

WHAT IS A FINE BUBBLE AND WHY IS FINE BUBBLE AERATION 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. Diffuser systems produce 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.

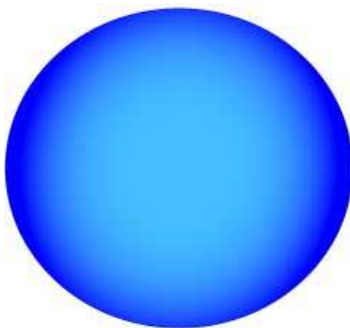
Diffused aeration products rely on the transfer of oxygen from the diffused gas (air) to the surrounding fluid. The relative operating efficiency of these devices is directly linked to the surface area of the diffused gas.

Technical Presentation

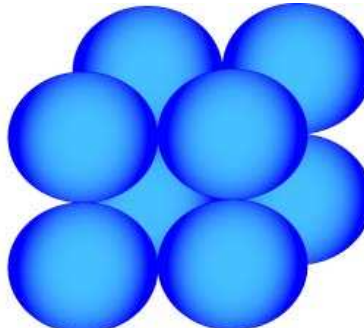
In general, most aeration devices utilize the oxygen contained in the atmosphere to oxygenate the water. Since the transfer of oxygen in the atmosphere (gas) is directly related to its contact to the water (total bubble surface area), diffused air products are commonly categorized by bubble size.

How fine bubble diffusers create maximum bubble surface area and maximum efficiency can be shown graphically.

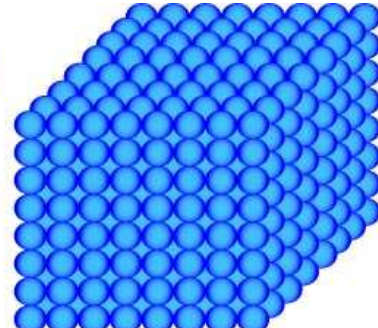
Bubble(s) volume = 1 cubic foot.



4.8 square feet



185 square feet



1,800 square feet

A single gas bubble with a 1 cubic foot volume produces a surface area of 4.8 square feet. This is a very low surface area to volume ratio and results in minimal oxygen transfer. Diffusers, classified as coarse, medium and fine bubble, produce a greater surface area to volume ratio by breaking up the diffused gas into smaller bubbles.

Coarse bubble diffusers generally product bubbles in the 10 mm and larger range. A cubic foot of air made up of 10 mm bubbles has approximately 54,000 bubbles with total surface area of 185 square feet.

A cubic foot of air made up of 1 mm bubbles has approximately 54,000,000 bubbles with total surface area of 1,800 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 are also crucial to determining how a system will perform.

Fine bubble diffuser systems effectively disperse the diffused gas and commonly results in a 50% reduction in compressed gas volume to transfer an equivalent amount of oxygen as a coarse bubble system. The diameter of a gas bubble 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 the use of 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.

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