



**Christoph Koeth**  
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**Online monitoring of total parenteral nutrition products produced in high-pressure homogenization processes**

“With OF2i® we can now go way beyond our previous capabilities and see great potential to replace several devices. We are investing in a future which will provide us with real-time information about the product quality and may deliver insights beyond currently established controls.”

**Continuous online monitoring of high-pressure homogenization processes**

Online monitoring of the particle size distribution (PSD) of emulsions for intravenous application of pharmaceuticals, parenteral nutrition during homogenization to ensure formulation stability.

**Challenge**

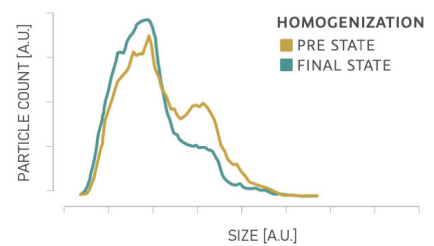
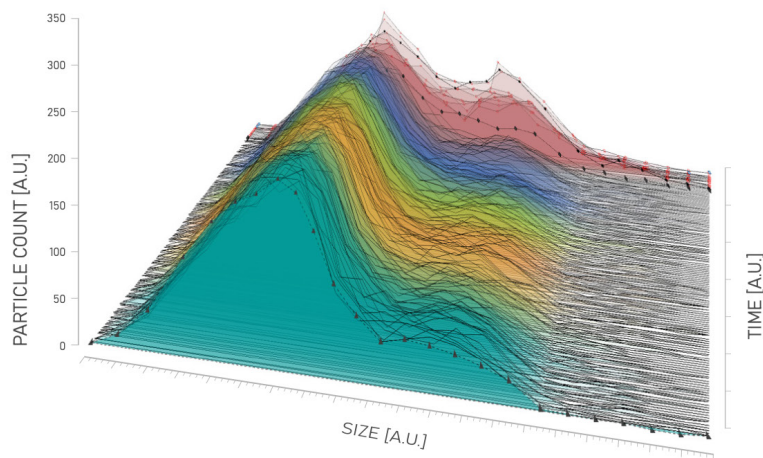
The particle size distribution of parenteral emulsions is a critical quality attribute (CQA). Christoph Koeth and his colleagues tested a number of sensor systems for online monitoring of their emulsions. A chance meeting with Chris Hill and Gerhard Prossliner from BRAVE Analytics led to the joint collaboration and development of the BRAVE B-Continuous online sensor.

**Application highlights**

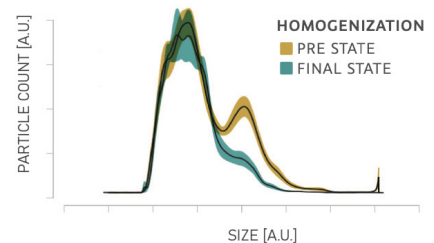
The BRAVE B-Continuous online unit (including a continuous and automated online sample preparation unit) was installed in a four-stage homogenization pilot plant. After the first step, the particle size is reduced from 3 µm to approx. 0.3 µm. The process analyzer continuously monitors the PSD distribution and automatically evaluates data such as D-values to assess the efficiency of the first homogenization step.

**The challenges are:**

- The time lag inherent with laboratory measurements leads to inefficient production processes.
- Offline measurements are time-consuming and require qualified personnel.
- Current offline methods provide results too late for process optimization.
- Current measurements do not capture all fluctuations and anomalies.
- The values are sent to the LIMS every 20 seconds.
- A better understanding of the homogenization process leads to more efficient production and huge savings in product waste.



**OFFLINE STD. REFERENCE MEASUREMENT (NANO PARTICLE TRACKING ANALYSIS)**



OF2i® time-resolved online characterization as number-based size distributions versus nanoparticle tracking analysis of different processing steps in looped emulsion production. Timestep 10: fault detected within homogenization. © BRAVE Analytics & Marko Šimić