BIOTRICKLING FILTERS FOR TREATING EMISSIONS OF ODORS AND VOLATILE ORGANICS COMPOUNDS (VOCs)

Biofiltration has been used to control odors and emission of volatile organics from industrial processes, wastewater treatment plants, solids handling operation and numerous other sources. Biofiltration involves the biological transformation by active bacteria of organics and odors into carbon dioxide and water. The fact that air contaminants can be biodegraded by active bacteria has been known for quite some time. However, it is only in the last 10 years that biofiltration has begun to emerge as an economically viable treatment process.

Initially, biofiltration involved the use of naturally bioactive media, such as soil, peat or compost. The microorganisms present in these naturally bioactive media are capable of biodegrading a wide range of contaminants, and this has been used successfully in the bioremediation of contaminated sites. As more research was conducted on this simple process, it became clear that the biodegradation rates were low, and the size of the biofilter bed required to achieve high destruction efficiencies was very large. Since compost had a higher concentration of microorganisms than soil, compost became the media of choice for biofilters.

Major problems encountered with compost were: 1) settling of the compost which results in increased gas-phase pressure drop, 2) availability of nutrients such as nitrogen and phosphorus, 3) pH maintenance, and, 4) drying of the compost material due to moisture transferring to the flowing gas phase.

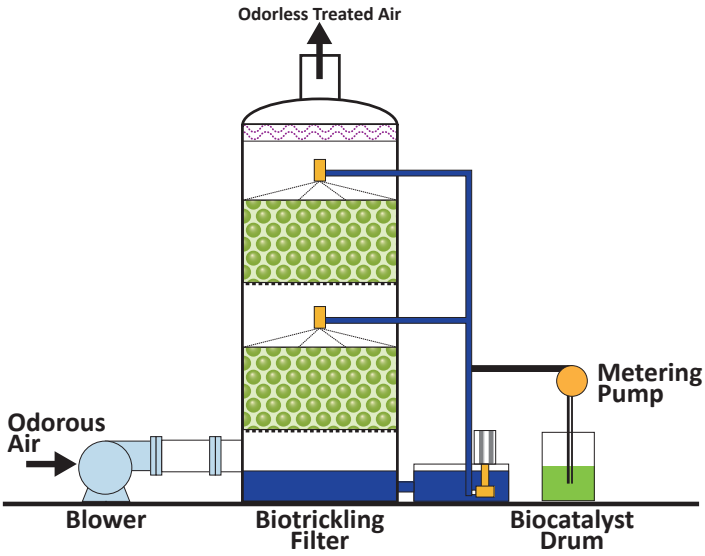
Odor Control at Wastewater Treatment Plants
Wastewater treatment plants emit a wide variety of odors depending on the type of treatment operation. Odors and volatile organics emanate from the intake headworks, screens, lift stations, sludge thickeners and sludge presses. Sulfides are formed by sulfate reducing bacteria (SRB's) due to the biological reduction of sulfate, i.e.,

$$SO_4^{-2} + CH_2O \longrightarrow HS^- + HCO_3^-$$

Sulfate Organic Mono-hydrogen sulfide

The primary odor producing substances are small, relatively volatile molecules having molecular weights between 30 and 150 g/mole [Allyl Mercaptan (Molecular weight 74.15); Amyl Mercaptan (104.22); Benzyl Mercaptan (124.21); Crotyl Mercaptan (90.19); and Dimethyl Sulfide (62.13)]. Other odor-producing substances include organic vapors such as indoles, skatoles, mercaptans and nitrogen-bearing organics.

Biofilters from Process Combustion Corporation
The figure below shows a typical schematic of PCC's biofilter.



The following are some of the unique features and benefits of PCC's synthetic media Biotrickling Filters:

- Low gas-phase pressure drop – PCC's synthetic media consists of low density open structure packings with minimal pressure drop across the media beds. Since pressure drop controls the fan size and energy consumption, significant savings can be realized in equipment and operating costs.
- Compact footprint – Due to the minimal pressure drop across the media beds, PCC Biotrickling Filters operate at high gas velocities, thereby minimizing the cross-sectional area and overall size of the equipment footprint.

- **Media guaranteed not to deteriorate or clog for 10 years** - In addition to being warranted against physical deterioration, PCC synthetic media is guaranteed not to become clogged due to the accumulation of excess biomass growth and/or insoluble precipitates. This is important since plugging of the media beds requires physical removal and cleaning of the media, which is time consuming, expensive and often infeasible.
- **Variable speed blowers** – PCC uses variable frequency drives to control the blower speed as a function of the negative inlet gas pressure, thereby minimizing energy consumption and preventing excessive negative pressure on the walls of the inlet air source.
- **Neutral pH** – Whereas other biofilters operate a very acidic pH levels, PCC Biotrickling Filters operate at near neutral pH. Although hydrogen sulfide can be treated effectively under acidic conditions, poor treatment efficiencies are achieved at low pH for organic sulfur compounds, such as mercaptans and disulfides, which are typically responsible for more wastewater odors than hydrogen sulfide. PCC Biotrickling Filters operating at neutral pH are able to achieve high treatment efficiencies for hydrogen sulfide as well as organic sulfur compounds, thereby achieving a significant reduction of odors as measured by their Detection Threshold levels.
- **Advanced control systems** – PCC's Biotrickling Filters are supplied with advanced control systems, rather than just PLC's, to monitor the operation and control of the equipment.

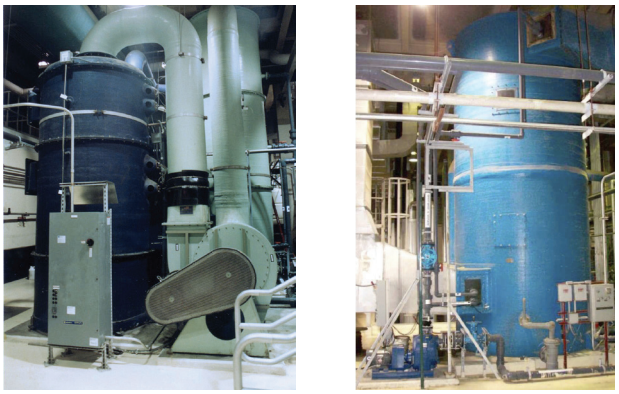
Existing Installations

PCC, in collaboration with PRD Tech, Inc., Leader in biofiltration technology and implementation, brings together the leading edge technology with the extensive experience of PCC in VOC destruction and project implementation.

Our collaboration partner in this area, PRD Tech, has several commercial installations treating air from 400 cubic feet per minute (cfm) to 280,000 cfm. Applications include treatment of organic odors, such as compounds emitted during heat treatment of waste sludge to hydrogen sulfide and reduced sulfur compounds from wastewater treatment plants.

Biofilters treating less than 1,000 cfm of air are generally skid mounted and delivered assembled and ready to use. Larger installations are field installed. Recently, in Israel, PRD Tech, Inc. designed the largest biofilter system treating 33,000 m3/hr of air at the Shafdan Wastewater Treatment Plant in Tel Aviv, Israel. In this project, PRD Tech provided the technical drawings, biomedia and technical expertise

All the other components, such as blower, pump, etc. were procured locally.



PRD Tech's Biofilters at Sanitation District No. 1 Plant, Florence, KY

Skid-mounted Biofilter Unit for Lift Station

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