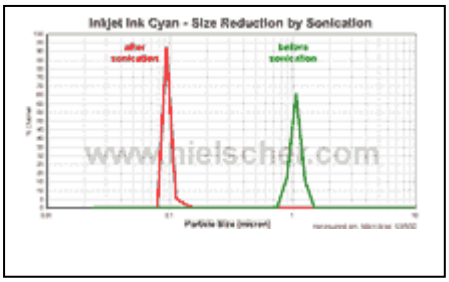
Ultrasonic Size Reduction of Ink
(e.g. for Inkjet)

Ultrasonic cavitation is an effective means for the dispersing and microgrinding (wet milling) of ink pigments.

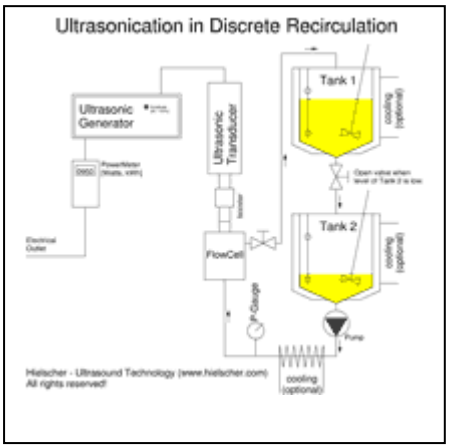


This technology can be used for UV-, water or solvent-based inkjet inks.

Ultrasound is very effective in the size reduction of particles in the range from 500µm down to approx. 10nm. The graph to the right shows an example for sonication of inkjet inks right curve: before sonication, left curve: after sonication).

Control Over Process Parameters and Results

The particle size and the particle size distribution of ink pigments affect many product characteristics, such as tinting strength or printing quality. When it comes to inkjet printing a small amount of larger particles can lead to dispersion instability, sedimentation or inkjet nozzle failure. For this reason it is important for the inkjet ink quality to have a good control over the size reduction process used in production.



Inline Processing

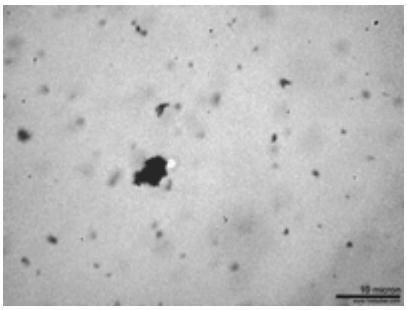
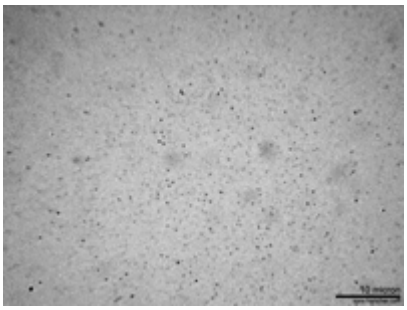
Hielscher ultrasonic reactors are commonly used in-line. The inkjet ink is pumped into the reactor vessel. There it is exposed to ultrasonic cavitation at a controlled intensity. The exposure time is a result of the reactor volume and the material feed rate. Inline sonication eliminates by-passing because all particles pass the reactor chamber following a defined path. As all particles are exposed to identical sonication parameters for the same time during each cycle, ultrasonication typically shifts the distribution curve rather than widening it. Generally, "right tailing" can not be observed at sonicated samples.

Process Cooling

For temperature-sensitive vehicles, Hielscher offers jacketed flow cell reactors for all laboratory and industrial devices. By cooling the internal reactor walls, process heat can be dissipated effectively.

The images below show carbon black pigment dispersed in UV ink. Please click at the images for a larger view.

before ultrasonication **after ultrasonication**

Dispersing and Deagglomeration in Any Scale

Hielscher makes ultrasonic devices for the processing of inks at **any volume**. Ultrasonic laboratory devices are used for volumes from 1.5mL to approx. 2L. Industrial ultrasonic devices are used in the process development and production for batches from 0.5 to approx 2000L or flow rates from 0.1L to 20m³ per hour. Different from other dispersing and milling technologies, ultrasonication can be **scaled up easily**. Laboratory tests will allow to select the required equipment size accurately. The table below shows general device recommendations depending on the batch volume or flow rate to be processed.

Batch Volume	Flow Rate	Recommended Devices
0.5 to 1.5mL	n.a.	VialTweeter
1 to 500mL	10 to 200mL/min	UP100H
10 to 2000mL	20 to 400mL/min	UP200S, UP400S
0.1 to 20L	0.2 to 4L/min	UIP1000hd, UIP2000
10 to 100L	2 to 10L/min	UIP4000
n.a.	10 to 100L/min	UIP16000
n.a.	larger	cluster of UIP16000

Robust and Easy to Clean

An ultrasonic reactor consists of the reactor vessel and the ultrasonic sonotrode. This is the only part, that is subject to wear and it can be easily replaced within minutes. Oscillation-decoupling flanges allow to mount the sonotrode into open or closed pressurizable containers or flow cells in any orientation. No bearings are needed. Flow cell reactors are generally made of stainless steel and have simple geometries and can **easily be disassembled** and wiped out. There are no small orifices or hidden corners.

Ultrasonic Cleaner in Place

The ultrasonic intensity used for dispersing applications is much higher than for typical ultrasonic cleaning. Therefore the ultrasonic power can be used to **assist cleaning** during flushing and rinsing, as the ultrasonic **cavitation removes particles** and liquid residues from the sonotrode and from the flow cell walls.