**LIQUID-LIQUID MIXING FACILITIES FOR DEVELOPMENT OF MODEL PREDICTIVE CONTROL FOR INDUSTRIAL SCALE-UP**

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A research facility for liquid mixing at scales ranging from 1 to 1000 L was established by CPI in a joint project with the Universities of Birmingham, Edinburgh and Leeds. This state-of-the-art facility enables academics and industrialists to develop, prove, prototype and scale-up the next generation of products and optimise their process. The facility allows a deep understanding of mixing processes at small scale, utilising a range of process analytical technology (PAT) in conjunction with state-of-the-art software for real-time data analysis. The information gained at small scale is used to scale the process to 1000L and beyond, by combining the hardware with validated Computational Fluid Dynamics (CFD) models. This approach accelerates and de-risks the translation of laboratory innovations into new products and processes for commercial companies of all sizes, as well as significantly reducing the cost of scaling up. The hardware control and data fusion software (Perceptive Engineering) allows us to implement an advanced process control model for real-time prediction of formulation properties such as particle size and viscosity, and the detection of process abnormalities.

The new facility has two major functions:

1. Developing, validating and utilising new Process Analytics Technologies (PAT) and process analytics capabilities.
2. Understanding the universal principles of liquid formulation processing at different scales and building predictive models for scale-up.

We will present results validating a new on-line viscometer using a combination of CFD calculations and experiments. The setup was optimised for flow pattern and sensor coverage to ensure the highest level of accuracy and precision in the measurements. We will also present data optimising a model formulation process which demonstrates the capability of the facility. By combining a classic design of experiments approach with step-change experiments and PRBS, we were able to understand and optimise the process from bench scale to pilot plant scale.

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