*Technical Bulletin 125*

# Calcium Carbonate Fouling

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Published: 1/2017

## BULLETIN BRIEF

Environmental Dynamics International (EDI) has broad experience with fine pore membrane diffuser systems, supplying over 4,000 installations to date in a wide range of industrial and municipal applications and treatment processes.

Our experience suggests that calcium carbonate fouling need not be a major concern for properly sized, engineered, and applied membrane diffuser systems. This bulletin addresses how that can be accomplished.

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## TECHNICAL BULLETIN 125– CALCIUM CARBONATE FOULING

Fine pore diffusers offer improved oxygen transfer efficiency and up to 50% energy savings compared to conventional diffuser types. They employ rigid media diffusers fabricated primarily of silica, aluminum oxide, or rigid polyethylene materials.

However, rigid media diffusers are prone to calcium carbonate build-up, resulting in performance deterioration. Calcium carbonate fouling occurs for several reasons:

- A rigid media fine bubble diffuser is always open. When air supply to the diffuser is interrupted (due to power outage or process disruption, for example), there is no check valve installed to prevent wastewater and solids from entering and settling on the upper layers of the thick rigid media.
- Rigid diffuser media materials, like ceramic, are hydrophilic. During diffuser operation, wastewater enters the top layers of the media. This wastewater often contains dissolved salts and calcium carbonate compounds. Over time, and after many wetting and evaporation cycles, deposits of salts and calcium carbonate accumulate on the surface and interior of the diffuser media.
- Poor air distribution to the media during operation accelerates the precipitation of salts and calcium carbonate solids on, and within, the diffuser media.

Calcium carbonate deposition clearly interferes with the fine bubble diffusion process, gradually increasing operating system pressure while diminishing overall performance. Maintenance efforts and costs can rise dramatically. For users aware of the presence of calcium carbonate in the wastewater they wish to treat, or who suspect such a presence, anticipated maintenance concerns can be a deterrent to choosing fine pore diffuser systems for their treatment process.

Several ways to mitigate calcium carbonate fouling include:

- Preventing wastewater from entering diffusers -- membranes are normally closed until sufficient air pressure opens the units to commence operation.
- Closing off membranes to wastewater and solids entry when airflow is interrupted.
- Engineering membrane diffusers with properties that allow only exterior surface wetting to occur while preventing wastewater from penetrating the internal structure of the membranes.
- Designing the membrane unit to flex back and forth during on/off and normal operation. The flexing motion significantly reduces accumulation of surface inorganic materials.
- Manufacturing the membrane materials to be smooth and slick to minimize or eliminate calcium carbonate deposition.

A key factor to reduce or prevent calcium carbonate build-up when designing a membrane diffuser system is knowing the chemistry of the water to be treated.

It is a mistake to conclude that a strong calcium carbonate concentration in the wastewater will automatically create fouling of membrane diffusers. The process of controlling wastewater chemistry for optimum diffuser operation is similar to that used for proper boiler water treatment using the Langlier Index. Properly managing the pH factor can ensure calcium carbonate remains in solution and does not precipitate out and foul membranes.

There are instances where precipitation of calcium carbonate is not driven just by its concentration in the wastewater, but also by how stable the biological process operation is while treating the wastewater.

We list a few operating procedures that can successfully maintain the great performance of membrane diffuser systems despite potentially troublesome calcium carbonate concentrations.

- The Milwaukee Method – For systems with multiple basins operating in parallel, maintenance is a straightforward process.
    - Dewater a basin to access the diffuser system.
    - Use a hand garden sprayer to apply diluted muriatic acid over the diffuser membrane surfaces for two minutes of contact before placing back in service.

This method is safe, quick, economical, and effective.

- For single basin operations, or where it is not otherwise possible to dewater the basin, in situ cleaning can be employed to restore performance of fouled membrane diffuser systems. We highlight two common techniques.
    - A dilute solution of muriatic acid is pumped into the air supply piping and allowed to sit for several minutes. The solution is then purged through the diffuser membranes using a low airflow rate.
    - Introduce anhydrous HCl gas or formic acid into the diffuser air lines during operation. Gases can be difficult to handle, requiring proper care and attention during use.

For most municipal and industrial wastewater treatment applications, calcium carbonate fouling of membrane diffuser systems is not a significant issue. Quality membrane diffuser manufacturers like EDI mitigate such concerns by engineering an appropriate system design that accounts for:

- Selection of appropriate membrane materials.
- Optimized membrane perforation patterns.
- Correct airflow and capacity.

In this manner, we can ensure a quality installation and long-term performance in wastewater aeration applications, even in wastewaters with strong calcium carbonate concentrations.