

BIOLOGICAL WASTEWATER TREATMENT

VOLUME 4

ANAEROBIC REACTORS

Carlos Augusto de Lemos Chemicharo



Anaerobic Reactors Biological Wastewater Treatment
Volume 4 By Carlos Augusto De Lemos Chernicharo
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Wolfgang Guggemos



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Anaerobic Reactors Carlos Augustos de Lemos Chernicharo, 2007-03-30 Anaerobic Reactors is the forth volume in the series Biological Wastewater Treatment 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 informative way the main concepts working principles expected removal efficiencies design criteria design examples construction aspects and operational guidelines for anaerobic reactors About the series The series is based 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 titles in the series are Volume 1 Waste Stabilisation Ponds Volume 2 Basic Principles of Wastewater Treatment Volume 3 Waste Stabilization Ponds Volume 5 Activated Sludge and Aerobic Biofilm Reactors Volume 6 Sludge Treatment and Disposal

Anaerobic Reactors for Sewage Treatment: Design, construction and operation Carlos Augusto de Lemos Chernicharo, Thiago Bressani-Ribeiro, 2019-07-15 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

Anaerobic Digestion Carlos Augusto de Lemos Chernicharo, E. Foresti, L. Florencio, M. T. Kato, 2001-07-31 Over the last decade the Latin American Workshop and Seminar on Anaerobic Digestion has become not only the premier regional forum for discussion integration

and exchange of experience among professionals active in this field but has acquired a wider reputation Not only does it contribute significantly to the diffusion of anaerobic technologies and processes in Latin America but it provides a forum for the work of the world s experts in anaerobic digestion From the many contributions to the 6th workshop and seminar 41 papers of high quality have been selected They range over the following topics traditional and innovative configuration of anaerobic reactors experience with pilot and full scale anaerobic treatment of domestic and industrial wastewater anaerobic digestion of solid waste anaerobic degradation of recalcitrant compounds anaerobic biofilm and granular sludge pretreatment of anaerobic effluents and integration of anaerobic aerobic processes and operation and control of anaerobic reactors

Anaerobic Municipal Wastewater Treatment: Comparison and Assessment of Different Design Approaches for UASB-Reactors Felipe Teixeira de Carvalho, 2014-04-11 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

Advanced Biological Processes for Wastewater Treatment Márcia Dezotti, Geraldo Lippel, João Paulo Bassin, 2017-09-12 This book presents recent developments

in advanced biological treatment technologies that are attracting increasing attention or that have a high potential for large scale application in the near future It also explores the fundamental principles as well as the applicability of the engineered bioreactors in detail It describes two of the emerging technologies membrane bioreactors MBR and moving bed biofilm reactors MBBR both of which are finding increasing application worldwide thanks to their compactness and high efficiency It also includes a chapter dedicated to aerobic granular sludge AGS technology and discusses the main features and applications of this promising process which can simultaneously remove organic matter nitrogen and phosphorus and is considered a breakthrough in biological wastewater treatment Given the importance of removing nitrogen compounds from wastewater the latest advances in this area including new processes for nitrogen removal e g Anammox are also reviewed

Developments in molecular biology techniques over the last twenty years provide insights into the complex microbial diversity found in biological treatment systems The final chapter discusses these techniques in detail and presents the state of the art in this field and the opportunities these techniques offer to improve process performance

Anaerobic Digestion Processes in Industrial Wastewater Treatment Sandra M. Stronach, Thomasine Rudd, John N. Lester, 2011-11-17 There have been many significant microbiological biochemical and technological advances made in the understanding and implementation of anaerobic digestion processes with respect to industrial and domestic wastewater treatment Elucidation of the mechanisms of anaerobic degradation has permitted a greater control over the biological parameters of waste conversion and the technical advances achieved have reduced the time and land area requirements and increased the cost effectiveness and efficiency of the various processes presently in use By product recovery in the form of utilisable methane gas has become increasingly feasible while the development of new and superior anaerobic reactor designs with increased tolerance to toxic and shock loadings of concentrated effluents has established a potential for treating many extremely recalcitrant industrial wastestreams The major anaerobic bioreactor systems and their applications and limitations are examined here together with microbiological and biochemical aspects of anaerobic wastewater treatment processes

London June 1986 S M Stronach T Rudd J N Lester v Table of Contents 1 The Biochemistry of Anaerobic Digestion 1 1 1 Kinetics of Substrate Utilisation and Bacterial Growth 3 1 1 1 COD Fluxes and Mean Carbon Oxidation State 3 1 1 2 Bacterial Growth and Biokinetics 4 1 1 2 1 Growth and Single Substrate Kinetics 4 1 1 2 2 Multisubstrate Systems 8 1 2 Kinetics and Biochemistry of Hydrolysis 8 1 3 Kinetics and Biochemistry of Fermentation and J1 Oxidation 11 1

Post Treatments of Anaerobically Treated Effluents Vinay Kumar Tyagi, Abid Ali Khan, Ng Wun Jern, Anwar Khursheed, A. A. Kazmi, 2019-06-15 The anaerobic process is considered to be a sustainable technology for organic waste treatment mainly due to its lower energy consumption and production of residual solids coupled with the prospect of energy recovery from the biogas generated However the anaerobic process cannot be seen as providing the complete solution as its treated effluents would typically not meet the desired discharge limits in terms of residual carbon nutrients and pathogens This has given impetus to

subsequent post treatment in order to meet the environmental legislations and protect the receiving water bodies and environment This book discusses anaerobic treatment from the perspective of organic wastes and wastewaters municipal and industrial followed by various post treatment options for anaerobic effluent polishing and resource recovery Coverage will also be from the perspective of future trends and thoughts on anaerobic technologies being able to support meeting the increasingly stringent disposal standards The resource recovery angle is particularly interesting as this can arguably help achieve the circular economy It is intended the information can be used to identify appropriate solutions for anaerobic effluent treatment and possible alternative approaches to the commonly applied post treatment techniques The succeeding discussion is intended to lead on to identification of opportunities for further research and development This book can be used as a standard reference book and textbook in universities for Master and Doctoral students The academic community relevant to the subject namely faculty researchers scientists and practicing engineers will find the book both informative and as a useful source of successful case studies

Design of Anaerobic Processes for Treatment of Industrial and Municipal Waste, Volume VII Joseph Malina, 2017-11-22 Principles methods and calculations for evaluating designing and operating anaerobic systems *Anaerobic Waste-Wastewater Treatment and Biogas Plants* Joseph Chukwuemeka

Akunna, 2018-07-16 The book guides specialists and non specialists from around the world on how or whether anaerobic processes can be part of solutions for the management of municipal and industrial solid semi solid and liquid residues The simple self learning presentation style is designed to encourage deep understanding of the process principles plant types and system configurations performance capabilities operational and maintenance requirements post treatment needs and management options for coproducts without complex biochemical terminologies and equations It describes key aerobic biological treatment processes used in conjunction with anaerobic biological treatment in feedstock pre treatment and in post treatment of by products Practical pre treatment processes techniques and operations are described alongside additional treatment techniques of biogas digestates and treated effluents for various end use options Effective applications in developing countries are also considered enabling practitioners and plant operators to effectively apply technology in temperate and warm climatic conditions

Anaerobic Wastewater Treatment Nicholas F Gray, 2025-04-29 This book introduces the reader to the exciting range of modern anaerobic processes that are now available for wastewater treatment To meet the new challenges of population growth global warming and the existing problems of protecting biodiversity and public health we must move away from existing energy intensive aerobic treatment processes to more sustainable systems Embracing the circular economy concept wastewater treatment plants are changing from being solely about pollution control to resource recovery centers and to achieve this anaerobic treatment is required Among the huge range of valuable by products that can be generated by fermentation are biomethane biohydrogen bioplastics biodiesel and volatile fatty acids which are used in the food chemical and pharmaceutical sectors The scope of the book covers all aspects of anaerobic

wastewater treatment including the microbiology and chemistry of hydrolysis acidogenesis acetogenesis and methanogenesis and the main end products of digestion including contaminants All processes are discussed including digesters combined attached growth and floc based systems Biogas production is examined along with biomethane and biohydrogen The book finishes by looking at the key sustainable factors of anaerobic treatment and how biotechnology is pushing towards more efficient and reliable processes This interdisciplinary book is essential reading for both engineers and scientists whether training at university or practitioners and consultants in the wastewater industry Startup and Stabilization of Anaerobic Membrane Bioreactors at Ambient Temperature Carlos Benito Peña, 2015 There has been an increasing interest in wastewater treatment in last decades to reduce human footprint Primarily anaerobic technology focused on treatment and stabilization of sludge but now the tendency is to give it a major role in low cost treatment of high low strength wastewaters since anaerobic digestion offers energy generation through gas production Anaerobic membrane bioreactors AnMBR combine anaerobic digestion with membrane filtration They are becoming a feasible option for treating previous unsuitable low strength wastewaters decoupling hydraulic and solid retention times and providing successful treatment with the benefits of biogas production However the digestion process is optimal at mesophilic or thermophilic 35 37 °C requiring heating of reactors The more inexpensive option to treat the wastewater at its ambient temperature is feasible using AnMBR since this type of reactor can offer long sludge retention times On the other hand the digestion equilibrium turns out more sensible and delicate and performing a proper and robust start up of AnMBR in ambient temperatures is still challenging The aim of the thesis was the successful startup and stabilization of AnMBR systems at ambient temperature 25 °C and low organic loading rate OLR Reactor operation was monitored and the most relevant process parameters were considered for the aim Two pilot scale AnMBR s 120L were used with an external membrane configuration The experiment was carried out in 100 days Substrate feeding consisted of synthetic dairy wastewater with added nutrients solution The inoculum was provided from a full scale anaerobic plant at a digester of BV dairy UK treating dairy wastewater at 30°C Main operation parameters were monitored every day along with gas production and methane yield Laboratory tests were performed twice a week with samples of the reactors and effluent A number of parameters were analyzed the most important of which were total solids content TSS alkalinity fatty acids biogas content and chemical oxygen demand COD The startup of the two AnMBR s differed greatly In System 1 stable conditions were acquired in one month of operation System 2 failed after 20 days of function and did not achieve successful startup It was not possible to fully recover it during the days of study due to dramatically slow growth of microorganisms and low stability of the process Thus satisfactory system performance could be achieved but the ambient anaerobic process was vulnerable to inhibitory conditions Both systems showed that the delicate process operation required fast corrective measures to prevent digestion failure Causes of instability and failure were washout of biomass high content of VFA low buffering capacity and poor performance of technical equipment and low pH

However the digestion could stand a lower pH range than found in literature In conclusion the best parameters to control the startup were pH alkalinity methane content biomass content and organic removal In this sense low buffering capacity of a reactor makes it vulnerable to inhibition by sudden pH changes easily solved by systematic addition of a buffering compound Finally the use of simple and fast alkalimetric methodologies can give satisfactory process overview compared to complex and more precise techniques for alkalinity measurement *Anaerobic Treatment of Industrial Wastewaters* Michael F. Torpy,1988-01-01 Describes several types of anaerobic treatment for municipal and industrial wastewaters Membrane Biological Reactors Faisal I. Hai,Kazuo Yamamoto,Chung-Hak Lee,2014

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