Continuous Reaction Calorimetry

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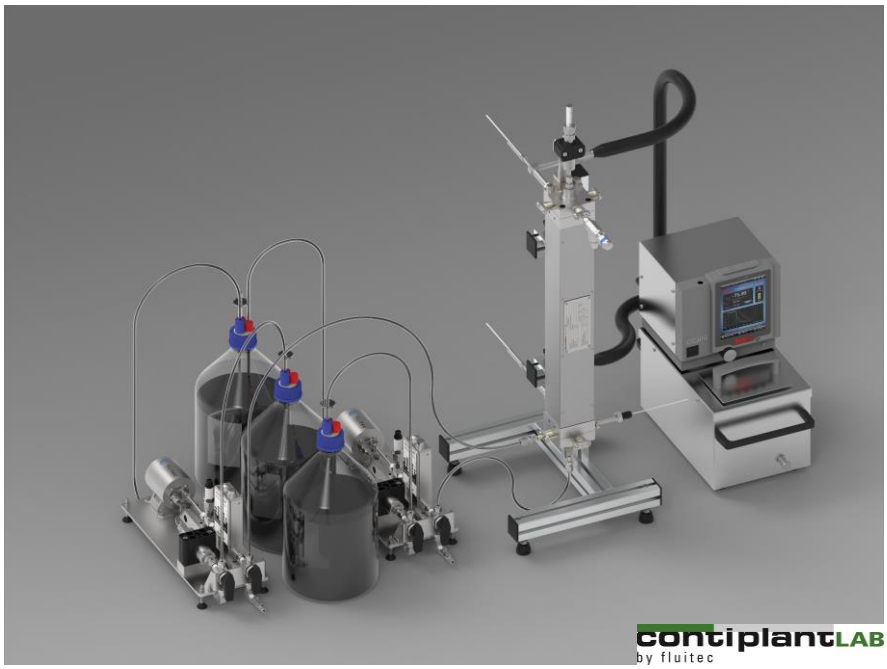
In process development, the focus is mainly on product quality and process safety. It is thus required to know the actual heat produced during the process. Historically, such reliable heat measurements have been carried out in well-developed batch-like reaction calorimeters. Although they are able to mimic batch-like processes, they are not always suitable to represent continuous processes in tubular reactors [1].

In this presentation, a simple set-up of a continuous calorimeter and a method to calculate the heat of reaction will be shown. The set-up comprises two controlled dosing systems, one jacketed tubular reactor with static mixers inside, one axial temperature sensor, two temperature sensors for the heat transfer medium side as well as a precise thermostat.



The evaluation is based on the well-known heat-exchanger characteristics of Fluitec Contiplant flow reactors. In some cases, this allows for a reaction calorimetry without calibration. In contrast to micro-reactor-like continuous calorimeters [2,3], the surface-to-volume ratio of this tubular calorimeter is so as to be easily scaled with Fluitec mixer-heat exchangers. It provides therefore a reliable analog to batch-like calorimeters for continuous process development and scale-up.

[1] F. Mortzfeld, J. Polenk, B. Guelat, F. Venturoni, B. Schenkel, P. Filipponi, *Org. Process Res. Dev.* **2020**, *24* (10), 2004–2016. DOI: 10.1021/acs.oprd.0c00117.

[2] M. C. Maier, M. Leitner, C. O. Kappe, H. Gruber-Woelfler, *React. Chem. Eng.* **2020**. DOI: 10.1039/d0re00122h.

[3] T. A. Frede, M. Dietz, N. Kockmann, *J. Flow Chem.* **2021**. DOI: 10.1007/s41981-021-00145-6.