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hielscher
Ultrasound Technology

Frequently Asked Questions on Ultrasonics

Below you will find answers to the most common questions regarding ultrasonication. If you do not find an answer to your question, please do not hesitate to ask us. We will be glad to assist you.

Q: Can I sonicate solvents?

Theoretically flammable solvents could be ignited by sonication, because flammable or explosive volatiles may be generated by the cavitation. For this reason you must used ultrasonic devices and accessories that are suitable for this kind of ultrasonic application. If you require solvents to be sonicated, please contact us, so we can recommend suitable measures.

Q: How much ultrasonic power do I need?

The needed ultrasonic power required depends on several factors, such as

- the volume exposed to sonication,
- the total volume to be processed,
- the time for processing
- the total volume material to be sonicated
- intended process result after ultrasonic treatment

In general a larger volume requires higher power (wattage) or more sonication time. For most of the sonotrode types, the power is mainly distributed across the tip surface. Therefore, smaller diameter probes generate a more focused cavitation field. A higher ultrasonic intensity (expressed in power per volume) will typically result in a higher processing efficiency

Q: Does the ultrasound affect humans? What precautions should I take using ultrasonication?

Ultrasonic frequencies itself are above the audible range of humans. The ultrasonic vibrations couple very well into solids and liquids where they can generate ultrasonic cavitation. For this reason you should not touch ultrasonically vibrating parts or reach into sonicated liquids. The airborne transmission of ultrasonic waves has no documented negative impact on the human body, as the transmission levels are very low. When sonication liquids the collapse of cavitation bubbles generates a screeching noise. The level of the noise depends on several factors, such as power, pressure and amplitude. In addition to that sub-harmonic (lower frequency) frequency noise can be generated. This audible noise and its effects are comparable to other machines, such as engines, pumps or blowers. For this reason we recommend the use of proper ear-plugs when being close to an operating

system for longer time. Alternatively, we offer suitable sound protection boxes for our ultrasonic devices.

Q: What is the difference between magnetostrictive and piezoelectric transducers?

In magnetostrictive transducers electrical power is used to generate an electro-magnetic field which causes a magnetostrictive material to vibrate. In piezoelectric transducers, electrical power is directly converted into longitudinal vibrations. For this reason, piezoelectric transducers have a higher conversion efficiency. This in turn reduces the cooling requirements. Today, piezoelectric transducers are prevalent in the industry.

Q: Why does the sample heat up during sonication?

Ultrasonication transmits power into a liquid. Mechanical oscillations, lead to turbulences and friction within the liquid. For this reason ultrasonication generates considerable heat during processing. Effective cooling is needed to reduce the heat-up. For smaller samples, vials or glass beaker should be kept in an ice-bath for heat dissipation. Besides the potential negative impact of elevated temperatures on your samples, e.g. tissue, the cavitation effectiveness lessens at higher temperatures.

Q: Are there general recommendations for sonicating samples?

Small vessels should be used for ultrasonic treatment, because the intensity distribution is more homogeneous than in larger beakers. The sonotrode should be immersed deep enough into the liquid to avoid foaming. Tough tissues should be macerated, ground or pulverized (e.g. in liquid nitrogen) prior to sonication. During ultrasonication free radicals can be generated that could react with the material. Flushing the liquid material solution with liquid nitrogen or including scavengers e.g. dithiothreitol, cysteine or other -SH compounds in the media, can reduce the damage caused by oxidative free radicals. Click here to see sonication protocols for tissue homogenization & lysis, particle treatment and sonochemical applications.

Q: Does Hielscher offer replaceable sonotrode tips?

Hielscher does not supply replaceable tips for sonotrodes. Low-surface tension liquids, such as solvents typically penetrate the interface between the sonotrode and the replaceable tip. This problem increase with the amplitude of oscillation. The liquid can carry particulates into the threaded section. This causes wear at the thread leading to an isolation of the tip from the sonotrode. If the tip is isolated it will not resonate at the operating frequency and the device will fail. Therefore Hielscher supplies solid probes, only.