

Power vs Intensity

Sonication is used for many applications such as liquid processing, cell disruption, homogenization and emulsification. When incorporated into your laboratory procedure, sonication proves itself to be an effective and time-efficient method. Defining the relationship and difference between the terms power and intensity will help in better understanding sonication.

Power is the measure of the electrical energy that is being delivered to the convertor. It is measured in watts. You will find this reading on the LCD screen of your sonicator. At the convertor, the electrical energy is transformed into mechanical energy. It does this by exciting the piezoelectric crystals causing them to move in the longitudinal direction within the convertor. This change from electrical into mechanical energy causes a motion that travels through the horn causing it to move up and down.

The distance of one movement up and down is called its amplitude. The amplitude depends on the output control knob setting. For example, with a ½” horn (part #200) at 50%, you will get approximately 60µm. If you are at 100%, you will get approximately 120µm.

Amplitude and intensity have a direct relationship. If you are at a low output control knob setting, you will have low amplitudes and low intensity sonication. The reverse is true also. If you are at a high output control knob setting, you will have high amplitudes and high intensity sonication. To be able to reproduce results, the output control knob setting, temperature, viscosity and volume of the sample are all parameters that need to be consistent. The output control knob, not the power, is most critical when trying to reproduce sonication results.

Power has a variable relationship with amplitude and intensity. For example, sonicating water at 50% will have a low wattage reading as opposed to a viscose sample, which will have a higher wattage reading at 50%. For both samples the amplitude and intensity will be the same but the power will differ because the viscose sample will need more power to drive the horn to produce the same amplitude and intensity. The viscose sample will be putting a heavier load on the horn since it will have to work harder to move up and down. This concept of variable power is also for a specific output control knob setting.

When sonicating the wattage readings on the LCD screen fluctuates. There are two instances that cause this. The first is when the horn has a sudden load increase; more power is applied to the generator. The second is when the horn has a sudden load decrease less power is applied to the generator. The reason for this is so the amplitude remains constant under varying load conditions of the sonication process. Pressure, viscosity and temperature changes do not affect amplitude.