

Proper Design Considerations

Aeration Systems

Bulletin Brief

The selection of an aeration-mixing system requires the evaluation of several application factors. Only after these design factors have been properly quantified can an aeration system be properly selected for an application. In general, consideration of accessibility, capital cost, operating cost, and maintenance costs is pertinent in selecting an aeration system.

Technical Presentation

The listing below identifies the primary criteria impacting the selection of an aeration system:

- Type of wastewater being treated including any special characteristics,
- Type of treatment process being operated or considered,
- Electrical energy cost, \$/kwh,
- Type and capacity of existing aeration components,
- Number and capacity of existing blowers,
- Number and configuration of existing or proposed reactors,
- Ability to access reactors including ability to dewater and take off-line, and
- Economic considerations including objectives for first cost and life cycle cost.

Once the above information has been considered, a rational determination of the best system for the application can be made.

Lifetime Operation Cost vs. Initial Purchase Cost

The cost of operating an aeration system is the single largest cost item for the system. (For a comparison of the relative operating efficiency of fine bubble versus coarse bubble diffusers, look at Technical Bulletin 105.)

If capital cost or first cost is the primary constraint, a coarse bubble aeration system may be a prudent choice for the application. Coarse bubble aeration systems offer moderate operating efficiency at an economical capital cost.

If life cycle costs including capital cost, operating cost, and maintenance cost are primary objectives, a high efficiency system such as a fine bubble aeration system may be the best selection for the application.

In general, the operating efficiency available with fine bubble diffusers is twice the efficiency of coarse bubble diffusers. In terms of operating horsepower, a 50% potential operating savings is available with high efficiency diffusers.

For small systems requiring a nominal amount of operating energy (e.g. less than 5 Hp), the economics of high efficiency versus low efficiency systems (fine bubble versus coarse bubble) may not be an important consideration. However, as the size of the system increases, the potential operating cost savings becomes very large and may be a controlling factor. If the existing system is operating at capacity, a conversion to a high efficiency system offers the ability to significantly increase the oxygen delivery capacity of the system without upgrading any of the existing components including the blower and header piping components.

When evaluating an upgrade of an existing diffused air system and the existing blowers are to be retained, the operating characteristics of the diffuser units and blowers should be reviewed because operating pressure requirements for diffusers will vary. The blower model number or design curves should be forwarded to EDI to properly evaluate the aeration system components and the capacity of the existing blower system.

Flexible membrane, fine pore diffuser units will normally require less maintenance than coarse bubble and other types of fine pore diffusers. A well-designed flexible membrane diffuser will include low extractable oil content for maximum service life, high tensile and tear strength for maximum product durability. Properly designed membrane diffusers also offer back-flow prevention capabilities. This feature excludes solids from the unit at low flow or idle conditions and minimizes both operator attention requirements and concerns regarding diffuser plugging.

With the exception of membrane replacement, membrane diffusers typically require limited routine maintenance for proper performance. Membrane diffusers will require periodic replacement of the membrane element, and a service life between 5 to 7 years can be expected for municipal applications. (Replacement frequency will vary depending on the application.)

Summary

Performance capabilities of aeration systems, including diffused air products and mechanical devices, are very diverse. By identifying and reviewing the criteria outlined in this Technical Bulletin, a rational equipment selection can be made for a cost effective, efficient aeration system.

For specific information on aeration system selection considerations, contact EDI at 573-474-9456.