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Foreword

The three of us—Joe Devinny (University of Southern California), Hinrich Bohn (University of Arizona emeritus) and Dan Chang (University of California, Davis), hope you enjoy this special issue on the topic of biofiltration for air pollution applications. The collection consists of contributions to the USC-CSC-TRG Biofiltration Conference held in October 2004. The papers were extended and subjected to additional peer review and revision. Attendance at the conference was not a requirement for inclusion in the special issue, though all of the included papers ultimately derived from contributions presented there. The range of papers dealing with applications is more practice-oriented than those typically found in the *Chemical Engineering Journal*, but they provide a snapshot of the state of biofiltration practice and research. We hope the readership will find it useful in developing insights into the state of biofiltration practice and in choosing fruitful topics for research.

There are two strands of papers, those focusing on experimental or operational aspects of biofilters and those describing biofilter models. Those dealing with operational studies appear first, and each strand begins with a summary or review of current practice. Dr. J.W. van Groenestijn (TNO, Netherlands) and Bart Kraakman (Bioway, Netherlands) provided a paper on recent developments in biofiltration practice in Europe, and Chris Easter and his colleagues at CH2M-Hill (Canada and USA) provided a summary on odor control practices at wastewater treatment plants in North America. The two summaries provide a contrast in the level of sophistication in addressing biofiltration in these two regions and outline the need for additional biofiltration research.

The rationale for ordering the remaining papers in the experimental and operational strand was to first group them by compound, then by operational strategy. A laboratory study of ammonia removal from composting processes using a compost-based biofilter is presented by E. la Pagans, X. Font and A. Sánchez (Universitat Autònoma de Barcelona, Spain), followed by a contribution on methane gas removal for landfill gas applications by J. Nikiema et al. (Université de Sherbrooke, Canada). The latter compares a compost media with a proprietary inorganic media. The study by S.Y. Kim and M.A. Deshusses (University of California, Riverside, USA) deals with hydrogen sulfide removal using a "differential" biotrickling filter, and provides insight into possible mass transfer limitations on removal of a reversibly reactive compound that partitions favorably to the liquid phase. The next contribution, by B. Sercu et al. (Ghent University, Belgium) addresses microbiological community considerations for the successful removal of dimethyl sulfide. It provides insights into differences of odor control performance at wastewater treatment plants that arise are evident from the data collected by Easter et al. in their summary. A second microbiological contribution that describes the use of community "fingerprinting" techniques to characterize microbial communities that degrade ethanol is presented by Steele et al. (University of Southern California, USA).

Closing out the strand are four articles describing different methods of operating biofilters. G. Trejo-Aguilar, S. Revah and R. Lobo-Oehmichen (Universidad Autónoma Metropolitana-Iztapalapa, Mexico) studied the effects of liquid flow rate on liquid hold-up in a trickle bed air biofilter (TBAF) and its effects on biofilter performance through changes to biofilm wetting and mass transfer. The contribution by D.K. Kim, Z.L. Cai and G.A. Sorial (University of Cincinnati, USA) attempts to unravel the response of a TBAF system to changes in the order of presentation of the volatile organic compounds toluene and styrene, comparing the biofilter's response to methyl ethyl ketone and methyl isobutylketone, compounds having greater solubility and different biodegradation pathways. The paper by W.F. Wright (California State University Fresno—formerly University of California, Davis, USA), discusses the response of biofilters to transient changes in loading by periodically switching the flow direction and its implications for improving degradation capacity and ability to respond to transient loads. Taking a different tack, W.M. Moe and C. Li (Louisiana State University, USA) develop a strategy for operating a combined adsorber-biofilter system and modeling its ability to handle transient loads. In principle, the directional-switching and combined adsorber-biofilter strategies are both relatively straightforward to implement, are complementary and have the potential to significantly reduce system size.

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The paper by Moe and Li segues to the modeling strand that begins with a review by Dr. J.S. Devinny and his student J. Ramesh (University of Southern California, USA). Their paper summarizes what the biofiltration community has done to model the processes occurring in biofilters. They conclude that practical models for biofiltration are still needed. M.J. Miller and D.G. Allen (U. Toronto, Canada) provide a novel mechanism and model of a biologically mediated process taking place in the interfacial region that can greatly enhance transport of hydrophobic compounds. G. Baquerizio et al. (Universitat Politècnica de Catalunya and Universitat Autònoma de Barcelona, Spain and University of California, Riverside) develop a dynamic model accounting for biofilm kinetics and effects of pH on ammonia removal. The section concludes with a semi-empirical model developed by Z. Shareefdeen et al. (Biorem, Canada) that used pilot-scale odor control data to successfully design full-scale units at rendering plants.

In physicochemical air pollution control systems, e.g., chemical scrubbers, incinerators, regenerative thermal oxidizers, etc., the mechanical aspects are relatively more complex and critical, though the actual oxidation process is rather simple. In biological systems the biochemical mechanism of oxidation are complicated by a dynamic biofilm, though the mechanical aspects are typically simple. The findings of this collection of papers should discourage naive application of biological methods by inexperienced people who are misled by the mechanical simplicity of biological systems.

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