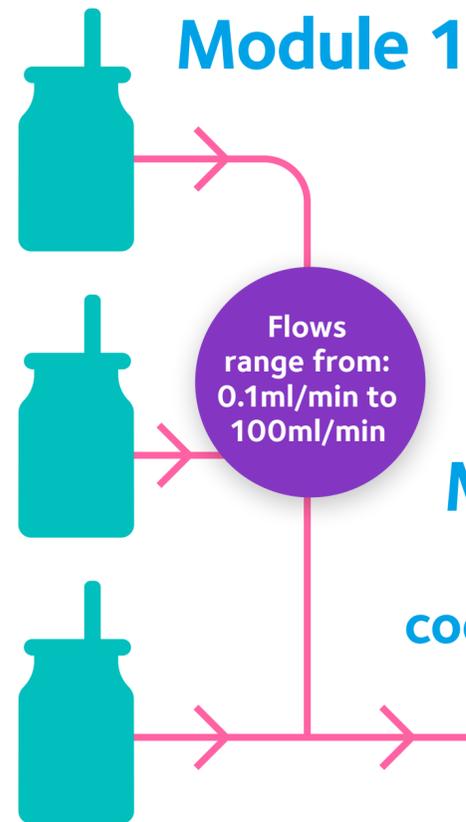


Continuous flow synthesis

-  Low volume equipment and reaction vessels need less energy to heat or cool.
-  x Continuous flow requires less equipment cleaning which also reduces climate impacts.
-  Pharma manufacturers must comply with stringent regulations. We work with partners, including regulators, across the ecosystem to specify if and how data from continuous synthesis will have parity with batch synthesis for quality control purposes.
-  Adaptive monitoring and control systems help maintain a steady process environment, assuring consistent quality of end product, and minimising waste reagent.



Module 2 Heating / cooling options

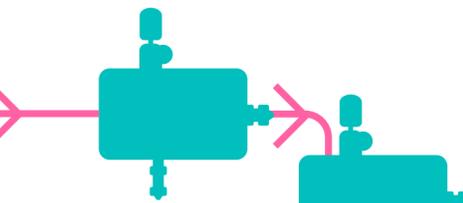


 Constant-running equipment is more energy efficient than multiple heat-up/cool down cycles.

 Smaller size equipment has lower embedded carbon from its manufacture and a smaller plant footprint.⁸

Module 3

COIL Reactors



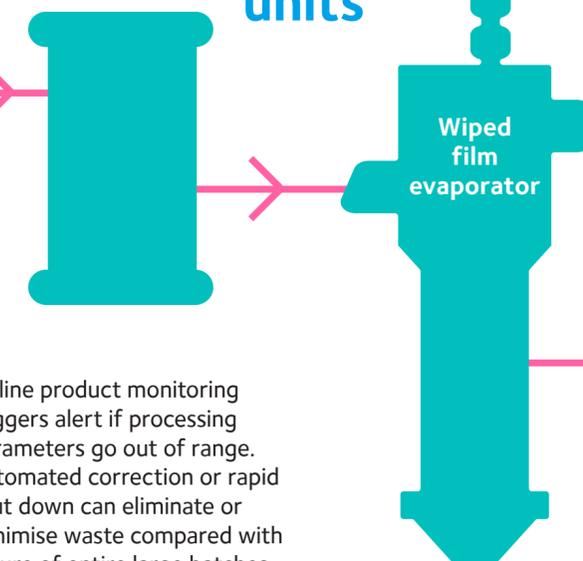
CSTRs

Glass Reactors

Fixed Bed Reactors

 In-line product monitoring triggers alert if processing parameters go out of range. Automated correction or rapid shut down can eliminate or minimise waste compared with failure of entire large batches.

Module 4 Separation units



Concentrated liquid

More efficient synthesis requires less feedstock, lowering costs and upstream supply emissions.

Facts and stats

Potential benefits of continuous processing & green chemistry:

- Up to double yield⁹ compared with batch production
- Waste streams halved⁹
- Overall process costs reduced by 35%⁹
- 10-fold increase in productivity⁹
- 30% lower cumulative mass intensity⁸
- Global warming potential halved⁸

Sources

- <https://www.uk-cpi.com/pharma-sustainability>
- <https://www.uk-cpi.com/decarbonisation-of-the-indian-pharma-industry>
- <https://www.uk-cpi.com/webinar-continuous-flow-synthesis>
- <https://www.uk-cpi.com/case-studies/continuous-2>
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- <https://pubs.acs.org/doi/full/10.1021/acs.oprd.6b00275>
- <https://www.thechemicalengineer.com/features/our-research-focus-converting-batch-production-to-continuous-processing/>

Find out more

- Decarbonisation of the pharmaceutical sector¹
- Decarbonisation of the Indian pharma industry²
- Webinar: Continuous flow synthesis³



CPI case studies

- Integrating continuous technologies for the rapid, cost-effective delivery of biotherapeutics to patients⁴
- NiTech Solutions x Croda Europe⁵
- Controlling Crystallisation Processes⁶
- Continuous Biologics Processing⁷

 Get our Downloadable Guide
Decarbonisation tips for the pharma industry