

Application example: Emulsion monitoring

This study demonstrates the performance of the Pixact Emulsion Monitoring (PEM) system in detecting droplets in liquids and accurately measuring their size distribution in the size range of 10 μm to 2 mm. Here, the PEM system has been installed on a side-flange of a 1-liter laboratory reactor. The same system is also applicable to pilot- and production-scale reactors. The measurement probe and the reactor are presented in Figure 1. The probe head in Fig. 1b is submersed in the reactor through the side flange shown in Fig. 1a. The example emulsion consists of diesel oil (50 %) and water (50 %). The emulsion is mixed with a laboratory mixer connected to a two-baffle propeller. The emulsion is trans-illuminated in a 10 mm measurement gap placed close to the propeller.



a) *Figure 1. a) Emulsion of diesel droplets in water in a 1-liter laboratory reactor. b) Pixact imaging probe with a 32 mm measurement head and a 10 mm measurement gap.*

An example image of the emulsion can be seen in Figure 2. The PEM system produces sharp high-contrast images. The images are full of droplets of different sizes, which the analysis identifies, rejecting highly overlapping detections. The detected droplets are encircled with red on the right in Fig. 2. The smallest droplets are the most difficult to recognize, but they do exist in the emulsion. The analysis distinguishes gas bubbles from liquid droplets based on the differences in their refractive indices.

The PEM system measures droplet size distributions with high accuracy. Figure 3 presents the oil droplet size distributions at two agitation speeds: 300 and 400 rpm. The Sauter and volumetric mean diameters are 500 and 540 μm for 300 rpm and 380 and 410 μm for 400 rpm. The PEM system has been shown to be a powerful tool for the diagnostics, optimization, control and troubleshooting of emulsion processes.

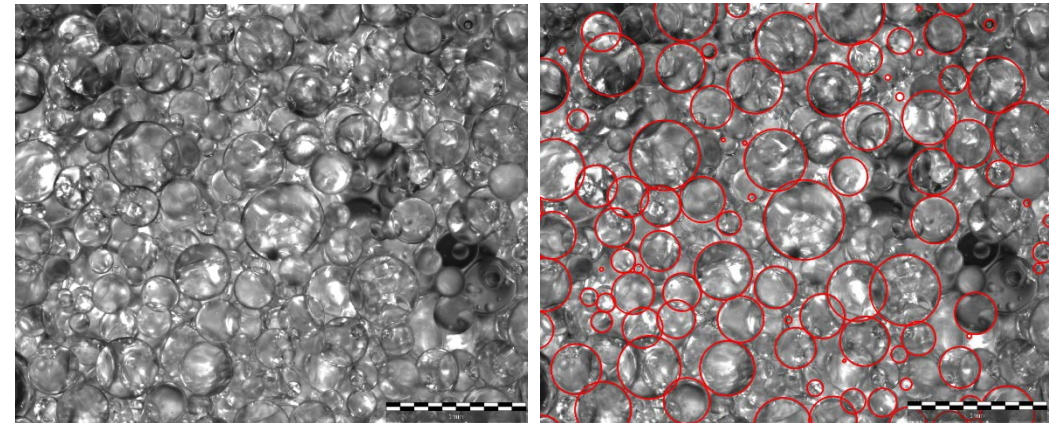


Figure 2. Diesel droplets. On the right, droplet detections are highlighted with red circles.

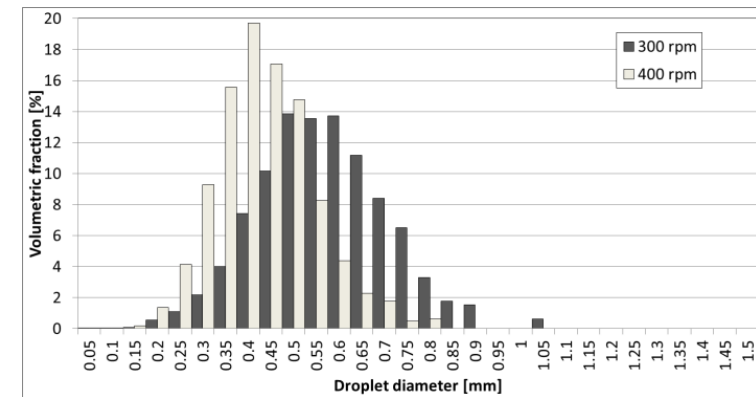


Figure 3. Diesel droplet size distributions at the mixing speeds of 300 and 400 rpm.

The benefits of the Pixact Emulsion Monitoring system summed up by a satisfied customer:
“With the information produced during an eight-week campaign in our pilot facilities, we were able to gain a remarkable increase in the capacity of our production plant.”

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