Advantages of anaerobic fixed film reactors over other biological treatment units are: (1) No limits set on influent soluble organics concentration. (2) No limits set on organic loads applied. (3) The lowest sludge (biomass) yield of all available bioreactors. (4) The lowest N & P requirements. (5) The availability of optional operation in plug-flow and completely mixed mode through recycle. (6) The lowest level of attention required and associated low operating costs. (7) Feasibility of seasonal, 5 days/week or otherwise intermittent operation. (8) Highest resistance to toxic and inhibitory compounds. (9) Low area (real estate) requirements. (10) Odorless operation. (11) Generation of high CH4-concentration (above 70%) gas.


Anaerobic Reactors is the fourth volume in the Biological Wastewater Treatment series. The fundamentals of anaerobic treatment are presented in detail, including its applicability, microbiology, biochemistry and main reactor configurations. Two reactor types are analysed in more detail, namely anaerobic filters and especially UASB (upflow anaerobic sludge blanket) reactors. Particular attention is also devoted to the post-treatment of the effluents from the anaerobic reactors. The book presents in a clear and didactic way the main concepts, working principles, expected removal efficiencies, design criteria, design examples, construction aspects, and operational guidelines for anaerobic reactors. The Biological Wastewater Treatment series is based on the book Biological Wastewater Treatment in Warm Climate Regions and on a highly acclaimed set of best selling textbooks. This international version is comprised by six textbooks giving a state-of-the-art presentation of the science and technology of biological wastewater treatment. Other books in the Biological Wastewater Treatment series: Volume 1: Wastewater characteristics, treatment and disposal Volume 2: Basic principles of wastewater treatment Volume 3: Waste stabilisation ponds Volume 5: Activated sludge and aerobic biofilm reactors Volume 6: Sludge treatment and disposal

This book presents a state-of-the-art report on the treatment of pulp and paper industry effluents using anaerobic technology. It covers a comprehensive range of topics, including the basic reasons for anaerobic treatment, comparison between anaerobic and aerobic treatment, effluent types suitable for anaerobic treatment, design considerations for anaerobic treatment, anaerobic reactor configurations applied for treatment of pulp and paper industry effluents, present status of anaerobic treatment in pulp and paper industry, economic aspects, examples of full scale installations and future trends.

This text is intended to provide students with a solid grounding in basic principles of biochemical engineering. Beginning with a historical review and essential concepts of biochemical engineering in part I, the next three parts are devoted to a comprehensive discussion of various topics in the areas of life sciences, kinetics of biological reactions and engineering principles. Having
described the different building blocks of life, microbes, metabolism and bioenergetics, the book proceeds to explain enzymatic kinetics and kinetics of cell growth and product formation. The engineering principles cover transport phenomena in bioprocess systems and various bioreactors, downstream processing and environmental technology. Finally, the book concludes with an introduction to recombinant DNA technology. This textbook is designed for B.Tech. courses in biotechnology, B.Tech. courses in chemical engineering and other allied disciplines, and M.Sc. courses in biotechnology.

In many countries, especially developing countries, many people are lacking access to water and sanitation services and this inadequate service is the main cause of diseases in these countries. Application of appropriate wastewater treatment technologies, which are effective, low cost (in investment, operation, and maintenance), simple to operate, proven technologies, is a key component in any strategy aimed at increasing the coverage of wastewater treatment.

Design of Anaerobic Processes for Treatment of Industrial and Municipal Waste, Volume VII Routledge

This report presents the results of an evaluation of technologies that may result in less biomass production in activated sludge processes. The report summarizes the results of a comprehensive literature review that was done to evaluate technologies in terms of their sludge reduction potential, ease of implementation, impacts on plant operations and effluent quality, reliability, and relative capital and operating costs. Reporting testing results supported significant biomass reduction by processes using chemical and thermal methods, higher life forms (predator processes), anaerobic instead of aerobic respiration, and extreme solids retention times, but biomass reduction for enhanced biological phosphorus removal (EBPR) processes and a mechanical disintegration process were less conclusive. The predator enhancement process showed promise for industrial wastewater treatment, but is less attractive for municipal wastewater treatment for which a lower soluble COD fraction is present. Extreme solids retention time processes may be practical for small wastewater flows and perhaps with the use of membrane separation technology. Anaerobic treatment processes are known to have a lower biomass yield (one fourth or a less than for aerobic treatment), but work is needed to develop their applications for low strength, low temperature wastewaters, such as in municipal wastewater treatment. For some processes such as the cell disruption using mechanical, thermal, and chemical means, the cost of implementing the biomass reduction technology was greater than the cost savings associated with less sludge production. Addition of chemical uncouplers can greatly reduce biomass production, but pose problems of toxic chemicals in the treated effluent.

In a series of bench-scale tests carried out at the Seattle West Point wastewater treatment facility and the University of Washington environmental engineering laboratories the presence and mechanism of COD loss (and subsequent less biomass production) in the anaerobic zone of EBPR processes was investigated. The results of the test work and fundamental evaluation could not support previous claims of a COD loss in EBPR processes, nor was less sludge...
production observed. Intended for advanced students and practitioners of wastewater engineering, this text explains the theory and quantitative rationale for treating wastewater and industrial sludges, with public safety and efficiency in mind. It offers important information on various practices for safe and legal sludge disposal.

Inhaltsangabe: Introduction: It is well known that freshwater is finite and an indispensable resource for any living organism on Earth. Inappropriately, during the last decades, anthropogenic activities expansion, in parallel with population growth, has been the main cause of the deterioration of water quality. According to UNESCO the world's population is growing nearby 80 million people each year, which suggests an increasing of freshwater demand of about 64 billion m³ a year. Likewise, the demographic estimations indicate that 90% of the 3 billion people, who are expected to be added to the world population in 2050, will be living in developing countries, mainly in regions that are already by this time in water stress. However, in order to relate the increasing demand for water, not only the demographic aspect should be taken into account but also economic and social aspects must be considered. The economic expansion affects water since there is an increase in the number of consumers as well as modifications in their consumption habits, in a way that services are offered, goods are produced and transported. The social aspect points out to individual rather than collective actions mainly considering poverty, education, culture, lifestyle and consumption patterns. Obviously the demand and the importance for satisfactory sanitation conditions become indispensable. The World Health Organization (WHO) and The United Nations Children's Fund (UNICEF) report that 2.5 billion people still have a lack of access to improved sanitation, including 1.2 billion people who have no facilities at all. While in developed areas the sanitation coverage achieves 99%, in developing regions this number is around 53%. Furthermore, in Latin America and the Caribbean the coverage sanitation is approximately 79%. In Brazil, target area of this study, only 55.2% of the municipalities are covered by a sewage collection system. In this manner, coverage sanitation does not mean necessarily that the wastewater is treated. Hence, the wastewater must be followed by a treatment system (removal of physical, chemical and biological compounds) in order to achieve pollution mitigation targets for the environmental quality and human health and welfare. According to UNESCO more than 80% of the domestic wastewater in developing countries is discharged untreated, polluting rivers, lakes and coastal areas. Therefore, a large number of technologies have been developed with the intention [...] Membrane-Based Hybrid Processes for Wastewater Treatment analyzes and discusses the potential of membrane-based hybrid processes for the treatment of complex industrial wastewater, the recovery of valuable compounds, and water reutilization. In addition, recent and future trends in membrane technology are highlighted. Industrial wastewater
contains a large variety of compounds, such as heavy metals, salts and nutrients, which makes its treatment challenging. Thus, the use of conventional water treatment methods is not always effective. Membrane-based hybrid processes have emerged as a promising technology to treat complex industrial wastewater. Discusses the properties, mechanisms, advantages, limitations and promising solutions of different types of membrane technologies. Addresses the optimization of process parameters. Describes the performance of different membranes. Presents the potential of Nanotechnology to improve the treatment efficiency of wastewater treatment plants (WWTPs). Covers the application of membrane and membrane-based hybrid treatment technologies for wastewater treatment. Includes forward osmosis, electrodialysis, and diffusion dialysis. Considers hybrid membrane systems expanded to cover zero liquid discharge, salt recovery, and removal of trace contaminants.

The Definitive Guide to Solids Treatment and Management. This authoritative resource is essential for professionals involved in the design, approval, and operation of municipal solids treatment and disposal systems. Solids Process Design and Management contains the latest information on public outreach and involvement, waste minimization, anaerobic and aerobic digestion, odors, and treatment and utilization of green gases. Significant advancements in equipment, technologies, and processes as well as improved planning, design, and management practices are addressed in this comprehensive manual. Coverage includes: Conveyance of wastewater residuals, Chemical conditioning, Thickening, Sludge minimization technologies, Dewatering and composting, Alkaline treatment, Thermal drying and oxidation, Disinfection and stabilization processes, Pyrolysis and gasification, Transport and storage, Sidestreams from solids treatment processes, Instrumentation and monitoring, Landfill management systems. And much more.

Anaerobic Sewage Treatment: Optimization of Process and Physical Design of Anaerobic and Complementary Processes focuses on process design and deals with start-up procedures and steady state performance of UASB reactors, as well as the influence of operation on reactor performance.

Anaerobic biotechnology is a cost-effective and sustainable means of treating waste and wastewaters that couples treatment processes with the reclamation of useful by-products and renewable biofuels. This means of treating municipal, agricultural, and industrial wastes allows waste products to be converted to value-added products such as biofuels, biofertilizers, and other chemicals. Anaerobic Biotechnology for Bioenergy Production: Principles and Applications provides the reader with basic principles of anaerobic processes alongside practical uses of anaerobic biotechnology options. This book will be a valuable reference to any professional currently considering or working with anaerobic biotechnology options.

This important new book covers recent advancements, innovations, and technologies in industrial biotechnology,
specifically addressing the application of various biomolecules in industrial production and in cleaning and environmental remediation sectors. The goal of industrial biotechnology is to develop new techniques and technologies to transform renewable raw materials into chemicals, materials, and fuels by the substitution of fossil fuels. With the increase in the world’s population and the resultant growing energy demand, the need for more energy can be successfully met with the advancements in industrial biotechnology. Currently across the globe significant research has been undertaken in the production of cleaner fuels, materials, and semi-synthetic chemicals, with environmental benefits. Developing countries have huge agricultural resources that could be utilized for production of value-added byproducts for the sustainable development of bio-based economy. The book opens with the chapter on the production of exopolysaccharides from halophilic microorganisms, a polymer that is normally very useful in various production sectors of the food, pharmaceutical, and petroleum industries. The book goes on to cover: The production of antimicrobial compounds from alkaliphilic bacteria Thermophilic actinomycetes Food, agro, and pharmaceutical potential and biotechnological applications of biosurfactants, halophiles, cyclodextrin glycosyl transferase, fungal chitinase, proteases, yeasts and yeast products Also covered in the book are the environmental aspects of industrial biotechnology such as the genetic enhancement for biofuel production, the production of biodegradable thermoplastics, advancements in the synthesis of bio-oil, ecofriendly treatment of agro-based lignocelluloses, and anaerobic bio reactors for hydrocarbon remediation. The international roster of chapter authors have been chosen for their renowned expertise and contribution to the various fields of industrial biotechnology. This book is suitable to chemists, biotechnologists from research institutes, academia, and students as well as for industry professionals

Principles of Parenteral Solution Validation: A Practical Lifecycle Approach covers all aspects involved in the development and process validation of a parenteral product. By using a lifecycle approach, this book discusses the latest technology, compliance developments, and regulatory considerations and trends, from process design, to divesting. As part of the Expertise in Pharmaceutical Process Technology series edited by Michael Levin, this book incorporates numerous case studies and real-world examples that address timely problems and offer solutions to the daily challenges facing practitioners in this area. Discusses international and domestic regulatory considerations in every section Features callout boxes that contain points-of-interest for each segment of the audience so readers can quickly find their interests and needs Contains important topics, including risk management, the preparation and execution of properly designed studies, scale-up and technology transfer activities, problem-solving, and more

This 41st Edition presents case histories with operating data-and new research-on most topics of this major subject in today's world. This valuable Purdue Book will prove invaluable to all involved with waste treatment, providing information
and data to help solve current problems. These proceedings of the May 1986 Purdue Conference include applications, research, methods and techniques, case histories, and operating data. The 91 papers include two special sections: 21 papers discuss toxic and hazardous wastes and 24 papers cover physical-biological systems. The book is further divided into papers on the following topics: (1) Pretreatment Programs and Systems; (2) Dairy Wastes; (3) Oilfield and Gas Pipeline Wastes; (4) Dye Wastes; (5) Coal, Coke and Power Plant Wastes; (6) Landfill Leachate; (7) Laws, Regulations, and Training; (8) Physical/Biological Systems; (9) Pulp and Paper Mill Wastes; (10) Plating Wastes; (11) Food Wastes; (12) Metal Wastes; and (13) Toxic and Hazardous Wastes.

The purpose of this manual is to present a contemporary review of sludge processing technology and the specific procedures to be considered, modified, and applied to meet unique conditions. The manual emphasizes the operational considerations and interrelationship of the various sludge treatment processes to be considered before selecting the optimum design. The manual also presents case histories of existing wastewater treatment plants to illustrate the various unit processes and results.

Anaerobic sewage treatment using UASB reactors has significantly expanded in the last few decades and is now a consolidated technology in some warm climate regions. Several advantages of the anaerobic process make it a more sustainable option for sewage treatment. However, there are still important constraints related to design, construction, and operation of UASB reactors. Conversely, there is enough knowledge, experience, and proven technology that can be used to effectively tackle all the related drawbacks. This book delivers the most relevant techno-scientific developments from academia and water authorities, comprehensively addressing the main aspects of interest in design, construction, and operation of UASB reactors for sewage treatment. Special attention is given to the proper and integrated management of sludge, scum, gaseous emissions, energy recovery, and effluent quality. The main purpose is to provide information and share experiences not yet compiled in the specialized literature on anaerobic sewage treatment. Therefore, a sequence of 12 well-interconnected chapters consolidates the practical knowledge and experiences that important research groups and recognized professionals worldwide have acquired over the past 20 years in demo- and full-scale anaerobic-based sewage treatment plants. Anaerobic Reactors for Sewage Treatment: Design, Construction and Operation can significantly contribute towards a responsible expansion of the anaerobic technology in the world. The book is a valuable tool for engineers, constructors, operators, wastewater utility managers, as well as for students interested in anaerobic processes for sewage treatment.

The aim of Biosolids Treatment Processes, is to cover entire environmental fields. These include air and noise pollution control, solid waste processing and resource recovery, physicochemical treatment processes, biological treatment
processes, biosolids management, water resources, natural control processes, radioactive waste disposal and thermal pollution control. It also aims to employ a multimedia approach to environmental pollution control. The IWA Task Group for Mathematical Modelling of Anaerobic Digestion Processes was created with the aim to produce a generic model and common platform for dynamic simulations of a variety of anaerobic processes. This book presents the outcome of this undertaking and is the result of four years collaborative work by a number of international experts from various fields of anaerobic process technology. The purpose of this approach is to provide a unified basis for anaerobic digestion modelling. It is hoped this will promote increased application of modelling and simulation as a tool for research, design, operation and optimisation of anaerobic processes worldwide. This model was developed on the basis of the extensive but often disparate work in modelling and simulation of anaerobic digestion systems over the last twenty years. In developing ADM1, the Task Group have tried to establish common nomenclature, units and model structure, consistent with existing anaerobic modelling literature and the popular activated sludge models (See Activated Sludge Models ASM1, ASM2, ASM2d and ASM3, IWA Publishing, 2000, ISBN: 1900222248). As such, it is intended to promote widespread application of simulation from domestic (wastewater and sludge) treatment systems to specialised industrial applications. Outputs from the model include common process variables such gas flow and composition, pH, separate organic acids, and ammonium. The structure has been devised to encourage specific extensions or modifications where required, but still maintain a common platform. During development the model has been successfully tested on a range of systems from full-scale waste sludge digestion to laboratory-scale thermophilic high-rate UASB reactors. The model structure is presented in a readily applicable matrix format for implementation in many available differential equation solvers. It is expected that the model will be available as part of commercial wastewater simulation packages. ADM1 will be a valuable information source for practising engineers working in water treatment (both domestic and industrial) as well as academic researchers and students in Environmental Engineering and Science, Civil and Sanitary Engineering, Biotechnology, and Chemical and Process Engineering departments. Contents Introduction Nomenclature, State Variables and Expressions Biochemical Processes Physicochemical Processes Model Implementation in a Single Stage CSTR Suggested Biochemical Parameter Values, Sensitivity and Estimation Conclusions References Appendix A: Review of Parameters Appendix B: Supplementary Matrix Information Appendix C: Integration with the ASM Appendix D: Estimating Stoichiometric Coefficients for Fermentation Scientific & Technical Report No.13 Step-by-step procedures for planning, design, construction and operation: * Health and environment * Process improvements * Stormwater and combined sewer control and treatment * Effluent disposal and reuse * Biosolids disposal and reuse * On-site treatment and disposal of small flows * Wastewater treatment plants should be designed so that the effluent standards and reuse objectives, and biosolids regulations can be met with reasonable ease and cost. The design should incorporate flexibility for dealing with seasonal changes, as well as long-term changes in wastewater quality and future regulations. Good planning and design, therefore, must be based on five major steps: characterization of the raw wastewater quality and effluent, pre-design
studies to develop alternative processes and selection of final process train, detailed design of the selected alternative, contraction, and operation and maintenance of the completed facility. Engineers, scientists, and financial analysts must utilize principles from a wide range of disciplines: engineering, chemistry, microbiology, geology, architecture, and economics to carry out the responsibilities of designing a wastewater treatment plant. The objective of this book is to present the technical and non-technical issues that are most commonly addressed in the planning and design reports for wastewater treatment facilities prepared by practicing engineers. Topics discussed include facility planning, process description, process selection logic, mass balance calculations, design calculations, and concepts for equipment sizing. Theory, design, operation and maintenance, trouble shooting, equipment selection and specifications are integrated for each treatment process. Thus delineation of such information for use by students and practicing engineers is the main purpose of this book.

Principles, methods, and calculations for evaluating, designing and operating anaerobic systems

Advanced Biological Treatment Processes for Industrial Wastewaters provides unique information relative to both the principles and applications of biological wastewater treatment systems for industrial effluents. Case studies document the application of biological wastewater treatment systems in different industrial sectors such as chemical, petrochemical, food-processing, mining, textile and fermentation. With more than 70 tables, 100 figures, 200 equations and several illustrations, the book provides a broad and deep understanding of the main aspects to consider during the design and operation of industrial wastewater treatment plants. Students, researchers and practitioners dealing with the design and application of biological systems for industrial wastewater treatment will find this book invaluable.

Copyright: c2d35e65de20734b0a14792acee05c9f