

Upgrading Ceramic Diffusers

Conversion to Advanced Technology, Flexible Membrane Diffusers

Bulletin Brief

Fine pore diffusers provide demonstrated advantages over coarse bubble diffusers and other types of aeration devices. When properly operated and maintained, fine pore diffusers offer:

1. Highest level of oxygen transfer efficiency of all aeration devices, and
2. Major savings in energy consumption with 30 to 50% savings over low efficiency devices.

The wastewater treatment industry has a long history with fine pore devices. Ceramic fine pore diffusers have been widely used since the introduction of ceramic plates in the 1900's. Since then, system design developments including dome and disc diffusers have been marketed, with disc diffusers the primary configuration marketed today.

Flexible membrane, fine pore diffusers offer improved resistance to fouling and specifically address the deficiencies of rigid fine pore media. Flexible membrane diffusers offer:

1. Positive backflow prevention capabilities; fully capable of being operated intermittently for process objectives or due to unforeseen power outages.
2. Greater resistance to fouling with full utilization of apertures and a smooth surface texture.
3. Reduced frequency of cleaning; easily maintained and cleaned with simple surface scrubbing.

Applying these substantial membrane diffuser benefits over the life of any project, most systems are employing membrane units instead of ceramic. There are a large number of ceramic diffuser systems installed in the U.S. and England that currently need upgrades to maintain peak performance. These existing aeration-mixing systems require careful evaluation on how to economically convert from ceramic to the fine pore membrane diffuser systems.

Technical Presentation

History of Ceramic Media

Fine pore aeration systems were introduced using ceramic media. Early systems employed ceramic plates bonded to the floor of the aeration basin using silica or aluminum oxide as the diffuser plate basic material. These systems offered excellent operating performance for oxygen transfer and demonstrated the benefits of fine pore aeration mixing. However, the plate type diffusers had some limitations on tank construction, capital cost, and

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difficulty in diffuser maintenance. Another drawback was the requirement for super clean air to ensure operating performance and long term aeration life. Ceramic plate diffuser systems were installed primarily in the 1920s and 30s.

Few advancements in fine bubble technology occurred after the 1920s and 30s until about 1960. At that time ceramic dome diffuser units were developed in England and the United States to take advantage of integral piping systems and reduce some of the operational issues with ceramic plates. Dome diffuser units were approximately 7 inches in diameter with a bolt extending through the center of unit into the piping system to maintain the installation. Advancements obtained from these units include: raising the diffusers up off the floor so any loss of aeration would not allow the sludge to settle completely into the ceramic aeration media; minimizing field installation labor by having an integral piping system; installing at a competitive total system cost. The dome diffuser gradually evolved into a superior mechanical product that became the ceramic disc diffuser system.

These ceramic disc systems became the standard for fine pore aeration mixing systems during the next 25 years and enjoyed substantial success. But the systems also presented a substantial number of difficulties for diffuser systems operation, maintenance and life.

Fine pore diffusers are susceptible to buildup of biological and/or inorganic precipitates on the surface or internal to the media depending of the construction of the device. Rigid or ceramic media are particularly susceptible to these conditions as the media has an aggressive surface texture with a large number of pore sites and offers no backflow prevention capabilities. Regular maintenance to remove foulants is typically required. Drain down with manual scrubbing is a common procedure. One manufacturer promotes the use of anhydrous HCL gas injection to reduce manual cleaning requirements.

Membrane Diffusers Introduced

Membrane diffusers were developed in the late 1970s. The initial membrane diffuser units were modest in both performance and system life. Continued development and evolution of the membrane diffuser products led to major increases in fine pore aeration performance. Membrane diffusers now offer major benefits over any of the ceramic diffuser systems and command a very high percentage of the total market worldwide.

In the U.S., the membrane diffuser captures approximately 95% of the total market. Benefits of membrane diffusers over ceramic diffusers include:

- lower capital cost
- lower installation cost
- higher efficiencies
- lower maintenance costs

- allow on/off operation without allowing solids and liquids back into the media, as is the case with ceramic media causing operation and maintenance difficulties
- maximum process flexibility, i.e., on/off and variable airflows all apply to match process needs.

Flexible membrane, fine pore diffusers offer improved resistance to fouling and specifically address the deficiencies of rigid fine pore media.

Conversion Options

Three primary types of installations utilizing ceramic media are explored: systems with dome diffusers, ceramic disc diffuser systems, and ceramic plate systems. By converting ceramic to EPDM systems it is possible to incorporate major savings as outlined in the benefits of membrane diffusers listed above and in other Technical Bulletins.

Dome Diffuser Conversion

Systems containing dome diffuser units with a center bolt through the dome can be retrofitted using a kit developed by Environmental Dynamics Inc. This kit allows removal of the dome diffuser, then the quick and effective installation of a replacement membrane holder and EPDM into the dome diffuser's base plate holder.

Ceramic dome unit conversions provide membrane diffuser benefits while minimizing changes to currently installed piping and aeration hardware. This arrangement allows the quickest and most economical capital cost upgrade for many existing dome diffuser systems. Please refer to EDI's catalog for available ceramic/membrane conversion kits.

Ceramic Disc Diffuser Conversion

Ceramic disc diffuser systems use a unique mounting holder for the diffuser units. Disc diffuser conversion kits include a backer plate to properly position the membrane and to allow sealing of the holder unit with the membrane installed. This is a quick and easy conversion: remove the ceramic disc, insert the backer plate, then install the EPDM membrane on the top and piping the retainer ring. This installation is economical as it can be accomplished without disturbing existing piping.

Ceramic Plate System Conversion

Most ceramic plate systems that are built into the floor of the aeration basin are limited to facilities with very large installations. Those systems generally require complete system replacement with all piping and fine pore membrane diffuser units supplied for the conversion.

Summary

In recognition of the performance advantages provided with flexible membrane diffusers, Environmental Dynamics Inc. offers kits to convert ceramic diffusers to advanced technology EDI membrane diffusers.

Conversion kits are available for the following systems.

- a. AERCOR™ 7" dome units with 1/2" bolt connection.
- b. AERCOR™ 9" disc units.
- c. Norton™ 7" dome units with 1/2" bolt connection.
- d. Sanitaire™ 9" disc units.
- e. Flygt™ 9" disc units.

For installations that own both AERCOR™ and Sanitaire™ ceramic discs, EDI offers conversion kits that allow operators can use the same replacement media for all units.

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