

MultiPhase BioSystem™ Proves Superior Alternative to RTOs, Conventional Biotreatment Methods

The Tri-Mer MultiPhase BioSystem is based on the latest scientific advances in the rapidly evolving field of biological pollution control. The result is a superior system with high removal efficiency across a wide spectrum of VOC compounds. These compounds include formaldehyde, methanol, styrene, xylenes, PAHs, sulfur compounds, glycols, ethanol, solvents, and many others.

The MultiPhase BioSystem represents a major milestone in green technology for VOC control.

The MultiPhase incorporates both air phase and liquid phase approaches, taking advantage of the natural tendency of VOCs to partition into both phases. Using proprietary synthetic media and enhanced bioremediation techniques to treat high inlet concentrations of VOC, the MultiPhase has a much smaller, manageable footprint compared to the large, in-bed biofilters of the past.

These single-vessel systems can be sited close to the emission source, sometimes even inside the facility, minimizing long duct runs, and thus eliminating both the initial cost and the operating costs due to increased pressure drop in the duct.

The MultiPhase can also accept much hotter sources of VOC emissions, such as dryers and other heat-producing processes. In the past, biofilters have been limited to low inlet temperatures, otherwise the bacteria that consume the VOCs are killed by the heat. The capability of the MultiPhase to manage higher temperatures substantially expands the applications for biological treatment.

In contrast to thermal oxidation, the MultiPhase is much less expensive to operate over time. There is no perpetual

natural gas cost, and consequently no dependence on the unstable natural gas market. Future greenhouse gas (GHG) regulations will certainly target RTO sources.

In contrast to conventional biofilters, the MultiPhase uses permanent media – no replacement of media or packing is necessary. The MultiPhase is highly reliable, with lower maintenance and operating costs, and provides superior performance over a wider range of VOC compounds.

Handles Particulate

The MultiPhase provides high VOC removal rates even with high particulate concentrations in the flow stream and heavy loadings of biotreatment products. For conventional biofilters, these pose the problem of clogging the media beds, allowing channeling, and requiring cleaning. In thermal oxidizers, even small concentrations of particulate in the gas stream pose serious challenges such as bed fouling, efficiency degradation, and fire hazard.

Production Friendly

Shift and weekend shutdowns are easily accommodated. Unlike older biological systems, the MultiPhase is a single compact vessel operated like standard industrial equipment. It is fully instrumented, integrated in the plant control system, and can rapidly be brought on and off line. Key parameters are monitored to insure proper operation and are suitable for regulatory reporting.

Low Waste and CO₂, No NO_x

The MultiPhase generates minimal wet and solid waste and does not create NO_x



Systems range from 30,000 acfm to 400,000 acfm (300,000 acfm pictured above).

by-products because there is no combustion. It also produces much less CO₂ during its long life-cycle, because it is not burning natural gas, and the media does not degrade, unlike old-style biofilters. *The life-cycle environmental impact is much smaller than conventional biofilters, RTO, and RCO.*

This new VOC control alternative is available exclusively through Tri-Mer Corporation, which offers turnkey engineering, VOC emission control equipment manufacturing, installation and project management. With its own manufacturing facility in Michigan, and resources nationwide, project schedules can be expedited and regulatory deadlines met.

MACT Compliant

For information contact:

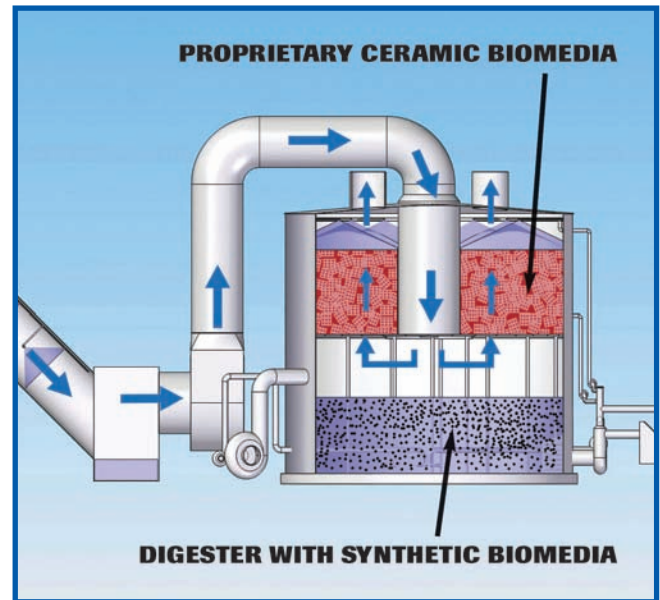
Kevin Moss, (801) 294-5422

kevin.moss@tri-mer.com

Evolution Beyond Conventional Biotreatment

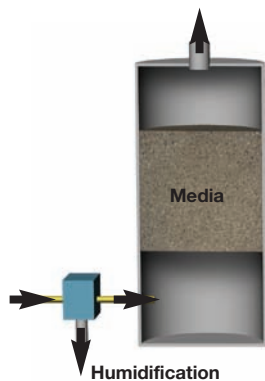
- MultiPhase treats VOC contaminants in the liquid and gas phases in which they naturally partition, as a result of their inherent physical properties, in accordance with Henry's Law.
- Highly volatile compounds that exhibit low water solubility are treated mainly in the gas phase in a ceramic biomedia bed.
- Low volatility compounds that are water-soluble are treated mainly in the water phase in a digester sump incorporating special neutrally-bouyant media.
- Intermediate compounds are treated in both phases.
- The ductwork and central pipe contain spray nozzles. The soluble fraction of the VOCs and water end up in the digester sump, along with indigestible particulate that is later filtered out.

MultiPhase BioSystem



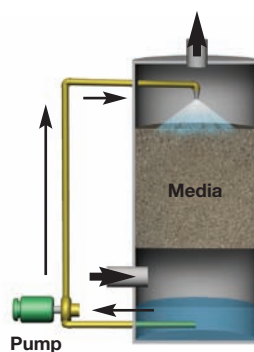
MultiPhase Innovation Solves Typical Problems with Conventional Biotreatment Schemes

Biofilters



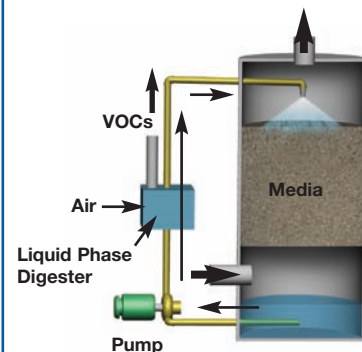
- Biomass growth (clogging)
- Particulate plugging
- Temperature limitations
- Water soluble compounds escape
- Condensables not treated
- Biomass decay during shutdown

Biotrickling Filters

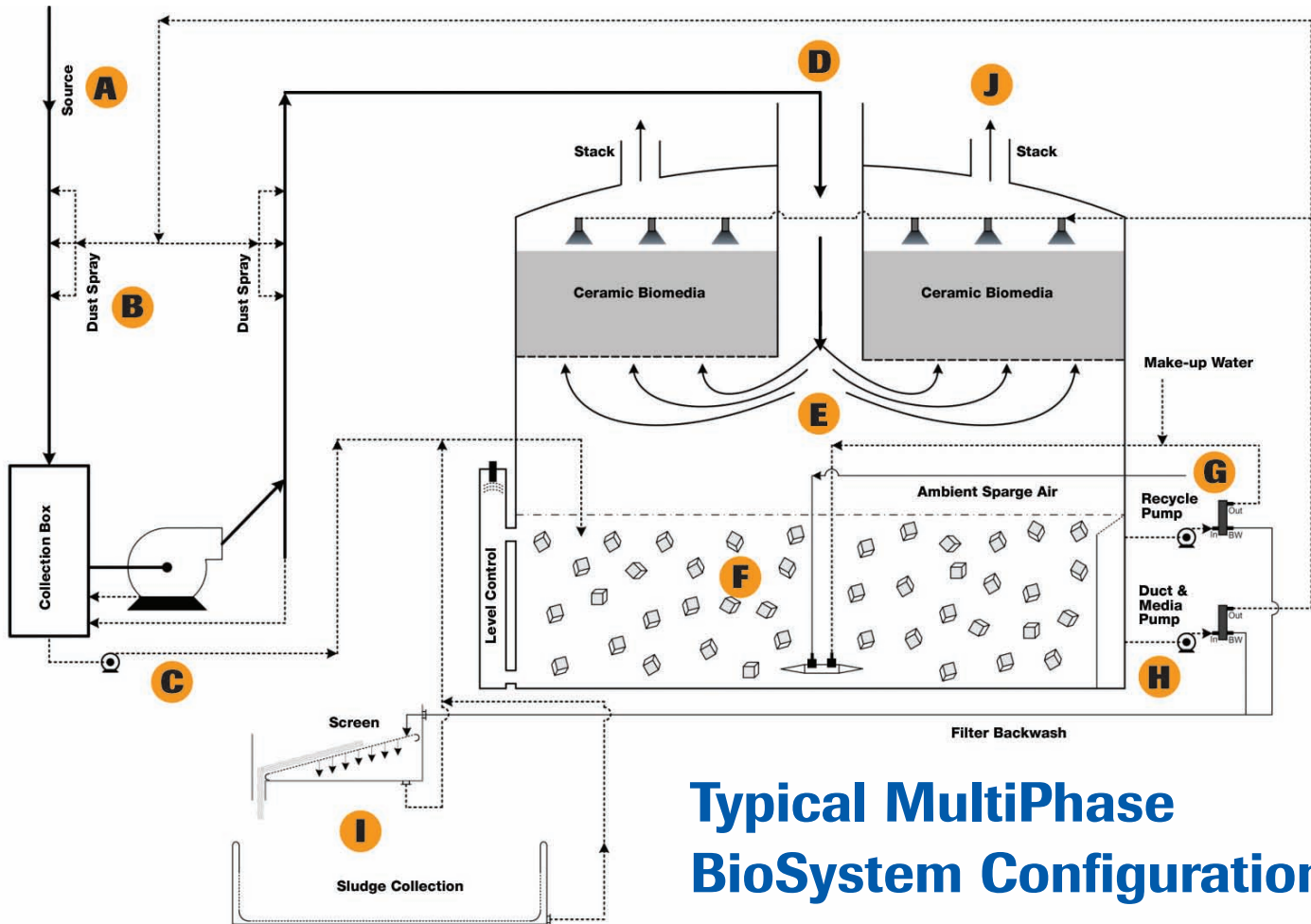


- Biomass growth (clogging)
- Particulate plugging
- Temperature limitations
- Water soluble compounds escape
- Condensables not treated
- Biomass decay during shutdown

Bioscrubbers



- Biomass growth (clogging)
- Particulate plugging
- Temperature limitations
- Re-emission at liquid phase
- Condensables (tars, oils, etc.)



Typical MultiPhase BioSystem Configuration

- A** Air stream enters from the VOC source or multiple sources such as dryer and press. The MultiPhase can accept a very wide spectrum of VOC compounds.
- B** Ductwork is sprayed by water recycled from the digester sump. This humidifies the air, puts the water-soluble VOCs into solution, removes bulk particulate, and keeps the ductwork clean.
- C** Water, water-soluble VOC, and bulk particulate are collected before and after the fan and sent directly to the digester sump.
- D** VOCs in the gas phase enter the central duct and flow downward into the vessel.
- E** The gas phase VOC in the air is drawn upwards through the bio-media bed, which consist of proprietary randomly packed ceramic bio-media. Bacteria films thrive on the media and consume the VOC. The media is continuously washed down by water recycled from the digester sump. This provides additional food for the bacteria, especially during shutdown, and keeps the bed free from excess build-up of biomass that occurs as the bacteria consume the VOC and multiply.
- F** The water in the digester sump is full of bacteria that consume water-soluble VOC. Special neutrally-buoyant media

provide extra surfaces for the bacteria films, multiplying by severalfold the density of bacteria able to thrive in the digester. Complex VOC are in the digester for several hours being decomposed and consumed.

- G** Ambient air is introduced into the bottom of the digester. This prevents settling of solids in the vessel, cools the sump, and provides extra oxygen that "revs up" the bacteria.
- H** A low volume stream of water from the digester is filtered. This prevents build-up in the digester by removing particulate, fibers, and other non-digestible debris. Recycled water is also used to spray the ducts, keep the bio-media clean, and provide bacteria food and water.
- I** Clean, non-hazardous solids are removed from the system. These can be landfilled, burned for their fuel value, or otherwise disposed of.
- J** If any stripping of gas-phase VOC occurs in the digester sump, this air also flows upward through the ceramic bio-media and is exposed to the bacteria films. Treated air exits the stacks.

Proprietary Synthetic Ceramic Biomedia



- Proprietary design specifically for MultiPhase biofilter.
- Custom engineered according to requirements of each project.
- Surface modified to allow accelerated attachment and growth.
- Low bulk density, completely permeable to water.
- Very high biologically-active surface area.
- Designed for good distribution on high gas flows while using a very low liquid flow rate for washdown and hydration.
- Prevents clogging due to biomass growth or particulate build-up.
- No replacement required; media bed is permanent.
- Pressure drop monitored. Washdown spray prevents clogging and increased ΔP without interrupting operation.
- Durable in terms of strength and temperature range.



MultiPhase BioSystem Advantages:

- Gas and liquid phase treatment integrated into one technology.
- Single-vessel design operated like standard industrial equipment.
- Treats VOCs with high efficiency, up to 98%.
- Accepts higher inlet temperatures from dryers and other processes.
- Handles high particulate loadings.
- Handles tars, waxes, heavy VOC compounds.
- No media bed clogging, automatically self-cleaning.
- Very low wastewater generation.
- Very low system pressure drop and operating costs.
- Minimal waste generation; creates no NO_x compounds.
- Smaller footprint, easier placement, shorter duct runs.
- Accommodates shut-downs and production schedules.
- Treats a wide spectrum of VOCs: formaldehyde, methanol, styrene, xylenes, PAHs, sulfur compounds, glycols, ethanol, solvents, and many others.