

# WHAT IS A FINE BUBBLE AND WHY IS FINE BUBBLE MORE EFFICIENT?

## Aeration Systems

### Bulletin Brief

Fine bubble aeration is generally defined as a diffuser system that produces air bubbles in water or wastewater with bubble diameters of approximately 0.5 mm to 4 mm diameter. All diffuser systems create a spectrum of bubble sizes but high efficiency fine bubble systems have a large proportion of bubbles in the 0.5 mm to 2 mm diameters.

### Technical Presentation

Mixing is related to the amount of energy applied to the tank. To ensure proper performance, consider the diffuser layout and applied energy. Application of fine bubble and coarse bubble diffusers at equivalent energy rates will yield equivalent mixing. However, efficiency gains by converting from coarse bubble to fine bubble can range from 100% to 150%.

Fine bubble aeration uses each cfm of air effectively, usually saving **50%** compared to coarse bubble aeration. The diameter of a gas bubble or water droplet has a dramatic impact on surface area. Comparing 1 cubic foot of air used in fine, medium, and coarse bubble systems demonstrates why fine pore diffusers optimize use of the air and reduce energy consumption. As shown in the following illustration, a fine bubble device develops approximately **10 times** the surface area of a coarse bubble diffuser with approximately **1,000 times** the number of bubbles.

In general, most aeration devices utilize the oxygen contained in the atmosphere to oxygenate the water. Since the transfer of oxygen in the atmosphere (gas) is directly related to its contact to the water (total bubble surface area), diffused air products are commonly categorized by bubble size. How fine bubble creates maximum bubble surface area and maximum efficiency can be shown graphically.

In theory, if you had a single bubble that measured 1 cubic foot, you would have 6 square feet of surface area in contact with the surrounding water. Obviously, 6 square feet per cubic foot of air is not adequate for facilitating oxygen transfer. Diffusers, classified as coarse, medium and fine bubble, are utilized to increase surface area between the oxygen in the air and the water by breaking up each cubic foot of air into smaller bubbles.

Coarse bubbles may be defined as 10 mm and larger. A cubic foot of air made up of 10 mm bubbles has approximately 432,650 bubbles with total surface area of 365 square feet.

A cubic foot of air made up of 1 mm bubbles has approximately 54,081,391 bubbles with total surface area of 1,829 square feet.

Since oxygen transfer is closely related to surface area contact between the air and the water, the smaller the bubble, the better the transfer. Simply pumping a prescribed amount of air into an aeration basin does not guarantee that you will get the results you want. Diffuser selection and position is, therefore, crucial to determining how a system will perform.

For additional information regarding your specific application contact Environmental Dynamics Inc. at (573) 474-9456