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ENVIRONMENTAL POLLUTION 14

Wastewater Treatment in Constructed Wetlands with Horizontal Sub-Surface Flow



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Wastewater Treatment In Constructed Wetlands With Horizontal Sub Surface Flow Environmental Pollution

Jan Vymazal, Lenka Kröpfelová



Wastewater Treatment In Constructed Wetlands With Horizontal Sub Surface Flow Environmental Pollution:

Wastewater Treatment in Constructed Wetlands with Horizontal Sub-Surface Flow Jan Vymazal, Lenka

Kröpfelová, 2008-07-15 Wetlands have been used for uncontrolled wastewater disposal for centuries. However, the change in attitude towards wetlands during the 1950s and 1960s caused the minimization of the use of natural wetlands for wastewater treatment at least in developed countries. Constructed wetlands have been used for wastewater treatment for about forty years. Constructed wetland treatment systems are engineered systems that have been designed and constructed to utilize the natural processes for removal of pollutants. They are designed to take advantage of many of the same processes that occur in natural wetlands but do so within a more controlled environment. The aim of this book is to summarize the knowledge on horizontal surface flow constructed wetlands (HF CWs) and objectively evaluate their treatment efficiency under various conditions. The information on this type of wastewater treatment technology is scattered in many publications but a comprehensive summary based on world wide experience has been lacking. The book provides an extensive overview of this treatment technology around the world including examples from more than 50 countries and examples of various types of wastewater treated in HF CWs.

Constructed Subsurface Wetlands Abdel Razik Ahmed Zidan, Mohammed Ahmed Abdel Hady, 2018-01-03 With a sharp focus on environmental pollution and its impact on life and nature, scientists and engineers have studied the water treatment effect of natural wetlands for many years, resulting in the development of constructed wetlands (CWs) for treating wastewater. This informative new book provides current information and guidance on the construction, performance, operation, and maintenance of subsurface flow constructed wetlands of domestic and municipal wastewater. The focus of the volume is to evaluate the performance of horizontal subsurface flow constructed wetlands in treating domestic wastewater to establish the limit that can be safely discharged to agricultural drains. Two step procedures were used for the preparation of this book. Using modeling and statistical analyses of treated water samples showed a significant difference between different media for the treatment of most pollutants. The authors went on to design artificial neural network models (ANNs) using Matlab software to simulate some of the experimental data and to anticipate the parameters of output concentration. The wetland systems have the ability to deal with various pollutants with different concentrations and to decrease the treated water to the standard limits. This volume presents the main role of emergent plants for treatment performance in the constructed wetlands and will be a very important resource for engineers in this field as well as for both undergraduate and graduate students.

Constructed Wetlands for Wastewater Treatment in Hot and Arid Climates Alexandros Stefanakis, 2022-10-11 This edited book presents the first collection of case studies and research projects on the sustainable technology of constructed wetlands for wastewater management under hot and arid climates. It is the first such work that summarizes in a single reference the current international experiences and knowledge on the implementation of this nature based solution under these diverse and often harsh climatic conditions. It covers the relevant

gap in the fragmented and limited literature by providing integrated information and documentation on the feasibility of this green technology The book presents the treatment efficiency of constructed wetland facilities and the research output from 29 different countries across South America Africa Asia and Oceania while it covers various applications such as domestic and municipal wastewater various industrial effluents and municipal sludge Many examples and case studies further demonstrate the potential of this technology to contribute to better address the issues of water scarcity and limited fresh water resources through circular management of treated effluents e g reuse in irrigation It also discusses the various challenges and technical aspects that should be considered in such climates along with the environmental financial and social benefits of this technology This work is a useful handbook and guide for professional engineers practitioners academics researchers students and water authorities who wish to get a better understanding and first hand information on the potential of constructed wetlands for cost effective and sustainable wastewater management in countries with hot and arid climates

Experimental and Modeling Studies of Horizontal Subsurface Flow Constructed Wetlands Treating Domestic Wastewater Njenga Mburu, 2014-01-10 Sustainable sanitation and water pollution control calls for adoption of affordable and efficient wastewater treatment technologies In the developing countries the safe management of wastewater is not widespread There is therefore a need for an appropriate technology that can reliably achieve acceptable effluent quality for discharge to the environment at minimal cost Constructed wetland CW systems have been used as a cost effective alternative to conventional methods of wastewater treatment However the mechanistic understanding of the CW has not matured while performance data that can guide design and operation of CW under tropical climate are scarce This study explores the treatment of domestic wastewater with subsurface constructed wetlands in order to provide performance data that can influence design and operation of CW under tropical conditions and to evaluate the processes involved with the transformation and degradation of organic matter and nutrients The thesis contributes to performance data and getting a better mechanistic understanding about the factors influencing the performance of horizontal subsurface flow constructed wetland HSSF CW treating real domestic wastewater under tropical conditions The findings obtained in this research may prove useful towards the wider application of the constructed wetland wastewater treatment technology and the optimization of full scale HSSF CW

Treatment Wetlands Robert H. Kadlec, Scott Wallace, 2008-07-22 Completely revised and updated Treatment Wetlands Second Edition is still the most comprehensive resource available for planning designing and operating wetland treatment systems It provides engineers and scientists with a complete reference source that includes detailed information on wetland ecology design for consistent performance site specific studies estimated costs construction guidance and operational control through effective monitoring Case histories of operational wetland treatment systems illustrate the variety of design approaches presented allowing readers to tailor them to the needs of their projects

Constructed Wetlands and Sustainable Development Gary Austin, Kongjian Yu, 2016-08-25 This book explains how

with careful planning and design the functions and performance of constructed wetlands can provide a huge range of benefits to humans and the environment It documents the current designs and specifications for free water surface wetlands horizontal and vertical subsurface flow wetlands hybrid wetlands and bio retention basins and explores how to plan engineer design and monitor these natural systems Sections address resource management landscape planning technical issues environmental engineering and botany recreation and physical design landscape architecture and biological systems ecology Site and municipal scale strategies for flood management storm water treatment and green infrastructure are illustrated with case studies from the USA Europe and China which show how these principles have been put into practice Written for upper level students and practitioners this highly illustrated book provides designers with the tools they need to ensure constructed wetlands are sustainably created and well manage

Artificial or Constructed Wetlands María del Carmen

Durán-Domínguez-de-Bazúa, Amado Enrique Navarro-Frómata, Josep M. Bayona, 2018-06-15 Artificial or constructed wetlands are an emerging technology particularly for tropical areas with water scarcity For big cities the sustainable management of water resources taking into account proper use is always challenging The book presents case studies illustrating the above As plants and microorganisms are a fundamental part of the correct functioning of these systems their contribution to the degradation of the organic matter and to the removal and transformation of the pollutant compounds present in the wastewaters is also a highlight of this book

Environmental Pollutants and their Bioremediation Approaches Ram

Naresh Bharagava, 2017-07-06 This book is a compilation of detailed and latest knowledge on the various types of environmental pollutants released from various natural as well as anthropogenic sources their toxicological effects in environments humans animals and plants as well as various bioremediation approaches for their safe disposal into the environments In this book an extensive focus has been made on the various types of environmental pollutants discharged from various sources their toxicological effects in environments humans animals and plants as well as their biodegradation and bioremediation approaches for environmental cleanup

Environmental Pollution and Remediation Ram

Prasad, 2021-04-16 This book presents state of the art environmental remediation processes Environmental protection and management is a global concern especially in the context of industrial regions Over the years several conventional engineering based physicochemical decontamination methods have used in the remediation of polluted sites However these methods are expensive and have limited efficiency Drawing on research and examples from around the world this book offers a comprehensive review of and insights into green technologies and sustainable remediation alternatives It discusses the emerging importance of nanotechnology chemo and biosensors indicator species microbe based remediation of organic compounds and ex situ remediation methods Addressing the growing global need for a holistic overview of the environmental remediation of polluted sites it will appeal to teachers researchers scientists capacity builders and policymakers It also serves as additional reading material for undergraduate and graduate students of biotechnology and environmental sciences

Sustainable Wastewater Treatment Systems José Alberto Herrera-Melián, 2020-12-28 Water is one of the main concerns of modern societies. Climate change will significantly complicate access to quality water for millions of people worldwide and the threat of contamination of aquatic resources by poor wastewater management is real and growing fast. Therefore, there is an urgent need to develop efficient and sustainable wastewater treatment methods. Although there are numerous water treatment methods, not all of them are equally sustainable, be it environmentally, economically, or ethically. For this book, some of the latest advances in sustainable wastewater treatments were collected and 13 articles selected. The selected articles deal with aspects such as the removal of nanoparticles, the applicability of constructed wetlands, the recovery, removal of wastewater, the use of low cost bio sorbents, the optimization of activated sludge, the application of advanced oxidation technologies, and the modeling of reverse osmosis systems. This book will give the reader an idea of the latest trends in the sector of sustainable wastewater treatment.

Phytoremediation of Environmental Pollutants Ram Chandra, N.K. Dubey, Vineet Kumar, 2017-12-14 Phytoremediation aids to augment bioremediation as it uses broad range plants to remediate soil, sediment, surface water, and ground water that have been contaminated with toxic metals, organic pesticides, and radionuclides. This book serves to disseminate detailed up to date knowledge regarding the various aspects of phytoremediation and plant-microbe interaction. The book highlights process and molecular mechanisms for industrial waste detoxification during phytoremediation, the role of endophytic bacteria for phytoremediation of environmental pollutants, constructed wetland treatment system for treatment and recycling of hazardous wastewater, amongst other relevant topics.

Key Features: Focuses on phytoremediation process for different pollutants, mainly heavy metal detoxification in the presence of other co-pollutants. Includes plant-soil-microbe interactions in phytoremediations and remediation of contaminated water. Explores life cycle assessment of industrial waste-contaminated site with organic pollutants. Discusses hyperaccumulator versus non-hyperaccumulator plants for environmental waste management. Includes bacterial-assisted phytoremediation and siderophore formation in specific environmental conditions.

Removal of Toxic Pollutants through Microbiological and Tertiary Treatment Maulin P. Shah, 2020-08-20 Removal of Toxic Pollutants through Microbiological and Tertiary Treatment: New Perspectives offers a current account of existing advanced oxidation strategies, including their limitations, challenges, and potential applications in removing environmental pollutants through microbiological and tertiary treatment methods. The book introduces new trends and advances in environmental bioremediation technology with thorough discussion of recent developments in the field. Updated information as well as future research directions in the field of bioremediation of industrial wastes is included. This book is an indispensable guide to students, researchers, scientists, and professionals working in fields such as microbiology, biotechnology, environmental sciences, ecotoxicology, and environmental remediation. The book also serves as a helpful guide for waste management professionals and those working on the biodegradation and bioremediation of industrial wastes and environmental pollutants.

for environmental sustainability Introduces various treatment schemes including microbiological and tertiary technologies for bioremediation of environmental pollutants and industrial wastes Includes pharmaceutical wastewater oil refinery wastewater distillery wastewater tannery wastewater textile wastewater mine tailing wastes plastic wastes and more Describes the role of relatively new treatment technologies and their approaches in bioremediation including molecular and protein engineering technologies microbial enzymes bio surfactants plant microbe interactions and genetically engineered organisms Provides many advanced technologies in the field of bioremediation and phytoremediation including electro bioremediation technology microbial fuel cell technology nano bioremediation technology and phytotechnologies Impact of Water Pollution on Human Health and Environmental Sustainability McKeown, A. Elaine, 2015-10-27 Water is at the core of all life on Earth and exists as one of the main components of the human body Because water is essential to life addressing water pollution and sustainability issues is of great concern to environmentalists and public health specialists alike Impact of Water Pollution on Human Health and Environmental Sustainability highlights several important water related issues and explores a number of potential solutions to the problem of water sustainability Focusing on research based perspectives on water availability industrial and agricultural pollution water contamination and their impacts on the human population as well as the environment this crucial publication is a necessary addition to academic and government libraries serving graduate level students environmental scientists public health workers policy makers and legislators seeking the latest information on sustainable and contaminant free water resources **Recent Trends in Wastewater Treatment** Sugghosh Madhav, Pardeep Singh, Vandana Mishra, Sirajuddin Ahmed, Pradeep Kumar Mishra, 2022-07-14 This volume discusses contemporary techniques technologies and solutions for industrial wastewater remediation and treatment It covers biological chemical and physical aspects of wastewater treatment with a background on the generation of wastewater associated with different industries as well as a comparison of traditional treatment technologies with new advancements The authors also describe the reuse and recovery of nutrients and precious metals from wastewater and how such sustainable strategies can be incorporated into industrial wastewater planning and legislation The book also contains practical and theoretical aspects of various industries and their wastewater management practices in a changing climate with an emphasis on recent research examining the environmental impact of wastewater The work will be of interest to students teachers and researchers studying wastewater pollution and remediation wastewater management based NGOs and people involved in the planning and legislation of industrial operations Routledge Handbook of Wetlands Alan Dixon, Ian Maddock, 2025-08-29 This handbook provides a comprehensive and interdisciplinary overview of the place value and significance of wetlands presenting perspectives from across the environmental and social sciences Recent decades have witnessed unprecedented global interest in wetlands and the critical role they play in supporting biodiversity and ecosystem services such as carbon storage flood mitigation as well as their direct benefits for people and society that include the provision of food clean water

and a range of cultural services This Routledge Handbook of Wetlands brings together a wide range of perspectives from social and environmental disciplines and voices from different wetland stakeholders from the global north and south to present an assessment of our current understanding of wetlands their environmental significance and their place in society and policy A recurring theme of the book is an exploration of how our current knowledge of wetlands that is often fragmented along traditional disciplinary lines can be brought together to enable a more integrated interdisciplinary and social ecological conceptualisation that aligns more closely with real world complex challenges and which offers new directions in wetland management for sustainable development This handbook will be essential reading for students and scholars of wetland management environmental science water resource management conservation ecology environmental humanities and sustainable development

Phytoremediation Abid A. Ansari, Sarvajeet Singh Gill, Ritu Gill, Guy R. Lanza, Lee Newman, 2016-09-23 This text details the plant assisted remediation method phytoremediation which involves the interaction of plant roots and associated rhizospheric microorganisms for the remediation of soil contaminated with high levels of metals pesticides solvents radionuclides explosives crude oil organic compounds and various other contaminants Each chapter highlights and compares the beneficial and economical alternatives of phytoremediation to currently practiced soil removal and burial practices

Subsurface Flow Constructed Wetlands for the Treatment of Domestic Wastewater Tanveer Ferdous Saeed, 2010 This thesis describes in detail the background methods results and conclusions of a three year PhD research project subsurface flow constructed wetlands for the treatment of domestic wastewater which was undertaken at Monash University between April 2008 and December 2010 The overall objective of the research was to discover the efficiencies of key pollutant removals organics nutrients solids and coliforms when a medium strength wastewater is treated in different types of subsurface flow wetlands and how the pollutant removal should be modelled to reflect the biodegradation kinetics of the pollutants The research was designed and carried out in four phases In phase 1 a comparative experiment was carried out to understand how wetland media may affect the removal of organics and nitrogen special focus was on studying the nitrification denitrification process in hybrid wetland systems with an unconventional organic containing wetland media wood mulch The results indicated simultaneous nitrification denitrification in vertical flow wetlands with organic mulch media primarily due to greater oxygen flux in the wetland matrix and the supply of organic carbon from the media In contrast this unconventional media was found to be inefficient when it is applied in horizontal flow wetlands as anoxic conditions caused excessive leaching of organics from the media The monitoring of the performances of different wetland units during this phase allowed the selection of an effective hybrid wetland system for further experiments to monitor pollutant removal stability in the next phase In phase 2 experiments were carried out in three hybrid wetland systems that had identical configurations plants *Phragmites australis* and media including gravel wood mulch and zeolite The three systems were operated under different pollutant and hydraulic loadings to monitor the removal of nitrogen and

organics The results demonstrated stable nitrogen and organics removal efficiencies within the range of hydraulic and pollutant loading variations The media of wood mulch and zeolite were found or further confirmed to enhance nitrogen removal in vertical flow wetlands by enhancing simultaneous nitrification denitrification and adsorption of ammonia Horizontal flow wetlands with the traditional gravel media showed abilities to remove nitrate and the excess organics that was leached into the wastewater from wood mulch media and within the experiment range the mass removals of nitrate and COD in the horizontal flow wetlands were found to increase with their loadings In phase 3 kinetic models were developed to describe the biodegradation of nitrogen and organics removal in wetland systems Reaction kinetics that were considered in the model development included first order Monod and multiple Monod kinetics these kinetics were combined with continuous stirred tank reactor CSTR or plug flow pattern to produce equations that link the inlet and outlet concentrations of each key pollutants across a single wetland Using three statistical parameters a critical evaluation was made to evaluate the suitability of five potential models for describing pollutant removals in vertical and horizontal flow wetlands The results recommended the models that were derived from Monod kinetics for nitrogen and organics removal in both vertical and horizontal flow wetland systems Finally in phase 4 a simple MATLAB programme was established based on the model studies in the previous phase to provide a potential design tool for determining the surface area of a single subsurface vertical or horizontal flow wetland when it is required to achieve a given pollutant removal target The MATLAB programme can also be used to predict the performances of existing wetland systems In order to assist readers to track the results of four phases of this research in its logic sequence the thesis has been arranged to contain seven chapters Chapters 1 2 describe the scope and objectives of the research and a literature survey on the technical development of subsurface flow wetlands for wastewater treatment Chapters 3 6 describe in sequence the detailed methods and results of the four phases of the research Overall conclusions are presented in Chapter 7 Four publications including three ISI journal papers and one international conference paper have been produced as a direct result of the research The papers are attached in Appendix I and all the original experiment records are attached in Appendix II Overall this research improved the current understanding of the removal of ammonia nitrate COD and BOD in vertical and horizontal flow wetlands In addition it produced kinetic models to describe the removal of these pollutants potentially allowing model based design of vertical and horizontal flow constructed wetlands for the direct treatment and reclamation of medium strength wastewater

Wastewater Reuse and Management Sanjay K. Sharma, Rashmi Sanghi, 2012-11-06 Over the past 50 years the volume of wastewater has grown exponentially as a result of the increasing world population and the expansion of industrial developments Researchers all over the world have been trying to address this issue suitably in order to fight water scarcity yet it is only recently that wastewater recycling has caught their attention as an effective and responsible solution Wastewater is a resource that can be adequately treated to successfully satisfy most water demands as well as decreasing wastewater discharges and preventing

pollution This book presents the studies of some of the most prestigious international scientists and gathers them in three different sections Wastewater Management and Reuse Wastewater Treatment options and Risk Assessment The result is an insightful analysis of waste water management its treatments and the processes that have been studied optimized and developed so far to sustain our environment Wastewater Reuse and Management represents a valuable resource to academic researchers students institutions environmentalists and anyone interested in environmental policies aimed at safeguarding both the quality and the quantity of water Handbook of Research on Microbial Tools for Environmental Waste Management Pathak, Vinay Mohan,Navneet,2018-04-27 The remediation of environmental pollutants has become a relevant topic within the field of waste management Advances in biological approaches are a potential tool for contamination and pollution control The Handbook of Research on Microbial Tools for Environmental Waste Management is a critical scholarly resource that explores the advanced biological approaches that are used as remediation for pollution cleanup processes Featuring coverage on a broad range of topics such as biodegradation microbial dehalogenation and pollution controlling treatments this book is geared towards environmental scientists biologists policy makers graduate students and scholars seeking current research on environmental engineering and green technologies Environmental Crisis: Pollution and Governance Dongfei Han,Mukesh Khare,Siyue Li,2025-08-04 This book presents cutting edge research findings on environmental pollution and remediation covering key areas such as pollution analysis and monitoring as well as pollution control and restoration At the 2024 UN Environment Assembly environmental pollution and remediation were once again defined as one of the three major crises facing the planet The global environmental pollution issue remains severe despite the efforts of many countries and regions the situation is still far from optimistic Issues such as heavy metals and radioactive contamination in seawater are gradually becoming significant topics in environmental pollution Accurate composition analysis and effective remediation strategies are essential in addressing pollution and enhancing the accuracy of pollutant source analysis and the effectiveness of harmless pollution management are key subjects of discussion in this book Furthermore the book aims to facilitate the exchange of scientific information among scholars from leading universities research centers and high tech enterprises around the world This book will be highly beneficial to scholars engineers and researchers in the fields of environmental engineering and environmental remediation

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Wastewater Treatment In Constructed Wetlands With Horizontal Sub Surface Flow Environmental Pollution

Introduction

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