature
6. Liquid recirculates system

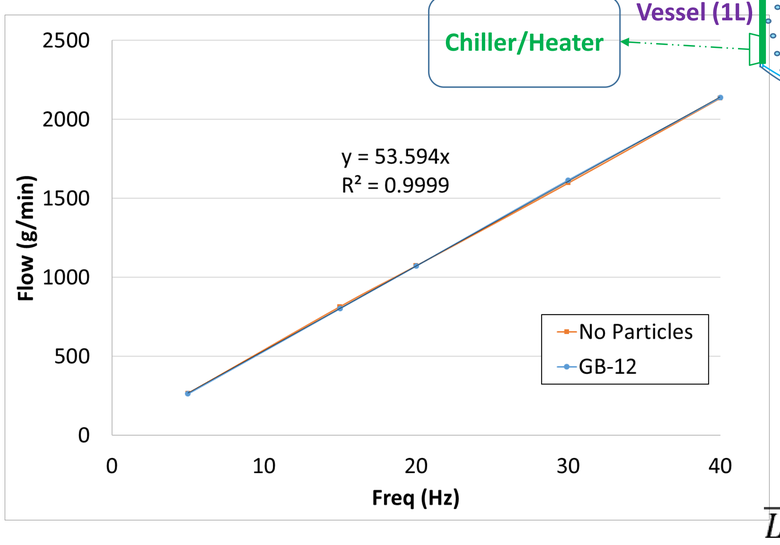
RESULTS

- Pump was calibrated so that the pump flow rate could be determined from the inverter frequency.
- Packed bed voidage can be estimated using the Ergun Equation.

OBJECTIVE

- Investigate the effect of liquid flow (pressure drop) through packed beds of crystals on particle breakage and more specifically, how hydrodynamic forces impact the particle size distribution (PSD).

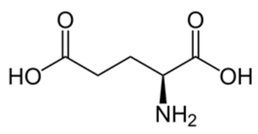


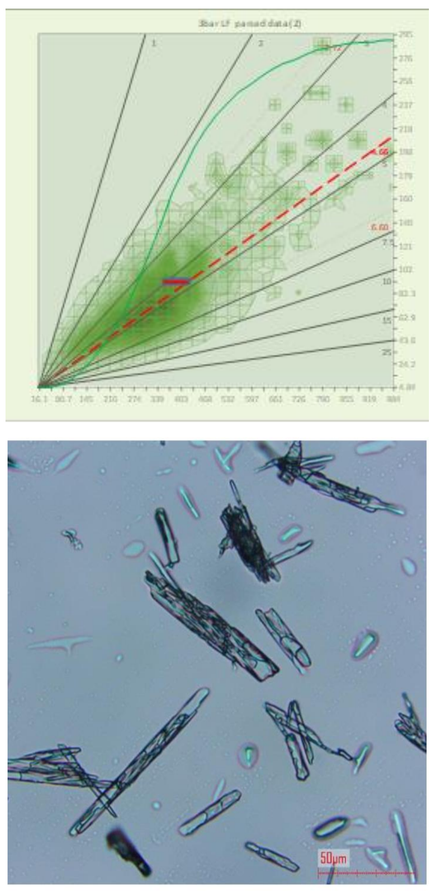


Particle size reduction of β-Glutamic Acid

- The β-LGA needles experience different extent of breakage at different bed heights.

B-Glutamic Acid (β-LGA)





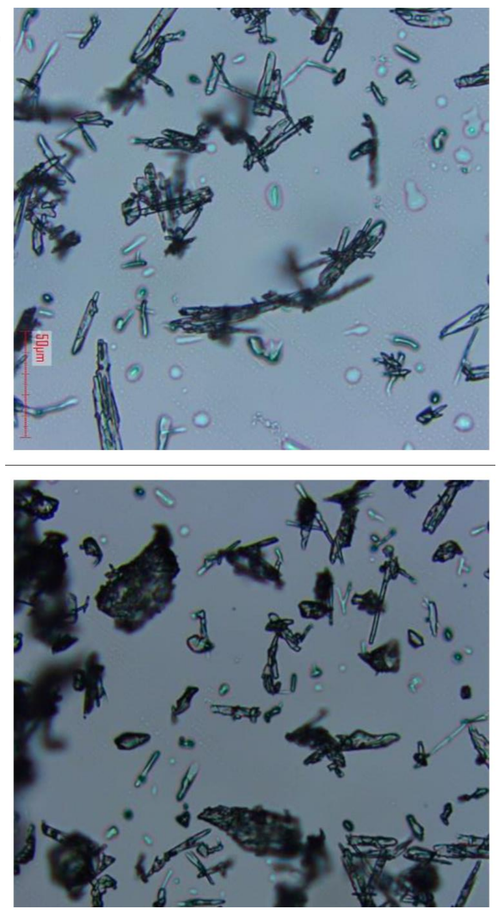
$\overline{L_V}$=390, $\overline{W_V} = 90, {}^{L}/_{W} = 4.7$

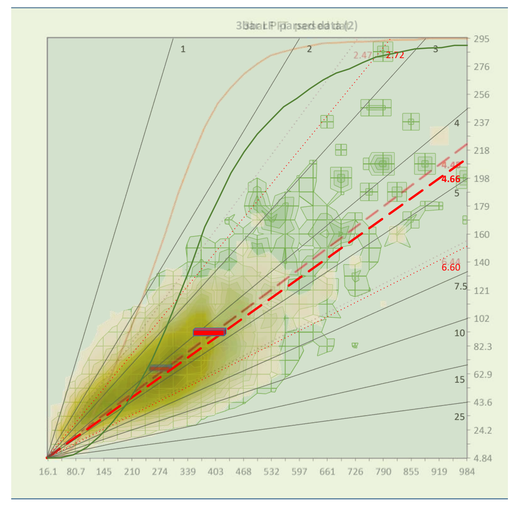
Before → After

Top

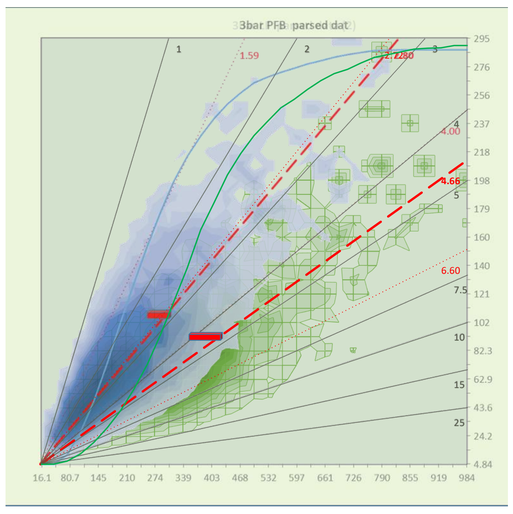
$\Delta P = 3\ bar$

Bottom





$\overline{L_V}$=270, $\overline{W_V} = 65, {}^{L}/_{W} = 4.6$



$\overline{L_V}$=280, $\overline{W_V} = 105, {}^{L}/_{W} = 2.8$

Malvern Morphologi G3 optical microscope images of β- LGA crystals before (left) and after (right) liquid percolation at 3bar

F.M. Mahdi, A. Shier, I.S. Fragkopoulos and F.L. Muller (2019). *Particle breakage under hydrodynamic stress: A novel method to study the effects of continuous percolation on needle-like crystals*. Chemical Engineering Science, to be submitted.

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