

P. M. SUTTON & ASSOCIATES, INC.

ENVIRONMENTAL ENGINEERING CONSULTANTS

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Paul M. Sutton, P.Eng., Ph.D.

President and Principal Engineer

Qualifications

Dr. Paul Sutton, the principal of P.M. Sutton & Associates, has a wealth of experience in the treatment of industrial and municipal wastewater, and contaminated surface and groundwater, specializing in the field of biotechnology as applied to environmental management. An innovative chemical and environmental engineer with over thirty-nine years of experience, Dr. Sutton is recognized nationally and internationally for his efforts in the development and commercialization of advanced biological processes for treatment of industrial and municipal wastewater.

Expertise:	Process and system design engineering Biological nutrient removal systems Anaerobic treatment systems Development and commercialization of novel biological treatment systems
Experience:	39 years engineering
Education:	Ph.D. Chemical Engineering M.Eng. Chemical Engineering B.Appl.Sci. Chemical Engineering

Dr. Sutton has experience as a researcher, consultant, and as a supplier of equipment and systems in the treatment of contaminated waters and wastewaters. Prior to establishing P.M. Sutton & Associates in late 1987, Dr. Sutton held positions of Technical and General Manager at Dorr-Oliver in Stamford, CT, Senior Process Development Engineer at the Wastewater Technology Centre in Burlington, Ontario, and Private Consultant in Hamilton, Ontario.

Education

Ph.D., Chemical Engineering, 1976, McMaster University, Hamilton, Ontario
M. Eng., Chemical Engineering, 1973, McMaster University, Hamilton, Ontario
B. Appl. Sc., Chemical Engineering, 1971, Queen's University, Kingston, Ontario
Executive Education Programs, 1983-1985, Business Administration and Executive Development, Standard Oil Company of Ohio/British Petroleum

Professional Affiliations

Association of Professional Engineers of the Province of Ontario
Water Environment Federation (WEF)
International Water Association (IWA)

Key Experience/Accomplishments

- Served on the Water Environment Research Foundation (WERF) project subcommittee formed to support the investigation of hybrid suspended growth/attached growth biosystems (1994-1999), the committee formed to establish research priorities for debottlenecking, optimizing and rerating wastewater treatment plants (1998-1999) and the subcommittee formed to support the pilot investigation of a membrane aerated bioreactor (2000-2003). Served on Water Environment Federation (WEF) committees developing manuals for nutrient removal (1995-1998) and membrane treatment (2004-2005). Member of the WEF Municipal Wastewater Treatment Design Committee. Has served as a chapter author of various books and manuals including EPA's 1993 Nitrogen Control Manual. Served as peer reviewer for EPA's National Center for Environmental Research (2000). Has organized and directed short courses on the topics of membrane biological reactors (2003), nitrogen control treatment systems (1993) and biological fluidized bed reactors (1990).
- Developed process design criteria for removal of carbonaceous material and nitrogen compounds in biological suspended growth systems (1974-1977). Criteria was subsequently adopted by government agencies in the U.S. and Canada and extensively referenced in the Water Pollution Control Federation Manual of Practice FD-7 (1983) and EPA's 1975 Nitrogen Control Manual.
- Key member of the team selected by WERF to complete the research project entitled "Membrane Bioreactors for Anaerobic Treatment of Conventional and Medium Strength Wastewater" (2002-2006).
- Received the 1995 Willem Rudolfs Medal from WEF for noteworthy accomplishment in industrial waste control.
- Developed a municipal wastewater treatment flowsheet which achieves the goals of energy sustainability and water and nutrient recovery, now undergoing commercialization (2006-to-date).
- In cooperation with General Motors, developed concept for treatment of oily wastewaters based on the coupling of biological and membrane ultrafiltration processes now in wide application (1985-1987).
- Member of the International Water Association (IWA) committee that established a standard notation for use in the description of wastewater treatment processes (1986-1987).
- Led commercialization of the biological fluidized bed reactor (FBR) concept to the extent where the Dorr-Oliver full scale reference list consisted of twenty five reactors as of 1986. Responsible for the process design of a number of commercial scale FBR systems for perchlorate and other more difficult to remove contaminants, since the late 1990s.

Technical Services

- Providing a preliminary technical/economical evaluation of alternative solutions, or peer review of proposed solutions, for treatment of an industrial or municipal wastewater stream or remediation of a contaminated surface or groundwater.
- Developing pilot and bench scale treatability testing programs, analyzing results and preparing reports in support of obtaining information for design of a full scale treatment system
- Developing and/or reviewing critical process design specifications and providing total system engineering including equipment sizing, specification development, instrumentation and controls engineering, piping and tank sizing, and hydraulic design for conventional and advanced biological treatment systems.
- Providing assistance in the commissioning of new treatment plants, preparing operating manuals, participating in process start-up, providing mechanical and instrumentation calibration and start-up, training employees and completing follow-up performance assessments.

- Assessing the performance of existing treatment systems through monitoring, sampling/analysis and review of operating history, and providing recommendations for improving plant performance.

Selected Client References

ADI Systems	Hydromantis
Aqwise	HydroQual
Asahi Kasei Chemicals	Infilco Degremont
Black & Veatch	Malcolm Pirnie
Blue Water Technologies	Metaldyne Corporation
British Petroleum	Monsanto
Brown & Caldwell	Nalco
DTE Energy	Pall Corporation
Dofasco Steel	SEA Consultants
Doosan Hydro	Shaw Environmental
EnerTech Environmental	Siemens
Essar/Algoma Steel	Stearns & Wheeler
Envirogen Technologies	Synagro Technologies
Fuss & O'Neill	URS Corporation
General Motors	U.S. Environmental Protection Agency
General Motors of Canada	Water Environment Federation
Geomatrix Consultants	Weyerhaeuser
Givaudan	General Electric

Selected Publications and Patents

Following is a list of more recently published papers/reports. Dr. Sutton's complete list of over 130 publications and numerous patents is available upon request.

Resource Recovery and Municipal Wastewater Treatment: Modeling of a New Approach. (with O.J. Schraa, R. Goel and H. Andres). Proceedings of the WEF 2011 Energy and Water Conference, Chicago, IL, CD-ROM, July-August (2011).

Wastewater as a Resource: A Unique Approach to Achieving Energy Sustainability (with B.E. Rittmann, O.J. Schraa, J.E. Banaszak and A.P. Togna). *Water Science & Technology*, 63, 9, pp. 2004-2009 (2011).

Treating Municipal Wastewater with the Goal of Resource Recovery (with H. Melcer, O.J. Schraa and A.P. Togna). *Water Science & Technology*, 63, 1, pp. 25-31 (2011).

Biological Fluidized Bed Reactor Technology: The Optimal Approach for Treatment of Perchlorate Contaminated Groundwater or Drinking Water. Proceedings of the WEF/IWA Biofilm Reactor Technology Conference, Portland, OR, CD-ROM, August (2010).

Wastewater Treatment and Sustainability: The Role of MBRs and Membranes (with A.P. Togna). Proceedings of the WEF Membrane Applications 2010 Conference, Anaheim, CA, CD-ROM, June (2010).

How Low Must You Go (with O.J. Schraa and R.L. Newcombe). *Water Environment and Technology*, 22, 4, pp. 32-36 April (2010).

Resource Recovery and Municipal Wastewater Treatment: A New Approach Combining Biological and Physical-Chemical Processes (with C. Wallis-Lage, O.J. Schraa and A.P. Togna). Proceedings of the WEF 82nd Annual Conference & Exhibition, Orlando, FL, CD-ROM, October (2009).

Continuous Backwash Filters: An Attractive Technology for Phosphorus Removal and Recover (with O.J. Schraa, C. Lancaster, A.P. Togna and R. Newcombe). Proceedings of the WEF Nutrient Removal 2009 Conference, Sustainable Treatment Solutions, Washington, D.C., CD-ROM, June-July (2009).

Wastewater Treatment and the Green Revolution (with A.P. Togna and O.J. Schraa). Proceedings of the International Conference on Nutrient Recovery from Wastewater Streams, Vancouver, BC, Canada, May (2009).

- Rotating Belt Screens: An Attractive Alternative for Primary Treatment of Municipal Wastewater* (with B. Rusten, A. Ghanam, R. Dawson and H. Kelly). Proceedings of the WEF 81st Annual Conference & Exposition, Chicago, IL, CD-ROM, October (2008).
- Long Term Application of Bioreactor and Membrane Technologies for Treatment of Metalworking Fluid Wastewaters* (with P. Gignac and A. Janson). Proceedings of the WEF Membrane Technology 2008 Conference, Atlanta, GA, CD-ROM, January (2008).
- Membrane Bioreactors for Industrial Wastewater Treatment: Applicability and Selection of Optimal System Configuration*. Proceedings of the WEF 79th Annual Conference & Exposition, Dallas, TX, CD-ROM, October (2006).
- Bioreactor Configurations for Ex-Situ Treatment of Perchlorate: A Review*. Water Environment Research, 78, 13, pp. 2417-2427, December (2006).
- Evaluating Bioreactor Alternatives* (with A.P. Togna). Water Environment and Technology, 18, 10, pp. 45-49, October (2006).
- Parameters Governing Permeate Flux in an Anaerobic Membrane Bioreactor Treating Low-Strength Municipal Wastewaters: A Literature Review* (with P.R. Berube and E.R. Hall). Water Environment Research, 78, 8, pp. 887-896, August (2006).
- Biological Treatment of Industrial Wastewaters and Other Contaminated Aqueous Streams: Selection of Bioreactor Alternatives* (with A.P. Togna). Proceedings of the WEF 51st Annual Conference & Exposition, Washington, D.C., CD-ROM, October/November (2005).
- Bioreactor Configurations for Ex-situ Treatment of Perchlorate: A Review*. Proceedings of the WEF Technology 2005, 2nd Joint Specialty Conference for Sustainable Management of Water Quality Systems for the 21st Century, San Francisco, CA, August (2005).
- Membrane Biological Reactors for Treatment of High-Strength Pharmaceutical Wastewater* (with A.P. Togna, S. Frisch and W. Guarini). Membrane Separation Technology News, Volumes 23 & 24, Nos. 8 & 9, May & June (2005).
- Membrane Bioreactors for Anaerobic Treatment of Wastewater – Phase 1 Report: Compilation/Review of Existing Literature* (with P.R. Berube and E.R. Hall). WERF Project 02-CTS-4 (2004).
- Pretreatment of Food and Dairy Processing Wastewater: Full Scale Application of the Biological Suspended Carrier Reactor System* (with A.P. Togna and H.D. Voight). Proceedings of the WEF 50th Annual Conference & Exposition, New Orleans, LA, CD-ROM, October (2004).
- Membrane Bioreactors for Industrial Wastewater Treatment: The State-of-the-Art Based on Full Scale Commercial Applications*. Proceedings of the WEF 74th Annual Conference & Exposition, Atlanta, GA, CD-ROM, October (2003).
- Biomass-Effluent Separation: Industrial Wastewater Treatment Application*. Proceedings Twenty-First Annual Membrane/Separation Technology Planning Conference, Boston, MA December (2003).
- Membrane Bioreactors for Anaerobic Treatment of Conventional and Medium Strength Wastewater* (with P.R. Berube, E.R. Hall and A.P. Togna). Membrane Technologies: Application in Wastewater Treatment, WEFTEC 2003 Workshop, pp. 6-13 to 6-32. October (2003).
- Testing and Process Design of a Thermophilic Membrane Biological Reactor to Treat High-Strength Beverage Wastewater* (with A.P. Togna, Y. Yang and H.D. Voight). Proceedings of the WEF 49th Annual Conference & Exposition, Los Angeles, CA, CD-ROM, October (2003).
- Modified Membrane Biological Reactor Reduces Disposal Costs* (with P.N. Mishra, J.A. Roberts, L. Abreu and P. Gignac). Industrial Wastewater, Volume 2, Number 1 (2003).
- Biotreatment of Pharmaceutical Wastewaters: An Ideal Application for MBRs* (with A.P. Togna). Proceedings 9th Annual WEF Industrial Wastes Technical and Regulatory Conference, San Antonio, TX, CD-ROM, April (2003).
- Membrane Separation Applications to Biosystems for Wastewater Treatment* (with D. Enegess and A.P. Togna). Filtration & Separation, pp. 1-5, January/February (2003).

- Membrane Biological Reactors for Treatment of High Strength Pharmaceutical Wastewater* (with A.P. Togna, S. Frisch and W.J. Guarini). Proceedings Industrial Wastewater and Best Available Technologies: Performance, Reliability and Economics, Nashville, TN, CD-ROM, February (2003).
- Treatment of MTBE-Contaminated Water in Fluidized Bed Bioreactors* (with S. Vainberg, A.P. Togna and R.J. Steffan). Journal of Environmental Engineering, pp. 842-851, September (2002).
- Membrane Bioreactor Industrial and Municipal Wastewater Applications: Long Term Operating Experience* (with P.N. Mishra, J.R. Bratby and D. Enegess). Proceedings of the WEF 48th Annual Conference & Exposition, Chicago, IL, CD-ROM, October (2002).
- Membrane Biological Reactor System Development for Treatment of High-strength Industrial Wastewater* (with A.P. Togna, A. Bohner, T. Webster, W. Guarini, M. Murray, S. Robinson and C. Presgrave). Proceedings of the WEF 48th Annual Conference & Exposition, Chicago, IL, CD-ROM, October (2002).
- Combined and Separate Municipal and Leachate Wastewater Treatment: Full Scale Application of the Membrane Bioreactor System* (with J. Manning, F.R. Gaines and W.G. Dunn). Proceedings of the WEF 74th Annual Conference and Exposition, Atlanta, GA, CD-ROM, October (2001).
- Oily Wastewater Membrane Bioreactor Treatment: The General Motors Windsor Powertrain Plant Experience* (with P.N. Mishra). Membrane Technology: Research and Applications in Wastewater Treatment, WEFTEC 2001 Workshop, pp. 153-168, October (2001).
- Treatment of MTBE Contaminated Groundwater in a Membrane Bioreactor* (with R.J. Steffen, A.P. Togna and S. Vainberg). Proceedings of the Sixth International Symposium In Situ and On-Site Bioremediation, San Diego, CA, June (2001).
- Application of the Membrane Biological Reactor Systems for Combined Sanitary and Industrial Wastewater Treatment* (with J.A. Roberts and P.N. Mishra). International Biodeterioration & Biodegradation 46, pp. 37-42 (2000).
- Industrial Biotreatment Plant Capacity Expansion and Upgrading Through Application of Membrane Biomass-Effluent Separation* (with J. Cantor, R. Steinheber and L. Novachis). Proceedings of the WEF 73rd Annual Conference & Exposition, Anaheim, CA, CD-ROM, October (2000).
- Membrane Biotreatment of Automotive Manufacturing Plant Wastewaters: Flowsheet Optimization* (with P.N. Mishra, J.A. Roberts and G. Vicevic). Membrane Technologies for Industrial and Municipal Wastewater Treatment and Reuse, WEF, pp. 255-270, October (2000).
- Perchlorate Treatment Utilizing GAC and Sand Based Biological Fluidized Bed Reactors* (with M. Greene). Proceedings of the WEF 72nd Annual Conference & Exposition, New Orleans, LA, CD-ROM, October (1999).
- Research Priorities for Debottlenecking, Optimizing, and Rerating Wastewater Treatment Plants* (with D. Parker, J. Buttz, G. Daigger, S. Dentel, J. Farrell and J. Stephenson). WERF, Project 99-WWF-1 (1999).
- Biological Fluidized Bed Treatment of Wastewater from Byproduct Coking Operations: Full Scale Case History* (with J. Hurvid and M. Hoeksema). Water Environment Research, 71, 1, pp. 5-9 (1999).
- Membrane Filtration* (with J. Cantor, R. Steinheber and M. Myronyk). Industrial Wastewater, Volume 7, No. 4, pp. 18-22, November/December (1999).
- Biological and Chemical Systems for Nutrient Removal* (with other members of task force). Prepared by Task Force on Biological and Chemical Systems for Nutrient Removal, WEF (1998).
- Application of Biotechnology for Environmental Control at General Motors Facilities* (with P.N. Mishra). Proceedings WEF Industrial Wastes Technical Conference, New Orleans, LA, pp. 8-23 to 8-34, March (1997).
- Phosphorus and Metals Removal from Assembly Plant Wastewaters Utilizing Membrane Enhanced Biotreatment* (with M.D. Knoblock and P.N. Mishra). Proceedings of the WEF 69th Annual Conference & Exposition, Dallas, TX, Volume 3, pp. 437-446, October (1996).
- Industrial Wastewater Biotreatment Optimization Through Membrane Applications* (with P.N. Mishra, P. Gignac and A. Janson). Proceedings of the 89th Annual Meeting Air & Waste Management Association, Nashville, TN, June (1996).