

What are the important factors influencing ultrasonic dispersion?

There are several factors which need to be considered for effective utilization of ultrasonic energy in dispersion. Given below are some broad guidelines about the influence of various factors on ultrasonic cavitation. These are not very rigorous and there can be considerable deviations depending upon the nature of the system:

- Frequency: As the frequency of sonication increases, the cavitation effect decreases. At high frequencies, there is too short a time is available during rarefaction cycle for formation, growth and collapse of bubbles in the medium.
- Intensity: This is the energy transmitted through a unit cross sectional area per unit time. As the distance from the ultrasonic source increases, the intensity falls off rapidly .This is where flow-through cell has an advantage.
- External pressure: Higher applied pressure increases the force required to pull the molecules apart and cause the voids during the rarefaction cycle. This increases the minimum negative pressure required to cause cavitation (called as 'cavitation threshold pressure'). Further, the higher applied pressure results in higher intensity of collapse of the micro bubbles.
- Vapour pressure of the solvent: The solvents with high vapour pressure at operating temperature tend to reduce the implosion energy of the bubbles as these are filled with solvent vapour upon cavitation. The higher the vapour pressure of the solvent, the lower will be the intensity of cavitation effects.
- Temperature: Higher ambient temperature will increase be the vapour pressure inside the bubbles which can cushion the implosion.
- Viscosity of the medium: Viscous liquids possess higher cohesive forces acting among the molecules. These forces have to be overcome to produce cavitation. The higher the viscosity of the medium, the more difficult it is to generate cavitation.
- Surface tension: Lower surface tension of the medium facilitates cavitation by lowering the cavitation threshold pressure.

- Presence of gases: In practice, most of the liquids do contain dissolved and dispersed gases which help to nucleate the cavities by reducing the threshold. The intensity of bubble collapse is also decreased. Monoatomic gases with higher heat capacities like He, Ne, and Ar will provide greater effect compared to diatomic gases like N₂ or O₂.
