BIOGRAPHICAL SKETCH - RAKESH GOVIND

PROFESSIONAL POSITIONS

- 2018- Co-Founded Nextgen Septic, LLC
- 2003 - Co-founded LCP Tech, Inc.
- 1996 - President and Founder of PRD Tech, Inc.
- 1988– Professor, University of Cincinnati
- 1984–1988 Associate Professor, University of Cincinnati
- 1979–1984 Assistant Professor, University of Cincinnati
- 1978–1979 Director of Industrial Control and Process Safety Center, Carnegie-Mellon Institute of Research (Mellon Institute), Pittsburgh, PA
- 1974–1978 Graduate Research & Teaching Assistant, Carnegie-Mellon University

EDUCATIONAL BACKGROUND

- B.S., Chemical Engineering, Indian Institute of Technology, Kanpur, 1974
- M.S., Chemical Engineering, Carnegie-Mellon University, 1977
- Ph.D., Chemical Engineering, Carnegie-Mellon University, 1978

SELECTED MAJOR HONORS

- Invited for "Scientists Helping America" 2002
- Earth Day Award, Cincinnati Gas & Electric Company, 1994, 1993, 1992
- Invited Keynote Speaker at International Conference on Membrane Reactors, Lyon, France, 1994
- Alfred Bodine Award, Society of Manufacturing Engineers, 1992
- Junior Morrow Research Chair Award, University of Cincinnati, 1988

RELEVANT EXPERIENCE

- Principal Investigator of 45 Research Projects with a total funding of $4.8 million.
- Reviewer for several funding agencies (NSF, DOE, EPA), Universities and Journals.
- Member of several national committees in the American Institute of Chemical Engineers and American Chemical Society.
- Chairman of several conference sessions at national and international meetings.
- Consultant to several corporations and the U.S. EPA
- Awarded several U.S. and Worldwide Patents.
- Founded several successful companies

SELECTED PATENTS

1. **SYSTEMS, APPARATUS, AND METHODS FOR SEPARATING SALTS FROM WATER**
   Publication number: 20140299529
   Abstract: A system, method, and apparatus for desalinating water, such as seawater. The system, method, and/or apparatus includes an electrodialysis cell that can separate monovalent ionic species from multivalent ionic species, so they may be separately treated. Each separate treatment may include precipitation of salt via the use of an organic solvent, followed by processing of precipitated salts and membrane treatment of water to remove solvent and remaining salts.
   Type: Application
   Filed: June 20, 2014
   Publication date: October 9, 2014
   Inventors: Rakesh Govind, Robert Foster

2. **SEPARATION OF NEUTRALLY BUOYANT MATERIALS FROM WATER**
Publication number: 20140158631
Abstract: Described herein are methods of separating phase separated, neutrally buoyant materials from liquids and apparatuses for carrying out the methods. The methods and apparatuses employ nanobubbles. In certain embodiments, the nanobubbles may be formed in solutions of hydrophobically modified water soluble polymers. The methods result in removal of 90% by weight or more of neutrally buoyant materials from liquids. The methods are useful in certain embodiments for separating neutrally buoyant oily mixtures from water produced by mining operations.
Type: Application
Filed: December 6, 2013
Publication date: June 12, 2014
Applicant: ADVANCED WATER RECOVERY, LLC
Inventors: Rakesh Govind, Robert Foster

3. **SELECTIVE SEPARATION OF A SALT FROM WATER**
Publication number: 20140158632
Abstract: Described herein are methods of separating a first soluble salt from water that contains the first soluble salt and a second soluble salt, by (a) adding a composition to a water product containing a first soluble salt and a second soluble salt, the composition comprising seed crystals composed substantially of a target insoluble salt to be formed from the first soluble salt; and (b) collecting the target insoluble salt. These methods may be used, for example, to separate strontium from water that includes at least one soluble strontium salt and a second soluble salt (such as one soluble calcium salt).
Type: Application
Filed: December 6, 2013
Publication date: June 12, 2014
Applicant: ADVANCED WATER RECOVERY, LLC
Inventors: Rakesh Govind, Robert Foster

4. **METHODS OF SEPARATING SALTS AND SOLVENTS FROM WATER**
Publication number: 20140158514
Abstract: Methods and apparatus for separation of one or more salts from water are described. The methods include addition of a water miscible solvent to the water, followed by separation of the precipitated salt in a slurry, and evaporation of the water miscible solvent from the slurry. The apparatus include a novel design for a wetted wall separator tube that allows the solids in the slurry to pass through while providing efficient evaporation of the water miscible solvent from the water.
Type: Application
Filed: December 6, 2013
Publication date: June 12, 2014
Applicant: ADVANCED WATER RECOVERY, LLC
Inventors: Rakesh Govind, Robert Foster

5. **SYSTEMS, APPARATUS, AND METHODS FOR SEPARATING SALTS FROM WATER**
Publication number: 20140158616
Abstract: A system, method, and apparatus for precipitating a water soluble salt or water soluble salts from water, including adding a water-miscible solvent to a water solution including an inorganic salt. The system, method and apparatus also allow for the separation of the precipitated salt, and for separation of the solvent from the water. In doing so, reclamation of water is provided.
Type: Application
Filed: December 6, 2013
Publication date: June 12, 2014
Applicant: Advanced Water Recovery, LLC
Inventors: Rakesh Govind, Robert Foster

6. **ENZYMATICALLY ACTIVE COMPOSITIONS FOR SUPPRESSING SULFIDE GENERATION AND METHODS OF USE THEREOF**
Patent number: 8535661
Abstract: The present invention provides an enzymatically active composition for suppressing sulfide generation. The composition is free from sulfur dehydrogenase and comprises at least one enzyme having sufficient sulfide-production inhibiting activity in an acidic medium to at least inhibit biogenic sulfide production, and an oxidized nitrogenous inorganic salt present in an amount sufficient to act as an electron acceptor for the enzyme. The oxidized nitrogenous inorganic salt preferably is selected from an alkali metal nitrite, an alkaline earth metal nitrite, an alkali metal nitrate, an alkaline earth metal nitrate, or a mixture of two or more of the foregoing salts. The enzymatically active composition is free from viable bacteria and is non-toxic (i.e., has an oral LD50 in rats greater than 1000 mg/Kg of body weight at a concentration of about 25,000 parts per million (ppm) in water).
Type: Grant
Filed: January 15, 2010
Date of Patent: September 17, 2013
Assignee: LCP Tech Holdings LLC
Inventors: Rakesh Govind, David Ferguson

7. **ENZYMATICALLY ACTIVE COMPOSITIONS FOR SUPPRESSING SULFIDE GENERATION AND METHODS OF USE THEREOF**
Publication number: 20100239555
Abstract: The present invention provides an enzymatically active composition for suppressing sulfide generation. The composition is free from sulfur dehydrogenase and comprises at least one enzyme having sufficient sulfide-production inhibiting activity in an acidic medium to at least inhibit biogenic sulfide production, and an oxidized nitrogenous inorganic salt present in an amount sufficient to act as an electron acceptor for the enzyme. The oxidized nitrogenous inorganic salt preferably is selected from an alkali metal nitrite, an alkaline earth metal nitrite, an alkali metal nitrate, an alkaline earth metal nitrate, or a mixture of two or more of the foregoing salts. The enzymatically active composition is free from viable bacteria and is non-toxic (i.e., has an oral LD50 in rats greater than 1000 mg/Kg of body weight at a concentration of about 25,000 parts per million (ppm) in water).
Type: Application
Filed: January 15, 2010
Publication date: September 23, 2010
Inventors: Rakesh Govind, David Ferguson

8. **PROCESS FOR THE PURIFICATION OF ACIDIC METAL-BEARING WASTE WATERS TO PERMISSIBLE DISCHARGE LEVELS WITH RECOVERY OF MARKETABLE METAL PRODUCTS**
Patent number: 7279103
Abstract: Acidic metal-bearing wastewaters are treated to produce a finished water of sufficient purity to meet discharge standards while recovering metals removed in forms which are commercially valuable. The metals are selectively precipitated, either in a batch or in a continuous system, for removal of individual metal products in a specific sequence of steps from the wastewater. In each step, the pH is adjusted to the specific pH range and sulfide ion is introduced to precipitate the metals, excepting the removal of ferric iron and aluminum which is achieved using hydroxide precipitation. Bioconversion process using unique equipment converts sulfate in the wastewater to the hydrogen sulfide gas required for the precipitation process. This bioconversion process reduces the sulfate in the wastewater so that the water can be directly discharged or used for agricultural applications.
Type: Grant
Filed: September 13, 2005
Date of Patent: October 9, 2007
Assignee: United States of America Enviromental Protection Agency
Inventors: John Burckle, Rakesh Govind, Fred Kawahara, Richard Scharp, Henry Tabak

9. **NITRIC OXIDE SENSOR**
Publication number: 20070181444
Abstract: The present invention generally relates to sensors configured to sense concentrations of nitric oxide. The sensors of the present invention generally comprise a selectively permeable membrane, a semi-permeable reference electrode, and a sensing electrode. The membrane generally comprises a dispersed solid electrolyte. The solid electrolyte generally is a nitric oxide trapping agent configured to stabilize the nitric oxide to form stable, oxidizable nitric oxide complexes. The nitric oxide complexes may then diffuse through the membrane and the reference electrode to the sensing electrode where they are oxidized. An electrical current indicative of the concentration of the nitric oxide generated by the oxidation may be transmitted from the sensor to a picoammeter, which may be configured to measure the electrical current and to signal to a user of the sensor the concentration of the nitric oxide.
Type: Application
Filed: October 13, 2006
Publication date: August 9, 2007
Applicant: UNIVERSITY OF CINCINNATI
Inventors: Jonathan Bernstein, Rakesh Govind

10. **PROCESS FOR THE PURIFICATION OF ACIDIC METAL-BEARING WASTE WATERS TO PERMISSABLE DISCHARGE LEVELS WITH RECOVERY OF MARKETABLE METAL PRODUCTS**
Publication number: 20070090057
Abstract: Acidic metal-bearing wastewaters are treated to produce a finished water of sufficient purity to meet discharge standards while recovering metals removed in forms which are commercially valuable. The metals are selectively precipitated, either in a batch or in a continuous system, for removal of individual metal products in a specific sequence of steps from the wastewater. In each step, the pH is adjusted to the specific pH range and sulfide ion is introduced to precipitate the metals, excepting the removal of ferric iron and aluminum which is achieved using hydroxide precipitation. Bioconversion process using unique equipment converts sulfate in the wastewater to the hydrogen sulfide gas required for the precipitation process. This bioconversion process reduces the sulfate in the wastewater so that the water can be directly discharged or used for agricultural applications.
Type: Application
Filed: September 13, 2005
Publication date: April 26, 2007
Inventors: John Burckle, Rakesh Govind, Fred Kawahara, Richard Scharp, Henry Tabak

11. **LIQUID CRYSTAL POLYMER TECHNOLOGY CHEMICALS AND APPLICATIONS**
Patent number: 7125499
Abstract: Liquid phase liquid crystal polymers (LCPs) are disclosed having a composition and structure that can be varied to provide desirable properties. The liquid phase LCPs have polyiminoborane, polyaminoborane, and/or borozine polymer backbone molecules, with silicon and/or phosphorous side chain molecules linked to the backbone that provide a degree of alignment assigned an Order Parameter (S), defined as S=? [3 cos2 ??1], where ? is the angle between the axis of an LCP molecule and the vertical direction. The inventive liquid phase LCPs have an average Order Parameter in the range of about 0.2 to about 0.99 and are applicable to a number of rinse, coolant, lubricant, sterilization and other protectant processes.
Type: Grant
Filed: August 12, 2002
Date of Patent: October 24, 2006
Assignee: LCP Tech Holdings, LLC
Inventors: Thomas David Ferguson, Rakesh Govind

12. **LIQUID CRYSTAL POLYMER TECHNOLOGY CHEMICALS AND APPLICATIONS**
Publication number: 20050072960
Abstract: Liquid phase liquid crystal polymers (LCPs) are disclosed having a composition and structure that can be varied to provide desirable properties. The liquid phase LCPs have polyiminoborane, polyaminoborane, and/or borozine polymer backbone molecules, with silicon and/or phosphorous side chain molecules linked to the backbone that provide a degree of alignment assigned an Order Parameter (S), defined as S=?[3 cos2 ??1], where ? is the angle between the axis of an LCP molecule and the vertical direction. The inventive liquid phase LCPs have an average Order Parameter in the range of about 0.2 to about 0.99 and are applicable to a number of rinse, coolant, lubricant, sterilization and other protectant processes.
Type: Application
Filed: August 12, 2002
Publication date: April 7, 2005
Inventors: Thomas Ferguson, Rakesh Govind

13. **NON-OZONE DEPLETING VAPOCOOLANTS**
Patent number: 6737041
Abstract: Chemical compositions are provided, for use as topical anesthetics or skin refrigerants. These compositions do not cause the depletion of the stratospheric ozone layer and are non-toxic, non-carcinogenic and less flammable than ethyl chloride. Also these chemical compositions match the skin temperature versus time profile needed in the management of myofascial pain syndromes, for effectively freezing skin prior to minor skin surgery and for effectively freezing skin prior to giving painless injections.
Type: Grant
Filed: August 20, 1993
Date of Patent: May 18, 2004
Assignee: University of Cincinnati
Inventors: Ajaz S. Hussain, Rakesh Govind

14. **METHOD OF DESTRUCTIVE, NONINVASIVE HYPERPYREXIA OF TISSUES AND ORGANISMS UTILIZING NUCLEAR MAGNETIC RESONANCE**
Patent number: 5690109
Abstract: A method of selectively heating targeted cells within a specimen while avoiding heating of non-targeted cells is provided. The method comprises the steps of:(a) determining at least one combination of magnetic field strength and radio wave frequency (strength-frequency combination) at which only the targeted cells will resonate when the magnetic field and the electromagnetic radiation are applied to the specimen orthogonal to one another; and(b) applying a magnetic field and a radio frequency wave to the targeted cells, the strength of the magnetic field and the frequency of the radio wave corresponding to the strength-frequency combination to the targeted cells, in order to cause nuclear magnetic resonance in the targeted cells, thereby increasing the temperature of only the targeted cells.
Type: Grant
Filed: June 23, 1995
Date of Patent: November 25, 1997
Inventors: Rakesh Govind, Robert G. Loomis

15. **ADSORPTION OF GASES BY AMINE AND PHOSPHINE COMPLEXED MN(II) AND COMPOUNDS**
Patent number: 4713091
Abstract: Amine or diphosphine complexed Mn(II) compounds reversibly adsorb sulfur dioxide and oxygen as well as nitrogen oxides, carbon monoxide, carbon dioxide and lower alkenes. More specifically, these compounds have the following formula:Mn(II)LX.sub.2where X represents F.sup.-, Br.sup.-, Cl.sup.-, I.sup.-, SCN.sup.- or OH.sup.-. L is a ligand having the formula ##STR1## The metal complexes are used to adsorb gases as a solid adsorbent, suspended on aluminum oxide or dissolved in a non-volatile solvent. The gas can be adsorbed at a low temperature in the range of 30.degree.-200.degree. C., and desorbed at a higher temperature in the range of 45.degree.-230.degree. C. or at a lower pressure.
Type: Grant
Filed: October 20, 1986
Date of Patent: December 15, 1987
Assignee: University of Cincinnati
Inventor: Rakesh Govind

16. **DUAL DISTILLATION COLUMNS**
Patent number: 4681661
Abstract: Dual interrelated distillation columns are disclosed wherein the heat for a first column is transferred by thermal conduction through a common wall or surface to a second column to increase efficiency and decrease waste of energy. In one embodiment, the first heat generating column is a cylindrical column, and the second column is an annular column concentric to the first column. This concentric arrangement permits the heat generated in the first column to flow outwardly into the second column, thereby improving its efficiency and reducing the heat loss. Typically, the inner first column is a high pressure rectifying column, and the outer concentric column is a stripping column. In an alternate embodiment, the inner column can simply be a portion of a high pressure distillation process, and the outer column is a portion of a lower pressure distillation column.
Type: Grant
Filed: October 9, 1984
Date of Patent: July 21, 1987
Inventor: Rakesh Govind

17. **ADSORPTION OF GASES BY AMINE COMPLEXED MN (II)**
Patent number: 4668255
Abstract: Amine complexed Mn(II) compounds reversibly adsorb sulfur dioxide and oxygen as well as nitrogen oxides, carbon monoxide, carbon dioxide and lower alkenes. More specifically, these compounds have the following formula:Mn(II)LX.sub.2where X represents F.sup.-, Br.sup.-, I.sup.-, SCN.sup.- or OH.sup.-. L is a ligand having the formulaN(R.sub.1).sub.n or R.sub.2 --N.dbd.N--R.sub.3wherein R.sub.1, R.sub.2 and R.sub.3 represents identical or different substituents generally including alkyl, aryl, cycloalkyl, heterocyclic and heterocyclic aromatic radicals and n is 1-3. The metal complexes are used to adsorb gases as a solid adsorbent, suspended on aluminum oxide or dissolved in a non-volatile solvent. The gas can be adsorbed at a low temperature in the range of 30.degree.-200.degree. C., and desorbed at a higher temperature in the range of 45.degree.-230.degree. C. or at a lower pressure.
Type: Grant
Filed: October 30, 1985
Date of Patent: May 26, 1987
Assignee: University of Cincinnati
Inventor: Rakesh Govind

18. DISTILLATION COLUMN AND PROCESS

Patent number: 4615770

Abstract: Dual interrelated distillation columns are disclosed wherein the heat from a first column is transferred by thermal conduction through a common wall or surface to a second column to increase efficiency and decrease waste of energy. In one embodiment, the first heat generating column is a cylindrical column, and the second column is an annular column concentric to the first column. This concentric arrangement permits the heat generated in the first column to flow outwardly into the second column, thereby improving its efficiency and reducing the heat loss. Typically, the inner first column is a high pressure rectifying column, and the outer concentric column is a stripping column. In an alternate embodiment, the inner column can simply be a portion of a high pressure distillation process, and the outer column is a portion of a lower pressure distillation column.

Type: Grant

Filed: February 26, 1985

Date of Patent: October 7, 1986

Inventor: Rakesh Govind

BOOK CHAPTERS (PAST 3 YEARS)

1. **Microbial Treatment of Acid Mine Drainage: Metal Toxicity and Biosorption. Vivek P. Utgikar**, Bor-Yann Chen, Henry H. Tabak, and, Rakesh Govind. In Case "Studies in the Remediation of Chlorinated and Recalcitrant Compounds." Wickramanayake G.B., Gavaskar A.R., Gibbs J.T. and Means J.L., (Ed.). Vol. C2-7, pp. 307-318, Battelle Press, Columbus, Ohio, 2000.
2. **Effect of Metal Ions on Acetate-Utilizing Mixed Culture of Sulfate-Reducing Bacteria (SRB). Vivek P. Utgikar**, Henry H. Tabak, John R. Haines, Stephen M. Harmon, and Rakesh Govind. To be published in the Proceedings of the Sixth International Symposium on In Situ and On-Site Bioremediation to be held in San Diego, June 2001.
3. **Biomedia Design for Biofilters** Rakesh Govind and Sandeep Narayan. Published in *Biofilters for Odor Control*.
4. **Membrane Reactor Technology**, Book published by American Institute of Chemical Engineers

PRESENTATIONS AT SCIENTIFIC MEETINGS (INCOMPLETE)

1. **New Biofiltration Technology for MACT Compliance**, Paper to be presented at the Panel and Engineered Lumber International Conference and Exposition (2008)
2. **Controlling Odors from Wastewater Treatment Plants**, IDS Paper (2007)
3. **The Science of Odors**, Waste and Water News, August 2007.
4. **Membranes for Bioseparations**, Chair Session, AIChE Conference, Nov 2007
5. **Biocatalysts for Accelerated Treatment of Municipal and Industrial Wastewater**, IDS Paper (2003)
6. **Advances in Biotreatment of Acid Mine Drainage abd Biorecovery of Metals. 2. Membrane Bioreactor System for Sulfate Reduction**, Biodegradation, Vol. 14, No. 6 (2003)
7. **Acid Mine Drainage Remediation by Mixed Cultures of Sulfate Reducing Bacteria: Biosorption and Metal Toxicity Studies**, V.P. Utgikar, B.Y. Chen, H.H. Tabak, D.F. Bishop, and R. Govind. Paper presented at the XIth Triennial Meeting of the International Biodeterioration and Biodegradation Society, Arlington, VA, August 1999.
8. **Feasibility Study on Metal Biosorption of Acid Mine Water using Cultures of Sulfate-Reducing Bacteria.** B.-Y. Chen, V.P. Utgikar, H.H. Tabak, D.F. Bishop, and R. Govind. Poster presented at the XIth Triennial Meeting of the International Biodeterioration and Biodegradation Society, Arlington, VA, August 1999.
9. **Quantification of Heavy Metal Toxicity to Microbe-Mediated Sulfate Reduction of Acid Mine Drainage and Extenuation using Biosorption.** Utgikar, V.P., Chen, B.-Y., Tabak, H.H., Bishop, D.F., and, Govind, R. Paper presented at the 20th Annual Meeting of Society of Environmental Toxicology and Chemistry, Philadelphia, PA, November 1999.
10. **Biosorption and Toxicity Study of Metal Ions in Acid Mine Water using Pure Cultures of Sulfate Reducing Bacteria.** Chen, B.-Y., Utgikar, V.P., Tabak, H.H., Bishop, D.F., and, Govind, R. Poster

presented at the 20th Annual Meeting of Society of Environmental Toxicology and Chemistry, Philadelphia, PA, November 1999.

11. **Microbial Sulfate Reduction of Acid Mine Drainage: Toxicity and Biosorption of Metal Ions.** Vivek P. Utgikar, Bor-Yann Chen, Henry H. Tabak, Dolloff F. Bishop, Rakesh Govind. Paper presented at the 10th Annual West Coast Conference on Contaminated Soils and Water, Association for the Environmental Health of Soils (AEHS), San Diego, CA, March 2000.
12. **Metal Toxicity and Biosorption Studies of Pure Culture Isolates of Sulfate Reducing Bacteria in Acid Mine Drainage Treatment Systems.** Bor-Yann Chen, Vivek P. Utgikar, Henry H. Tabak, Dolloff F. Bishop, Rakesh Govind. Poster presented at the 10th Annual West Coast Conference on Contaminated Soils and Water, Association for the Environmental Health of Soils (AEHS), San Diego, CA, March 2000.
13. **Microbial Treatment of Acid Mine Drainage: Metal Toxicity and Biosorption.** Vivek P. Utgikar, Bor-Yann Chen, Henry H. Tabak, and, Rakesh Govind. Paper presented at the 2nd International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 2000.
14. **Metal Biosorption and Toxicity to Cultures of Sulfate-Reducing Bacteria.** B.-Y. Chen, V.P. Utgikar, H.H. Tabak and R. Govind. Poster presented at the 2nd International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 2000.
15. **Acute Toxicity of Heavy Metal Ions To Sulfate Reducing Bacteria In Acid Mine Drainage Remediation.** Vivek P. Utgikar, Henry H. Tabak, and Rakesh Govind. Paper presented at the 16th Annual International Conference on Contaminated Soils, Sediments and Water, AEHS, Amherst, MA, October 2000.
16. **Effect of Heavy Metals on Sulfate-Reducing Bacteria: Threshold Toxic Concentrations and EC_{50}.** Utgikar, V.P. Tabak, H.H., Haines, J.R., Chen, B.-Y., and, Govind, R. Poster presented at the 21st Annual Meeting of Society of Environmental Toxicology and Chemistry, Nashville, TN, November 2000.
17. **Equilibria and Dynamics of Heavy Metal Biosorption in a Packed Column Adsorber.** Utgikar, V.P., Tabak, H.H., Chen, B.-Y., and, Govind, R. Paper presented at the 2000 Annual Meeting of the American Institute of Chemical Engineers, Los Angeles, November 2000.
18. **Dynamic Response of a Sulfate-Reducing Bioreactor to Heavy Metals.** Utgikar, V.P., Tabak, H.H., Haines, J.R., Chen, B.-Y., and, Govind, R. Paper presented at the 2000 Annual Meeting of the American Institute of Chemical Engineers, Los Angeles, November 2000.
19. **Inhibitory And Toxic Impact Of Metal Ions On Mixed Cultures Of Sulfate-Reducing Bacteria (SRB)**. Vivek P. Utgikar, John R. Haines and Henry H. Tabak, U. S. EPA, Rakesh Govind. Poster presented at the 11th Annual West Coast Conference on Contaminated Soils, Sediments and Water, San Diego, March 2001.
20. **Effect of Metal Ions on Acetate-Utilizing Mixed Culture of Sulfate-Reducing Bacteria (SRB).** Vivek P. Utgikar, Henry H. Tabak, John R. Haines, Stephen M. Harmon, and Rakesh Govind. Paper presented at the Sixth International Symposium on In Situ and On-Site Bioremediation to be held in San Diego, June 2001.
21. **Toxicity and Inhibition of Sulfate Reducing Bacteria by Heavy Metals.** Vivek P. Utgikar, Henry H. Tabak, John R. Haines and Rakesh Govind. Paper presented at the 22nd Annual Meeting of Society of Environmental Toxicology and Chemistry held in Baltimore, November 2001.

REVIEWED PUBLICATIONS

1. Govind, R., R. Melarkode, S. Yada, D. Ferguson, D. Grieszmer, "**Zero-Emission process for Electroplating Operations**," Metal Finishing, 101(5), 44(2003).

2. Govind, R., H.H. Tabak, "**Advances in Biotreatment of Acid Mine Drainage and Biorecovery of Metals**: 2. Membrane Bioreactor System for Sulfate Reduction," Biodegradation, 14(6), 437 (2003).

3. Govind, R., H.H. Tabak, "Advances in Biotreatment of Acid Mine Drainage and Biorecovery of Metals: 1. Metal Precipitation for Recovery and Recycle," Biodegradation, 14(6), 306 (2003).

4. Govind, R. and J. Fang, "**Design of Membrane Reactors**", I&EC Research (2003)

5. Govind, R. and J. Fang, "Biodegradation in Biofilms: Monod Analysis, Part I", Water Science and Technology (2003)

6. Govind, R, "Biofiltration: New Technology for the Metal Finishing Industries," Finishers Management, 4, 56 (2002).

7. Rakesh Govind, "Biofiltration: New Technology for the Metal Finishing Industries," Finishers Management, 4, 56 (2002).

8. Vivek P. Utgikar, Stephen M. Harmon, Navendu Chaudhary, Henry H. Tabak, John R. Haines and Rakesh Govind, "Metal Sulfide Induced Inhibition of Sulfate Reducing Bacteria (SRB)," Accepted for publication in Environmental Toxicology and Chemistry (2002).

9. Vivek P. Utgikar, Henry H. Tabak, John R. Haines and Rakesh Govind, "Mathematical Modeling of Toxic and Inhibitory Impact of Heavy Metals on Mixed Cultures of Sulfate Reducing Bacteria (SRB)," Accepted for publication in Biodegradation and Biodeterioiration (2002).

10. Neil Popovich and Rakesh Govind, "Studies on Granular Aluminum Anode in an Alkaline Fuel Cell," Accepted for publication in Journal of Power Sources (2002).

11. Utgikar V**.**, B.-Y. Chen, H.H. Tabak, D.F. Bishop and Rakesh Govind, "Treatment of Acid Mine Drainage: I. Equilibrium Biosorption of Zinc and Copper on Non-viable Activated Sludge," International Biodeterioration and Biodegradation, 46, 19 (2001).

12. Chen B.-Y., Utgikar V.P**.**, Tabak H.H., Bishop D.F. and Rakesh Govind, "Studies on Biosorption of Zinc(II) and Copper(II) on *Desulfovibrio desulfuricans*," International Biodeterioration and Biodegradation, 46, 11 (2001).

13. Utgikar, V.P**.,** Chen B.-Y., Chaudhary N., Tabak H.H., Haines J.R. and Rakesh Govind, "Acute Toxicity of Acid Mine Water Heavy Metals to Acetate-Utilizing Sulfate Reducing Bacteria: EC_{100} and EC_{50}," Environmental Toxicology and Chemistry, accepted for publication (2001).

14. Vivek P. Utgikar, Bor-Yann Chen, Henry H. Tabak, and, Rakesh Govind, "Microbial Treatment of Acid Mine Drainage: Metal Toxicity and Biosorption," in *Studies in the Remediation of Chlorinated and Recalcitrant Compounds*. Editors, Wickramanayake G.B., Gavaskar A.R., Gibbs J.T. and Means J.L., (Ed.). Vol. C2-7, pp. 307-318, Battelle Press, Columbus, Ohio (2001).

15. Henry H. Tabak, John R. Haines, Stephen M. Harmon, and Rakesh Govind, "Effect of Metal Ions on Acetate-Utilizing Mixed Culture of Sulfate-Reducing Bacteria (SRB)," Proceedings of the Sixth International Symposium on In Situ and On-Site Bioremediation, San Diego, CA (2001).

16. Tabak, H., Govind, R., Fu, C., Gao, C., Pfanstiel, S., "Protocol for determing bioavailability and biodegradation kinetics of toxic organic soil pollutants to enhance in-situ bioremediation," *J. Env. Sci. Health*, **A32**(4), pp. 1247–1268 (1997).

17. Tabak, H. and Govind, R., "Bioavailability and biodegradation kinetics protocol for organic pollutant compounds to achieve environmentally acceptable endpoints during bioremediation," *Annals of New York Academy of Science*, **829**, October 27 (1997).

18. Tabak, H. and Govind, R., "Protocol for determing bioavailability and biokinetics of organic pollutants in dispersed, compacted and intact soil systems to enhance in-situ bioremediation," *J. Ind. Micro. & Biotechnol*. **18**, pp. 338–339 (1997).

19. Tabak, H., Govind, R., Fu, C., Gao, C., "Application of bioavailability and biokinetics protocol to phenol and polycyclic aromatic hydrocarbon contaminants in soil and development of bioavailability

and biokinetic models for soil systems", in *Methods in Biotechnology*, Vol. 2: *Bioremediation Protocols*, Eds. Sheehan, D., Humana Press, Inc., Totowa, NJ, pp. 297-323 (1997).

20. Govind, R., Kumar, U., Puligada, R., Antia, J., Tabak, H., "Biorecovery of metals from Acid Mine Drainage", in Emerging Technologies in Hazardous Waste Management 7, Eds. Tedder and Pohland, Plenum Press, NY, pp. 91-101 (1997).

21. Govind, R., Lei, L., Tabak, H., "Development of Structure Biodegradability Relationships (SBRs) for estimating half-lives of organic contaminants in Soil systems", in *Biodegradability Prediction*, Eds. W.J.G.M. Peijnenburg and J. Damborsky, Kluwer Academic Publishers, pp. 115-138 (1996).

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