FWEA Manasota Chapter

Vol 26 – April 2016

Message from the Steering Committee

By Manasota Chapter Treasurer
Mike Jankowski, PE, Atkins

Another FWEA fiscal year is wrapping-up, and the Manasota Chapter's final event was a Kayak and Picnic held on April 1 at South Lido Key. Members, friends, and family were brought together for an evening of fellowship, water, and the environment, all for the benefit of Water for People and FWEA's State Scholarship Fund. We have historically moved around the location, day of the week, time of day, and even time of year. So if this year's kayak event did not meet your schedule and/or location needs, keep your eyes open for next year's!

Prior to the kayak event, the Manasota Chapter and the Florida Section of the American Water Works Association (FSAWWA) Region X held a joint luncheon at the Sarasota County Operations Center (BOB) on March 16. Sandeep Sethi of Carollo Engineers, with support from Katie Gilmore, Manatee County Water Treatment Plant Superintendent, presented on the Manatee County Water Treatment Plant Filter Upgrade Project.

Kayak participants at the kayak event fundraiser held April 1, benefiting Water For People and FWEA's State Scholarship Fund, take a moment to snap a picture on a beautiful sunny spring afternoon in Sarasota.

Our next luncheon is planned for May 26 at the BOB, and Juan Robles and Patty Baron of the Florida Department of Environmental Protection will be presenting. Additional details can be found on the FWEA website. Please pre-register by Thursday, May 19, so that we can provide an accurate number of attendees to the caterer. Our pricing structure remains the same:

- $15 FWEA/AWWA member pre-register, RSVP by Thursday, May 19.
- $20 non-member pre-register, RSVP by Thursday, May 19.
- $25 walk-in rate for FWEA/AWWA members and non-members alike.

As we welcome the new fiscal year, we give a shout-out to sponsors from our previous year, invite you to sponsor again this year, and both invite and welcome new sponsors. We would also like to announce that as of May 1, Mike Knowles will be the sole committee chair. Current co-chair Lindsay Marten will be moving on to bigger things at FWEA (details to come), but she will still be involved with the Manasota Chapter as a Member at Large.

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FWEA Manasota members (from left to right) Norman Robertson, Kyle Kellogg, Julie Karleskint, and Lindsay Marten stop to take a photo in the exhibit hall at this year's FWRC.

The Florida Water Resources Conference (FWRC) was held April 24 through April 27 at the Gaylord Palms Resort in Kissimmee, Florida. Our FWEA steering committee had a great presence at this year's conference, as always! If we did not see you there this year, plan to see us there next spring!

Lastly, be on the lookout for the annual summer social. Details to come!

MAY

6 FES Myakka Chapter Annual Awards Banquet, Sarasota

14 AWWA Region X Water Tower Competition, Bradenton

19 ASCE Suncoast Chapter Luncheon, Sarasota

26 FWEA/AWWA Manasota Chapter Joint Luncheon, Sarasota

JUNE

3 ASCE Suncoast Chapter Luncheon, Sarasota

May

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Biotower Performance at Various Empty Bed Contact Times with Elimination Capacity Curves Including High Rate Hydrogen Sulfide Systems

Chris Easter, Greeley and Hansen; Matthew Johnson, BioAir; and Bruce Singleton, CDM Smith

ABSTRACT

The objective of this paper is to provide information related to odor control design criteria used in sizing and selecting biotower odor control technologies and to provide odor removal performance data obtained over a wide range of loading rates.

This paper includes data for specific odor causing compounds such as hydrogen sulfide (H2S) and overall odor reduction in terms of odor concentrations as measured by olfactory analysis. Performance is presented in terms of both Empty Bed Retention Times (EBRTs) and elimination capacity curves. This paper builds on past experience at over a wide range of EBRTs and makes comparisons to more recent experience at very high loading rates and lower EBRTs.

EBRTs for the various systems range from 1.8 to 37 seconds, as well as H2S loading rates in excess of 150 g/m3/hr. All biotechnology-based odor control systems tested were treating foul air collected from municipal wastewater treatment plant process units including both collection systems and wastewater plant sources.

Performance data collected include both total odor and compound-specific removal efficiencies. Laboratory analysis for odor utilized the Odor Panel Method and followed ASTM E-679 "Determination of Odour and Taste Threshold by a Forced-Choice Ascending Concentration Series Method of Limits". Reduced sulfur compound speciation and quantification was completed using laboratory procedures adhering to ASTM D5504-01 GC/SCD. On-site field measurements of H2S were performed using an Arizona Instrument Jerome 631-X H2S Analyzer as well as OdaLog H2S data loggers.

The following conclusions are drawn from the available data:

- Full scale biotower results show reduced system footprints compared to other biological odor control systems while still maintaining very high removal rates for H2S.

- In recent years, high H2S removal rates reliably achieving 99% H2S removal have been achieved with full-scale biotowers that are designed with EBRTs in the range of 8 seconds or less.

- Research project results and other test data indicate that > 99% H2S removal is achievable with systems operating at 3-4 s EBRT with relatively constant loading rates.

- Some Systems show 99% H2S removal at mass loadings of up to 210 g/m3/hr. Overall, the technology appears capable of achieving reliable elimination capacities of > 400 g/m3/hr with relatively constant H2S loading rates.

- Overall odor removal for the more difficult organic based odorants such as methyl mercaptan and dimethyl sulfide can require longer EBRTs in the range of 15 seconds or more.

- Under complex field conditions, including very high loading, the flux rate of the sulfur based compounds through the biofilm may become limiting with formation of sulfur species that might effectively blind the media.

INTRODUCTION

Wastewater collection and treatment systems often generate offensive odors that elicit complaints from neighbors. Most odors generated within the collection system are sulfur-based compounds that are generated under anaerobic (reducing) conditions in the sewer. The predominant reduced sulfur compound is an inorganic species, hydrogen sulfide (H2S). Organic reduced sulfur compounds (ORSC) are also generated but are generally found in lower concentrations. These compounds are detectable at very low concentrations and therefore can also cause odor complaints. The combination of H2S and the organic reduced sulfur compounds are considered total reduced sulfur (TRS) compounds. The list of potential organic reduced sulfur compounds is long however the TRS compounds that are generally identified in wastewater odors are:

- H_2S
- Methyl mercaptan
- Dimethyl sulfide
- Dimethyl disulfide

Biological treatment of wastewater odors has become one of the industry standards for many odor control applications and to some extent this has resulted in biological systems sometimes being improperly employed. The main reason for this is a lack of understanding of the limitations of these systems to remove the less water soluble and biologically recalcitrant TRS compounds. The focus of this paper is a discussion of the implications of empty bed residence time (EBRT) for a full-scale biotower odor and air emissions control systems associated with TRS compounds. Further the paper will discuss the performance ramifications of lower EBRT and higher loading rates.

BACKGROUND

Biological odor control is a popular means of treating odorous air streams (Kraakman, 2004; Easter and Okanak, 2000). The biological process is popular because of the lower maintenance requirements, reliability of such systems, and because it is a "green" technology in that it uses no chemicals and creates no potentially hazardous media requiring disposal.

The process is deceivingly simple. Treatment includes mass transfer of gaseous contaminants to a liquid phase that incorporates a biofilm followed by mass transfer of the contaminants along with oxygen and nutrients to the biofilm where bacteria reside. Bacteria that have the capability of releasing energy from these compounds and also have a carbon source will thrive and oxidize and can effectively deodorize the odorous compounds.

The bacteria that perform the oxidation process on biogenic compounds associated with wastewater are ubiquitous in nature and therefore a "build it and they will come" mentality with regard to the biological process pretty much sums it up. This would point to the mass transfer process for biological uptake as the limiting factor and therefore the design of the fixed film surface is paramount in maximizing efficiency in biological filters. This can include both the type of media used and how the system is operated including choices on how spray water is applied.

There are two main types of biological control units: biofilters and biotowers. Biotowers include both biotrickling filters and bioscrubbers. Biofilters are the oldest and more traditional of the biological system designs using organic material as both a nutrient rich support for the fixed film and a source of bacteria. The associated process of irrigation is equally simple in biofilters.

Biotowers are more sophisticated in the biofilm support structure and have a more sophisticated irrigation control system including both nutrient and pH control mechanisms. The distinction between bioscrubbers and biotrickling filters involves the biological mechanism being either a fixed or suspended growth. This paper describes design criteria and performance data collected for full-scale biotower odor control at WWTPs and in collection systems. Comparisons are made to biofilters but performance data presented is focused on biotower style systems.

Both biofilters and biotowers rely on biological removal of odorous compounds but the two are fundamentally different in some ways. For this paper, biofilters are defined as traditional solid media systems that use soil media or organic-based media such as compost, bark, woodchips, or proprietary vendor supplied media. Biotowers are fully inert media with the nutrients provided in the spray water.

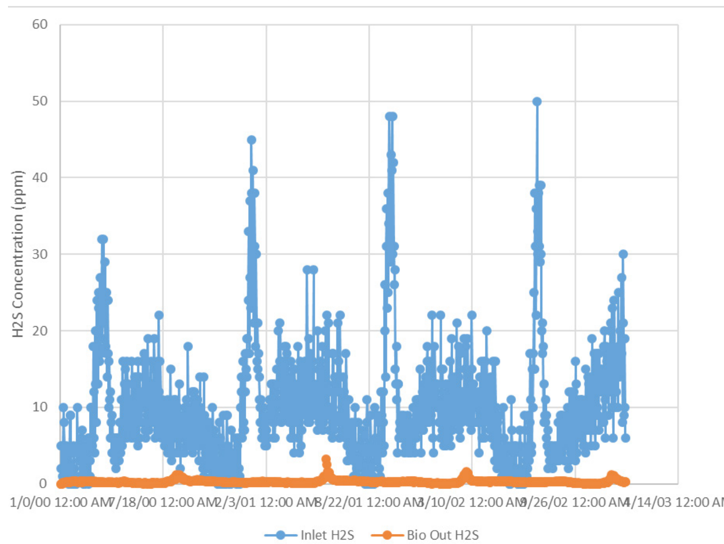
The microbes that consume odorous compounds live on the media within biofilters and biotowers. In a biofilter system, the media provides the trace nutrients, such as organics, nitrogen, potassium, and phosphorous, that the microbes need to thrive and also to buffer them against pH shifts. In biotower systems, the media is typically fully inert and nutrients are often provided in the humidification makeup water spray by using wastewater plant effluent water. Potable water or effluent water from advanced treatment may be used but may require the addition of trace nutrients. In many cases, biotowers are focused on H2S removal where the key bacteria thrive at a lower pH range of 2 to 3.

PERFORMANCE DATA

Performance data has been collected from over 40 operating biotower odor control systems. Sources of odorous and air emissions loads included wastewater collection system lift station wet wells, plant headworks facilities, primary clarifiers, trickling filters, sludge dewatering facilities, and sludge storage tanks.

Sampling consisted of a combination of air bag sampling for odor and TRS compound analyses. Air samples were collected in Tedlar bags (10 L for odor samples, 1 L for TRS samples) using a vacuum chamber. Laboratory analysis for odor used the odor panel method and followed ASTM E-679 "Determination of Odor and Taste Threshold by a Forced-Choice Ascending Concentration Series Method of Limits." Reduced sulfur compound speciation and quantification was completed using laboratory procedures adhering to ASTM D5504-01 GC/SCD using gas chromatography/flame photometric detection. On-site field measurements of H2S were performed using an Arizona Instrument Jerome 631-X H2S Analyzer or OdaLog H2S data loggers.

Figure: Cyclically loaded structured media biotower



Biotower Performance at Various Empty Bed Contact Times with Elimination Capacity Curves Including High Rate Hydrogen Sulfide Systems

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SUMMARY AND CONCLUSIONS

The following conclusions are drawn from the data presented in this paper:

- Biotowers have shown a rapid growth in full-scale system experience and available vendors and provide very high removal rates for H2S at EBRTs well below those typically required for biofilters.

- Biotowers loaded at or below 150 g/m3/hour can consistently achieve 99% H2S removal. This is higher than past design guidance suggesting systems should be sized for 75 to 100 g/m3/hour.

- Elimination capacity curves indicate that biotowers provided good removal of H2S for loading rates up to 210 g/m3/hr of H2S if the inlet loading is fairly consistent (without rapid variability).

- Organic based odor compounds tended to break through at significantly lower loading rates in the EC range of 0.1 to 0.5 g/m3/hr.

- Allowable ECs are media dependent and can be much lower if media is aging as shown with the aged lava rock biotower system.

- The variation in performance over a large range of EC values points to the complexity of the challenge for each specific biotower applications.

DISCUSSION

Much of the confusion in interpreting and comparing EC values is that it is only part of the design equation. As indicated by the data, the EC values for H2S removal can be driven very high with an optimum physical environment and process control. The high EC values are indicative of the fact that the biological removal of H2S is fast. However because of this, EC values and EBRT alone is insufficient in designing a sustainable biological system. When the diffusion rate across the biofilm exceeds the ability of the biofilm to remove waste products pH gradients develop in the biofilm, incomplete sulfur oxidation occurs, polythionates accumulate, heterogeneous populations grow, and the morphology of the biofilm changes. The result is an inefficient reactor, poor performance and in extreme cases fouling. Therefore an additional important consideration when designing biological treatment systems is the rate at which the contaminant is introduced to the biofilm. This parameter could be expressed as the mass flux rate for H2S expressed in terms of:

$$(\text{gH2S/sec})/\text{m}^2_{\text{media surface area}}$$

Like the EC value the mass flux rate is specific to the biological system including the media type and configuration, process configuration, and process control and should be derived empirically.

The problems associated with interpreting H2S EC values are enhanced when dealing with organic reduced sulfur compounds (ORSCs). The ORSCs are less water soluble and as discussed less biodegradable; in addition the biodegradation of certain ORSCs may be inhibited by the presence of other reduced sulfur compounds, including H2S, in the case of both methyl mercaptan and dimethyl sulfide (Cho et al 91). Therefore since organic based sulfur compounds are a strong contributor to the odor parameter (D/T) it is not unreasonable that even with high H2S removal inefficient ORSC removal can drive the odor concentration.

In conclusion H2S as a target compound for odor removal has long been established and high EC values can be achieved. However interpreting their value in design is difficult as EC is also a function of the mechanical design. As such designing on EC alone based solely on media selection can lead to poor performance and in some cases, where high loading is involved, disastrous results. The rate of exposure of the contaminants to the biological media surface is an important consideration that must be integrated into the design. This rate is also established empirically for the particular blend of media type, process type, irrigation control, and process control.

The article exceeds the number of pages allowed for the newsletter. Please email Mike Knowles (mknowles@greeley-hansen.com) if you would like the entire article emailed to you.

FWEA Manasota Chapter Steering Committee Officers

Chair
Mike Knowles: 941.378.3579

Vice Chair
Mike Nixon: 941.379.3404

Treasurer/Membership
Mike Jankowski: 813.281.7322

Secretary
Linda Maudlin: 941.378.3579

Chapter Relations
Samantha Nehme: 941.921.4183

Young Professionals and Outreach Coordinator
Kyle Kellogg: 941.225.4823

Communications
Rachel Cantor: 813.286.2075

At-Large
Chuck Hlavach: 941.915.4861
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Julie Karleskint: 941.378.2862
Laura Baumberger: 941.371.9832
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Founding Chair
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Past Chair
Lindsay Marten: 941.225.6178

If you are interested in joining the Steering Committee, please contact Mike Knowles (941-378-3579).

We are currently seeking Utility Liaisons and additional At-Large Members.

Joint Luncheon Meeting with AWWA Region X - May 26, 2016

FDEP Revised Total Coliforms Rule

By Patty Baron and Juan Robles, Department of Environmental Protection

The Total Coliform Rule applies to all public water systems and is a key rule protecting public health and ensuring bacteriological safety of public drinking water. EPA recently made important changes to this rule that all public water systems need to understand and implement. This presentation will highlight and explain the key changes to the Total Coliform Rule.

Juan Robles, Department of Environmental Protection

Mr. Robles is an Environmental Consultant with the Department of Environmental Protection since 2015. He has worked over 10 years with regulatory agencies in compliance assistance and emergency response plans for public water systems. Mr. Robles has a B.S. degree in General Sciences and M.S. Degree in Environmental Health from the Medical Sciences Campus, University of Puerto Rico.

Patty Baron, Department of Environmental Protection

Ms. Baron has been with the Department of Environmental Protection since 1993, and has been a part of the Drinking Water compliance assurance team for over 20 years. Ms. Baron graduated from the University of Wisconsin with a Degree in Conservation.

JOINT FWEA MANASOTA & AWWA REGION X CHAPTER LUNCHEON MEETING

Sarasota County Operations Center (BOB Building) ***Conference Room 1*** 1001 Sarasota Center Blvd., Sarasota, FL 34240 Registration - 11:30 • Lunch and Program - 12:15	Menu: 1) Market Salad, 2) Chicken Parmesan with Penne Pasta and Extra Sauce, 3) Rum Glazed Pork, 4) Steamed Green Beans, 5) Assorted Cookie Platter

Please register by Thursday, May 19th
Pre-registered Members: $15 • Pre-registered Non-members: $20 • Walk-in: $25
You can register online at www.fwea.org or register by phone, fax, or e-mail to Linda Maudlin
2601 Cattlemen Road, Suite 100, Sarasota, FL 34232
Ph: 941-378-3579 • Fax: 941-378-9489 • E-mail: lmaudlin@greeley-hansen.com

The Manasota Chapter is in search of Project Spotlight articles for future newsletter editions. Chapter sponsors are encouraged to submit an article highlighting a local project. Please contact Samantha Nehme at samantha.nehme@stantec.com or 941-921-4183 for more information.