



Act now and save later

Treating the off-gases from aerobic basins is expensive and inefficient because of the large volumes of air that must be processed at very low VOC levels.

Air stripping is a treatment process that lends itself well to the wide-ranging wastewater treatment challenges of typical liquid storage and transfer facilities.

It is highly efficient at transferring dissolved VOCs from the wastewater to an air stream. In addition to a high transfer efficiency, the process has very good flow turn-down capability and handles changing wastewater compositions predictably. Air stripping is a process that

VOCs released in wastewater processes such as aerobic bio-treatment can lead to costly control measures if the vapours violate air emission rules

should be considered for VOC control, due to these factors:

- It is highly efficient and stable in transferring VOCs from wastewater to air, capable of attaining
- parts per billion liquid effluent levels
- The process has quick start-up and wide flow turn-down capability to adjust for varying treatment loads

- Stripping can predictably treat wastewaters that quickly change in composition

What is air stripping?

Air stripping is a process that removes or strips VOCs from contaminated water by contacting clean air with contaminated water across a high surface area, moving the VOCs from the water into the air.

The process is governed by Henry's law and the Henry's law constant (H) of any dissolved contaminant can be used to predict how effectively that contaminant will be driven from the water into the air. For wastewater

that contains a dilute mixture of VOCs in water (less than 25% of the water solubility), each contaminant behaves independently of the others and theory can be used to provide a fairly accurate prediction of process effectiveness. If free-phase organics or non-volatile, polar, organic chemicals are also in the mixture, a pilot test is often required to determine the expected level of stripping, since these contaminants impact H values for the full range of VOCs present in the wastewater.

Air stripping methods

Two primary methods are used to provide the high surface area between the air and water phases in the stripping process: mass transfer packing media and turbulent froth.

Tower strippers are cylindrical structures, filled with mass transfer media which provide a high surface area for the wastewater to distribute over as it trickles down through the tower. Interstitial spaces within the packing allow air to flow past the media, with VOC transfer occurring at the air/water boundary. In contrast, tray style strippers use sieve trays to create a turbulent air/water mixture (froth), where the mass transfer occurs. Air to water ratio (A/W) is the primary process control parameter for both stripping methods, with higher air to water ratio providing higher VOC removal.

Both the tower and tray stripping methods use a counter current flow design to optimise the concentration driven mass transfer in the most efficient way: contaminated water enters the top and flows downward, clean air enters the bottom and flows upward. Counter current flow applies the cleanest air to the cleanest water to achieve very high removal rates, then loads up the air with VOCs as it contacts more concentrated water, giving the process its high efficiency.

Tower strippers use the height of a packed tower to provide greater residence time and extend the counter current flow path. Tray strippers are physically much

shorter and use multiple high efficiency tray stages to extend the counter current flow path, with more stages providing higher removal for a given A/W.

Which is better?

From a core process standpoint the two stripping methods are very similar, however, important practical

differences exist, especially if fouling conditions occur. Tower strippers theoretically require less energy to operate, since clean mass transfer packing produces relatively low back-pressure on the air moving device (blower). The blower for a tray stripper needs to have a higher pressure capability to create the froth on the multiple tray stages.

However, fouling conditions and changing liquid flow rates are a challenge for tower strippers, since the mass transfer media can become clogged and inefficient, or even worse, cemented into a solid mass that is difficult to clean and restore to proper flow. Also, the upper liquid distribution piping in tower strippers is optimised for a given liquid flow, so higher or lower liquid flow rates can lead to flooding or channeled flow and thereby knock down the removal efficiency further.

In contrast, the froth transfer zone in tray strippers is relatively immune to fouling, and the slide-out

trays and much lower height make the tray air strippers much easier to inspect, clean and maintain. The tray style design also provides a wide flow turn-down, since water depth is established with weirs in the flow channels, allowing stripping to continue even if the liquid flow is zero.

The following table compares tray stripping to tower stripping:

Tray stripping	Tower stripping
Easy process monitoring and inspection, even while in operation	Condition of liquid and air flow distribution are very difficult to observe
Reduced footprint for installation and maintenance	Small footprint but very tall structure required
High removal efficiencies easier to maintain	More difficult to keep at design performance
Easily modeled online by customer to help process evaluation	More complex process assistance

Air treatment

For sites that use traditional wastewater treatment steps, such as activated sludge or other aerobic bio-treatment, off-gas VOC control can be a major cost and difficult to solve problem. VOC stripping will occur in any aerobic bio process, but at a very low level of efficiency, which produces a high volume, low VOC-concentration off-gas that must be treated. Air stripping has been effectively used as a VOC pretreatment step prior to aerobic bio treatment to dramatically reduce the volume and increase the concentration of VOCs in the air that must be treated. The resulting reduction in off-gas treatment sizing (such as a catalytic oxidiser or vapour phase activated carbon) can produce huge saving in both capital equipment and operational costs. Strippers are so effective at VOC reduction that off-gas treatment from the bio unit is often eliminated. When a

site is facing increased air pollution control requirement, air strippers should be reviewed as a viable option to help minimise treatment plant changes and air treatment process costs.

Sites with changing wastewater flow rate

Wide ranging wastewater compositions are typical for liquid storage sites, where the wastewater treatment process often needs to handle inputs that include rainwater run-off, tank bottoms, wash water and other site wastewaters. Depending on site location, changing ambient temperatures can also play a role in the overall treatment system design and operation. If the changes in flow or composition are

significant, a bio process is often unable to react fast enough to avoid periods where performance fails to meet the design target.

In some cases, certain high concentration wastewaters can upset the bio process and result in a long period before the process returns to stability. In contrast, air stripping is a physical process which is very resilient and fast reacting.

As flows and concentrations rise or fall, the stripping process efficiency changes accordingly. If the process design considers the expected boundary conditions, the resulting removal process is predictable and target VOC removals will be maintained. In the absence of air treatment, the VOC component is very challenging for aerobic bio processes to maintain, since contaminant breakdown needs to occur quickly to avoid high VOC concentrations in the process off-gas. ●

For more information:

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