WHERE ENERGY MEETS WATER
MEGA WHAT H2O
may2012

ZERO ODOUR

ARE BIOLOGICAL ODOUR TREATMENT SYSTEMS A 'GREEN' AND 'ECONOMICAL' ALTERNATIVE TO CHEMICAL-BASED SYSTEMS?

HEAD LINES

- ALSTOM TO REHABILITATE IRAQI POWER PLANT
- DEWA DEFERS HASSYAN 1 IPP

CPI

ZERO ODOUR

ARE BIOLOGICAL ODOUR TREATMENT SYSTEMS A 'GREEN' AND 'ECONOMICAL' ALTERNATIVE TO CHEMICAL-BASED SYSTEMS?

By Anoop K Menon

WHEN IT COMES TO ODOURS, NO ELECTRONIC OR MECHANICAL DETECTOR CAN BEAT THE HUMAN NOSE, WHICH CAN DISTINGUISH BETWEEN MORE THAN 5,000 ODOURS AND DETECT SOME COMPOUNDS WITH CONCENTRATIONS AS LOW AS 0.1 PARTS PER BILLION. EVEN TODAY, THE HUMAN NOSE PROVIDES THE ONLY ACCEPTED STANDARD FOR DETERMINING ODOUR INTENSITY, WHERE A PANEL OF PEOPLE ARE USED TO ACCOUNT FOR THE RANGE OF SENSITIVITY TO ODOURS.

Prepare to see more of these panels as odour control is becoming one of the most challenging aspects of wastewater treatment. As urban sprawl encroaches on the land around remote wastewater treatment works, unpleasant odour from sewage can have a detrimental impact on the quality of the local environment, while increasing the number of people likely to be impacted by odour. Decentralised wastewater treatment could well exacerbate the impact, while public awareness and expectation of a better environment means increasingly lower tolerance for odour related issues. Several published research studies have concluded that chronic exposure to hydrogen sulphide (H_2S) can result in adverse human health effects ranging from eye irritation, sore throat and cough, shortness of breath to fluid in the lungs. Odour is usually caused by the presence of H_2S, mercaptans (Organic Sulphur Components), ammonia and Volatile Organic Compounds (VOC) in the air. So an odour control system will have to treat not only H_2S, but also other pollutants to reduce the total odour.

While the market for odour control systems has traditionally been dominated by chemical scrubber and carbon-based systems, in the past few years, environment-friendly odour control technologies have started advertising their presence in the Middle East, as 'green' alternatives to the 'traditional' systems.

"Biological odour systems seek to replace traditional odour control systems that have high operational and maintenance costs," said Mohanned Awad, Director of Business Development, Concorde-Corodex Group, which launched its new biological scrubber-based odour control systems in the region in the early part of the year.

Odours are formed by the breakdown of organic matter and sulphur under anaerobic conditions. The major sources of odours are wastewater collection systems, pumping stations, gravity sewer lines and to a lesser extent, sludge collection tanks. For example, in a gravity sewer line, H2S gas is formed in the anaerobic portion of the bacterial film layer on the invert of the sewer pipe. Typical places where H2S is released include force main discharge, pump stations and gravity sewer line manholes.

Chemical scrubbers have long been one of the most common odour control technologies used in the Middle East, especially in the municipal wastewater industry. "Caustic soda scrubbers, where the sulphides are scrubbed out with sodium hydroxide (caustic soda) or sodium hypochlorite (bleach) are pretty common in the region," notes Dr Louis D. le Roux, President, BioAir Solutions, a leading US-based provider of biological odour and emission control solutions.

The technology enjoys a long track record in the region as it was found to be highly effective on H2S and ammonia odours. Sodium hydroxide and sodium hypochlorite are used to control H2S while sulphuric acid is used to control ammonia odours. "In simple terms, you strip all the odours from gaseous phase and put them in liquid phase," explained Awad. "But that gives rise to problems related to disposal, storage of hazardous chemicals and also Health, Safety & Environment (HSE) issues."

Chemical scrubbers have a very small footprints, but have high O&M costs as the system requires chemical storage tanks, pumps as well as expensive control and instrumentation elements like pH and ORP sensors, metering pumps, recirculation pumps, level switches linked to chemical supply tanks and alarms and fan controls. "There is a lot of operator attention because you need to go and tweak pumps and calibrate all the sensors," said le Roux. Maintaining the chemical conditions favourable for ultimate performance is critical, so strict operation management is needed. Finally, chemical supply has to be replenished periodically, which gives rise to issues related to chemical storage and handling. "These systems use a lot of hazardous chemicals so their running costs are high," explained Le Roux. "What people perhaps overlook is the creation of ozone-depleting chlorinated by-products that are emitted into the atmosphere." Activated carbon systems reportedly have the smallest overall footprint of any of the odour control technologies. "They are a simple and easy-to-operate solution for odour control," said Le Roux. These systems don't have many moving parts and generally, do not require sensors or instruments. "However, if the concentration of sulphides goes up, the running cost becomes very high," cautioned le Roux. Further, the carbon must be removed and replaced when it becomes spent. Disposal of spent carbon is an issue, especially in countries with strict landfill disposal regulations.

Both BioAir and Corodex claim that their respective biological odour control systems address the high or skewed 'costs' associated with traditional odour control systems. Both rely on bacteria instead of chemicals to remove contaminants from the air stream, and tout savings in chemicals where the expenditure can run into millions, as the biggest benefit of deploying their systems.

Dr Louis D. le Roux, President, BioAir Solutions

OUR ODOUR TREATMENT SYSTEM TAKES BIO-TRICKLING FILTER TECHNOLOGY TO AN ADVANCED LEVEL TO TRULY CREATE A SUSTAINABLE PROCESS

"Our odour treatment system takes bio-trickling filter technology to an advanced level," said le Roux. "What really makes us unique is the fact that we use a structured synthetic media called EcoBase with engineered flow channels through it to truly create a sustainable process."

The odorous air comes in at the bottom of the reactor, where the H2S and organic odour compound are transferred from the odorous air to the bacteria growing on the EcoBase

FROM A MAINTENANCE STANDPOINT, THE MANUAL LABOUR REQUIRED FOR BIOLOGICAL SYSTEMS IS MINIMAL.

Mohanned Awad, Director of Business Development, Concorde-Corodex Group

media. Autotrophic bacteria then oxidises H2S while Heterotrophic bacteria oxidises the organic odorous compounds. "Inside the reactor, you have different layers of bacteria because we create a pH gradient. Thus, the autotrophic bacteria at the bottom eat the sulphides, while heterotrophic bacteria at the top eat the organics. That's how we can eliminate both organic and inorganic odours."

But what happens if inlet odour levels increase? "Even if there is surge in H2S, which is natural, the bacteria system is very forgiving," said le Roux. "During low concentration periods, they starve a little bit, so when the surge comes, it is the equivalent of a big steak. In the Middle East, we deal mostly with high loadings as the sulphide concentrations are high. The more bacteria you can retain in your reactor vessel, the more you can actually feed it per unit volume."

The BioAir filter media is guaranteed for 10 years, although it is expected to last in excess of 15 years.

Awad positions his company's biological odour control as biological scrubbers, operating more or less on the same principles as bio-trickling filters. "Our media allows the bacteria to live in multiple pH environments," he explained. "They can treat average of 250 ppm and high loadings of up to 1,000 ppm, and in the case of H2S removal, they have a minimum of 98% removal capacity and often exceed 99.9%."

Awad devoted nearly two years to developing the solution and then testing it at a sewage pumping station in Sharjah, before launching it this year. He has tied up with Canada's Biorem for media selection and design consultation. "We decided to go with their media after testing nearly a dozen types of media during the pilot phase," explained Awad. "What impressed us about their media is that it is readily available, is inorganic and comes with a 10-year warranty. They also have a huge technical staff to advise us on system configuration."

Biological odour control solutions don't require sophisticated instrumentation and control systems. "Our system is only automated to a level where it brings value for owners. For example, we provide PLC with Ethernet output to a SCADA system, which helps to monitor everything from the SCADA room," said le Roux. The elimination of chemicals means savings on HSE requirements too. "The personnel have to be fully trained in terms of HSE practices to be able to deal with the plant," said Awad.

The solutions supplied by Corodex and BioAir use Treated Sewage Effluent (TSE) as the nutrient source for the bacteria. "You are substituting the chemicals with a nutrient solution," explained Awad. "You are basically taking a small stream of treated wastewater at the plant where your system is working and using it as feedstock."

From a maintenance standpoint, the manual labour required for biological systems is minimal. "In the municipal sector, maintenance is always an issue because people don't want to go out," said Le Roux. "The manpower requirement for our system is only 20% of that for a chemical scrubber. The only O&M element is lubrication of the blower." The long media life exceeding 10 years also contributes to lowering the O&M costs.

However, biological odour systems also demand a disciplined approach to design. "It is important to understand the characteristic of the odours before you can design the treatment," said le Roux. "For example, in a wastewater treatment plant, you will see more sulphides and fewer organics at the head works, while the opposite is the case in the primary grit chamber. The odour characteristics shift as you move through the plant."

Odour control systems are custom designed; therefore, to get a good design basis for a system for a particular application, it is important to get several factors right. Le Roux elaborated: "If we consider the example of a pump station, people prefer to use the thumb rule of looking at the volume of the pump station, say six air changes per hour and base their solution on that. But that is not scientific. We prefer to model the air flow. So if you have sewage flowing in a gravity sewer line, we look at the drag between the air and the liquid, model that air flow and then calculate how to size the system properly."

Corodex has invested in a sophisticated state of the art pilot plant that can be placed at sites to treat a side stream of the nuisance odour and configure an optimised custom solution before up scaling into a large system. Awad explained: "Any industrial wastewater treatment designer will tell you that the best way to design a treatment plant is to have a pilot plant to measure the variance of the influent coming in. With odour, every single manhole or pump station has a unique smell. We use the pilot to measure the variance of the incoming odour and test different system configurations, like a

coverstory

With region becoming more environmentally conscious, being a 'green' solution is an added advantage

two step configuration or a three step configuration with a polishing step or one step with a double lift inside. The pilot tells us what type of media should be used. Once we configure and optimise the solution, we look at the site, the head works and the plant's operational working volume and then scale up."

Le Roux believes that biological odour control technology suits the Middle East because it provides total odour control rather than just H2S removal. Moreover, the market is also ready to try a feasible alternative to traditional chemical and carbon-based odour control solutions. "Though very niche solution, biological odour control solutions can contribute significantly to reducing the O&M costs of wastewater treatment works," said Awad.

For cost comparison, le Roux prefers to apply the concept of Present Worth to calculate the return on investment. "Typically, you take the capital cost and all the running costs over next 10 years and bring it to today's value, expressing it as a function of H2S concentration in the air. For the biological system, there is a slight slope because the blower needs power; but for chemical scrubbers, the relationship is linear - higher the concentration, the more chemicals you use."

He continued: "I have visited installations in the region that use chemical scrubbers. They are desperate because they don't have budgets anymore. What we are doing is installing our biological system in front of the scrubber. The money they save is their pay back. They can still use the chemical scrubber, but the operating cost is very low now and the payback in some cases is less than one year."

Awad believes that in addition to the replacement market, there is also a market in new projects. "In fact, biological odour control is recognised as unique technology with separate specification within a tender," he observed. "It will have detailed specifications and nominated system suppliers."

A common worry expressed by clients is whether the biological nature of the technology is robust enough to deal with peaks. "During our pilot project in Sharjah, we witnessed peaks of up to 600 ppm from a steady state of 20-30 ppm in a matter of a few minutes," said Awad. "But the bacteria were able to compensate. Even we were surprised by the robustness of the bacteria. We share this data with prospective clients so that they are convinced about the solution."

Both le Roux and Awad agree that the market for biological odour control solutions has received a boost thanks to the prevailing economic environment where people are being asked to do more with less. "Now that things are tough and nobody has money in their pockets, they are re-thinking about how they can save," said le Roux.
"This is a standard technology approved by the US EPA," said Awad. "People here are beginning to embrace it now because they see the economical benefits but the environmental benefits are even better."

Le Roux added: "With region becoming more environmentally conscious, being a 'green' solution is an added advantage."

End note: Le Roux notes that if one compares biological odour control systems with chemical scrubbers and activated carbon in terms of printer equivalents – the latter two are the equivalent of inkjet printers. "You get inkjet printer practically free, but you are paying for the ink. My solution is the laser printer equivalent."