Streamline

Wastewater Odor Control Technology and Best Practices

INDUSTRIAL AND MUNICIPAL WASTEWATER APPLICATIONS

Odor control at municipal and industrial wastewater treatment facilities has become a primary concern, as population growth brings more people into proximity of wastewater operations. Growing population centers are increasingly encroaching on wastewater operations, and residential communities are less tolerant of nuisance odors.

Fortunately, as the focus on odor control has increased, so have the number of odor control technologies available to wastewater professionals. In this paper we cover the most common odor control methods and discuss the best practices in wastewater management.

THE PROBLEM – H_2S

At the root of odors generated from wastewater operations is generally hydrogen sulfide (H_2S), which is a naturally occurring compound generated by bacterial breakdown or decomposition of organic material, both plant and animal, in anaerobic (absence of oxygen) conditions. This biological process occurs in oil and gas reservoirs, wastewater plants, volcanic gases, sulfur deposits, biogas digestors, landfill operations, hot springs and swamps.

Hydrogen sulfide is a toxic, poisonous gas that is destructive to infrastructure and can be deadly to humans. Low concentrations can cause noxious “rotten egg” odors and cause irritation to eyes and the respiratory system. Higher concentrations and prolonged exposure can damage infrastructure, including pipes and equipment that increase the risk of catastrophic failure and requires significant cost to replace. Prolonged exposure to H_2S can cause serious injury to a person’s central nervous system and inhalation can be lethal to workers.

As population centers grow and encroach on wastewater operations, residential contact with wastewater and industrial operations and their odors is a growing problem. Failure to control noxious odors can result in significant fines, unplanned interruptions to operations and a loss of goodwill with the community and regulators.

SOLUTIONS

Methods for mitigating H_2S-related odors have evolved over time, and today wastewater professionals have a variety of alternatives at their disposal.

Because traditional methods for treating H_2S were typically expensive and offered limited effectiveness at odor control, one strategy many businesses and municipalities used to cope with outdoor odors was to locate facilities in remote areas, away from population centers. Today, however, growth and urban sprawl has brought residential areas near operations that were once considered distant.

The higher the pH of the water, the more hydrosulfide will remain in solution and vice-versa, making pH a critical variable in odor control.

Additionally, traditional solutions were of narrow focus and expensive, relative to modern treatment methods and had limited application.

Around 2000, new solutions came to market based on the liquid reduction oxidation process, known as Redox. Redox treatment methods are generally classified by whether they treat H_2S in the aqueous (water) or vapor stage.

AQUEOUS PHASE TREATMENTS

In the aqueous phase (water), H_2S is in the form of hydrosulfide (HS-), which eventually volatizes into H_2S gas because it has a natural aversion to remaining dissolved in solution. Additionally, the higher the pH of the water, the more hydrosulfide will remain in solution and vice-versa, making pH a critical variable in odor control.

Traditional methods for treating hydrosulfides in the aqueous phase involve chemicals to either prevent the formation of H_2S in the first place or eliminate it after being produced. These methods typically replace sulfates with nitrates, as the primary food source for the bacteria that generate H_2S.

Historically, the preferred methods for treating hydrosulfides in water include:

Calcium Nitrates prevent formation of H_2S by giving bacteria a more attractive food source.

Iron (Ferric) Salts sequester HS^- by forming a bond with it, which then forms a heavy solid that falls out of solution.

Oxidants, including chlorine dioxide, bleach, hydrogen peroxide and permanganates, crudely change HS^- by breaking it down or converting it into another substance that does not generate odors.

Downsides to traditional aqueous phase treatments:

- **Increased operational expenses.** Large quantities of chemicals are typically required to achieve satisfactory results.
- **Negative downstream effects**. Some methods, such iron salts and nitrate, create significant "sliming" of pipes with sludge, which in turn hosts bacteria that in turn can reproduce, necessitating yet more demand for chemicals. Furthermore, excessive usage can harm beneficial bacteria.
- **Reduced capacity.** As sludge builds up in pipes and infrastructure, it reduces the capacity of the conveyance systems. Frequent cleaning is required to maintain plant capacity.
- **Corrosion of infrastructure.** Sequestration methods, such as iron salts, are corrosive in their own right, limiting the frequency of use and quantities used.
- **Inefficient**. Chemical oxidants can be inefficient and may require more pounds to treat the same amount of hydrosulfides.

VAPOR PHASE METHODS

The downsides and limitations of aqueous phase treatments gave rise to methods that treat H_2S in the vapor stage, including:

- **Caustic Scrubbers** typically use caustic to increase the PH of water and bleach to oxidize H_2S gas into elemental sulfur. Suited for high volumes of air with low H_2S loading.
- **Carbon Scrubbers** use activated charcoal-based media, and when contaminated gas is channeled over it, the media absorbs the H_2S like a sponge.
- **Biologic Scrubbers** use media to grow bacteria that naturally metabolize H_2S as it moves through the treatment system.

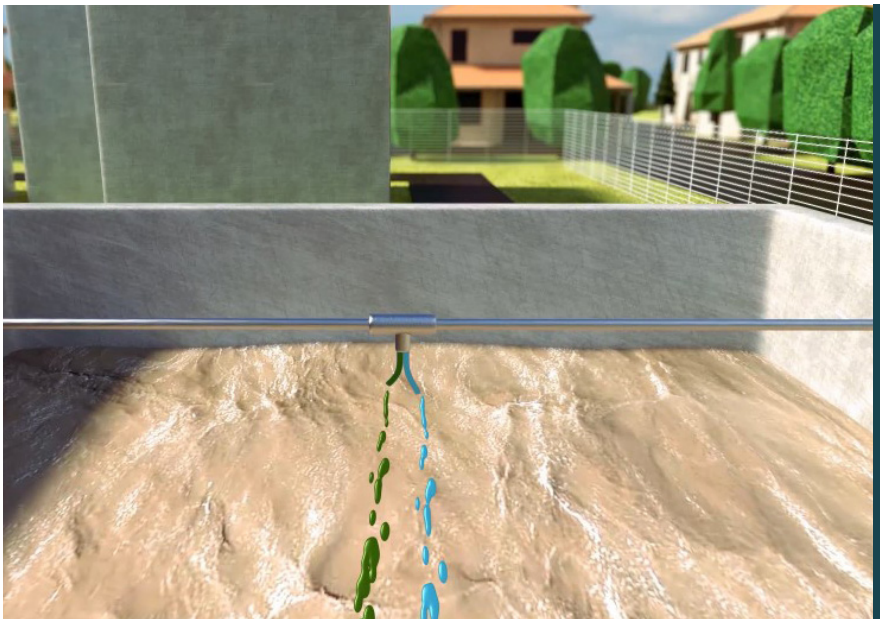
Downsides to traditional vapor phase treatments:

- **Caustics.** Relatively inefficient and require large amounts of chemicals. Caustic scrubbers use large vessels and require significant capital expenditures. Additionally, the media must be replaced frequently as it becomes fouled with caustic material and elemental sulfur cake.
- **Carbon-Based.** Activated carbon, or charcoal-based scrubbers, have lower capital and operating expenses than caustics, however, they are not as efficient at removing H_2S. Media replacement is difficult and expensive.
- **Biologics.** Require a larger footprint than caustic or carbon-based scrubbers, but have difficulty handling system changes, as bacteria do not like rapid changes in temperature, airflow or H_2S loading.

THE FUTURE OF WASTEWATER TREATMENT

More recently, technological breakthroughs in chemistry and process optimization have ushered in a new era of wastewater odor control.

The Talon™ Sulfide Elimination System (TSES) from Streamline Innovations is a next generation Redox process for treating H_2S in both the water and vapor stages, eliminating foul odors without the downsides of traditional treatment methods.



The TSES is a true game changer, by being the only solution capable of treating H_2S in both water and vapor phases. Using the same catalyst in both water and atmospheric situations, it works equally well (no loss in efficacy). This provides tremendous flexibility in applications at municipal and industrial wastewater operations.

The TSES uses Streamline's proprietary Talon Redox catalyst combined with an oxygen source (*primarily hydrogen peroxide*) to generate an oxidative reductive process that breaks apart H_2S and converts it to elemental sulfur, which cannot reform into H_2S. **Talon is biodegradable, non-toxic and regenerative.**

Talon can also be used for advanced oxidization of other contaminants, including other non-H_2S sulfur species like mercaptans, dissolved organic matter, volatile organic compounds, and metals along with biosolids to control H_2S and odor issues.

Regenerative Solution. The TSES is a regenerative process that restores the chemistry so it can be reused, significantly reducing costs.

Benefits of the TSES Redox solution:

- **Fast.** Talon generally removes hydrosulfides within 2-3 minutes with adequate mixing and is viable up to four hours.
- **Less chemicals.** Talon is regenerative and more efficient than traditional methods, resulting in lower overall chemical costs and less handling requirements.
- **No negative byproducts.** Talon generates dissolved oxygen, water and elemental sulfur.
- **No sludge or sliming.** Instead of binding to hydrosulfides to precipitate them out of solution, Talon converts HS- and H_2S into elemental sulfur, resulting in no sludge which can negatively impact plant capacity and increase biosolids disposal costs.
- **No need to adjust pH.** Talon works at neutral pH, so no adjustments to water pH levels are required.
- **No significant change to existing operations.** Talon is very simple to operate, increasing operational simplicity and reliability.
- **Harmless.** Talon is biodegradable, non-toxic and when used correctly, does not harm beneficial bacteria.
- **Automated.** The TSES solution can be automated to ensure optimal treating levels in response to variability in wastewater volumes.

As a green chemistry, the TSES solution also provides important benefits for environmental sustainability:

- Replacing hazardous chemistry with Talon's green chemistry makes for more sustainable and safe operations that do not rely on dangerous chemicals or create harmful byproducts.
- Faster and less frequent catalyst refills mean a lower carbon footprint from operations and maintenance.
- Improved safety profile by reducing the transportation, storage and handling of dangerous chemicals.

Streamline Innovations offers a holistic approach to implementation, from installation to operations and maintenance, making adoption of the technology simple, cost-effective and free of headaches.

A TSES includes two (2) chemical injection pumps and supply tanks which can be as simple as totes or larger bulk tanks. Depending on system requirements, a TSES can be installed in as little as a few hours. Additional features can include flow-pacing of pumps based on H_2S analyzers or flow meters as well as remote monitoring.

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CONTACT

Contact Streamline Innovations to learn more about next generation Redox solutions for odor control and determine if the Talon Sulfide Elimination System is right for your wastewater facility.

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ABOUT STREAMLINE INNOVATIONS

Streamline Innovation's vision is **Eliminating Pollution Through Technology**. We help heavy industry around the world achieve environmental performance objectives, improve sustainability, and transition to a sustainable, low-carbon economy.

Streamline's environmentally forward H_2S treating solutions help achieve the "E" in ESG. H_2S is present in many industrial processes throughout the world. Our technology can be applied across industries, delivering a sustainable solution that eliminates H_2S, a leading cause of human inhalation accidents and source of SO2 emissions, a primary cause of acid rain. Talon treats effectively in both gas and water phases.

Streamline believes that achieving environmental sustainability directives requires data. Creating intelligent systems that operate effectively and efficiently without human intervention is critical to measuring and reducing emissions that harm the environment. We integrate advanced process control, data collection and analytics in our technologies to provide a total solution for customers.

We serve organizations in multiple sectors, including Energy/Oil & Gas, Biogas, Landfill Gas & Renewable Fuels, Municipal Wastewater and Industrial Air & Water.

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