

ENHANCED BIOLOGICAL PHOSPHORUS REMOVAL

FROM DOMESTIC WASTEWATER

The discharge of excessive amount of phosphorus (P) from wastewater treatment plants may trigger eutrophication in receiving water, which threatens human health and aquatic life. Enhanced biological phosphorus removal (EBPR) provides the removal of P from wastewater without the need for chemical phosphates. EBPR can be achieved using co-selection and denitrification types of activated sludge. This book highlights the removal of P from domestic wastewater, the use of distributed denitrification zones related to remove P from domestic wastewater using co-selection and denitrification types of activated sludge, and the application of aerobic digestion and alternating anaerobic/aerobic process for removing P from wastewater. The book will benefit civil, chemical, and environmental engineers, environmental practitioners, scholars, and researchers.



Noor Huda Abdullah received his B.Sc. in 2017 in Chemical Engineering (First Class Honours) from Universiti Teknikal Malaysia Melaka (UTM) and completed his M.Sc. in Environmental Engineering from UTM in 2019. He is currently pursuing his Ph.D. in Environmental Engineering from UTM. His research interests are in water quality and wastewater treatment.



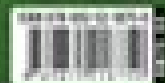
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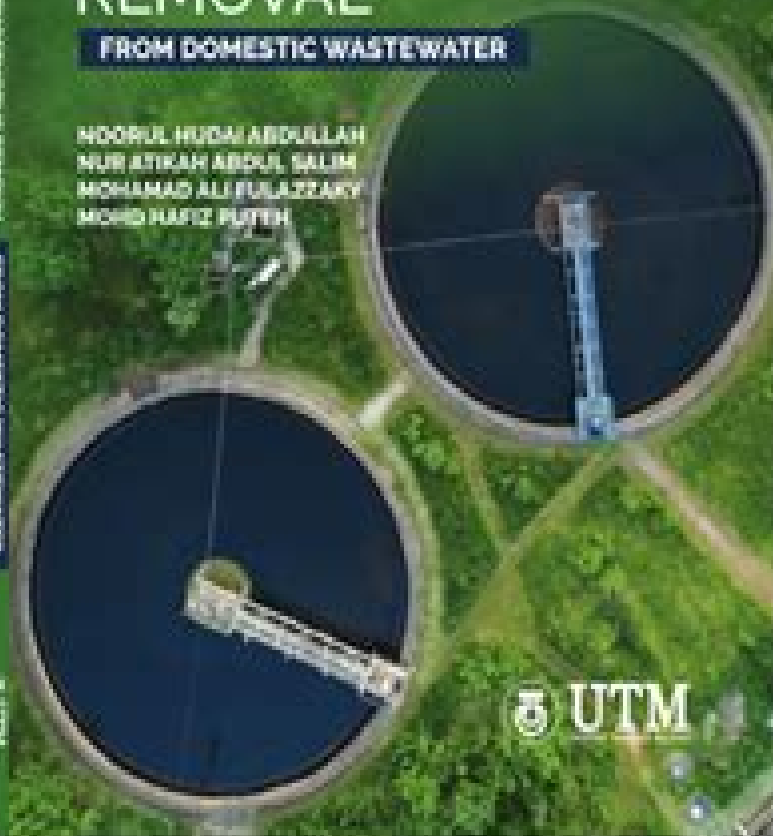


Enhanced Biological Phosphorus Removal from Domestic Wastewater

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MOHD NABIL HUDA



Enhanced Biological Phosphorus Removal From Wastewater Water Science And

**Val del Río, Ángeles, Campos Gómez,
José Luis, Mosquera Corral, Anuska**

Enhanced Biological Phosphorus Removal From Wastewater Water Science And:

Factors Influencing the Reliability of Enhanced Biological Phosphorus Removal J. B. Neethling, 2006-03-31

Enhanced biological phosphorus removal EBPR has been used for decades to remove phosphorus from municipal wastewater because it allows facilities to meet water quality goals while minimizing chemical consumption and sludge production. However, there is still substantial variability in both the practices applied to achieve EBPR and the level of soluble phosphorus removal achieved. The objective of this research project was to develop information that can be used to help municipal wastewater treatment plants more efficiently and cost effectively remove phosphorus through EBPR processes. This project included detailed analysis of routine water quality and operating data, field testing observations, and special studies conducted over the course of the project to evaluate the variability of EBPR factors influencing EBPR performance and the relationship between EBPR and the presence of glycogen accumulating organisms (GAOs).

Effect of Sulphide on Enhanced Biological Phosphorus Removal Francisco Rubio Rincon, 2017-03-03 The enhanced biological removal of phosphorus EBPR is a popular process due to high removal efficiency, low operational costs, and the possibility of phosphorus recovery. Nevertheless, the stability of the EBPR depends on different factors such as temperature, pH, and the presence of toxic compounds. While extensive studies have researched the effects of temperature and pH on EBPR systems, little is known about the effects of different toxic compounds on EBPR. For example, sulphide has shown to inhibit different microbial activities in the WWTP, but the knowledge about its effects on EBPR is limited. Whereas the sulphide generated in the sewage can cause a shock effect on EBPR, the continuous exposure to sulphide potentially generated in WWTP can cause the acclimatization and adaptation of the biomass. This research suggests that sulphate-reducing bacteria can proliferate in WWTP as they are reversibly inhibited by the recirculation of sludge through anaerobic, anoxic, and oxic conditions. The research enhances the understanding of the effect of sulphide on the anaerobic, oxic metabolism of PAO. It suggests that the filamentous bacteria *Thiothrix caldiformis* could play an important role in the biological removal of phosphorus. It questions the ability of PAO to generate energy from nitrate respiration and its use for the anoxic phosphorus uptake. Thus, the results obtained in this research can be used to understand the stability of the EBPR process under anaerobic, anoxic, and oxic conditions, especially when exposed to the presence of sulphide.

Determining the Potential for Enhanced Biological Phosphorus Removal Based on Wastewater Characteristics Pedro Ramada Curto, 2001

Biological Wastewater Treatment: Principles, Modeling and Design Guang-Hao Chen, Mark C.M. van Loosdrecht, G.A. Ekama, Damir Brdjanovic, 2020-07-15 The first edition of this book was published in 2008 and it went on to become IWA Publishing's bestseller. Clearly, there was a need for it because over the twenty years prior to 2008, the knowledge and understanding of wastewater treatment had advanced extensively and moved away from empirically based approaches to a fundamental first principles approach based on chemistry, microbiology, physical and bioprocess engineering, mathematics, and modelling.

However the quantity complexity and diversity of these new developments was overwhelming for young water professionals particularly in developing countries without readily available access to advanced level tertiary education courses in wastewater treatment For a whole new generation of young scientists and engineers entering the wastewater treatment profession this book assembled and integrated the postgraduate course material of a dozen or so professors from research groups around the world who have made significant contributions to the advances in wastewater treatment This material had matured to the degree that it had been codified into mathematical models for simulation with computers The first edition of the book offered that upon completion of an in depth study of its contents the modern approach of modelling and simulation in wastewater treatment plant design and operation could be embraced with deeper insight advanced knowledge and greater confidence be it activated sludge biological nitrogen and phosphorus removal secondary settling tanks or biofilm systems However the advances and developments in wastewater treatment have accelerated over the past 12 years since publication of the first edition While all the chapters of the first edition have been updated to accommodate these advances and developments some such as granular sludge membrane bioreactors sulphur conversion based bioprocesses and biofilm reactors which were new in 2008 have matured into new industry approaches and are also now included in this second edition The target readership of this second edition remains the young water professionals who will still be active in the field of protecting our precious water resources long after the aging professors who are leading some of these advances have retired The authors all still active in the field are aware that cleaning dirty water has become more complex but that it is even more urgent now than 12 years ago and offer this second edition to help the young water professionals engage with the scientific and bioprocess engineering principles of wastewater treatment science and technology with deeper insight advanced knowledge and greater confidence built on stronger competence

Microbial Biofilms in Bioremediation and Wastewater Treatment Y.V. Nancharaiah,Vayalam P. Venugopalan,2019-10-18 Biofilms represent the natural living style of microbial communities and play a pivotal role in biogeochemical cycles and natural attenuation Biofilms can be engineered for biodegradation and biotransformation of organic and inorganic contaminants for both in situ bioremediation and ex situ treatment in bioreactors This book focuses on microbial biofilms and their potential technological applications for sustainable development It covers recent advances in biofilm technologies for contaminant remediation coupled to recovery of resources and serves as a complete reference on the science and technology behind biofilm mediated bioremediation and wastewater treatment

Experimental Methods in Wastewater Treatment Mark C. M. van Loosdrecht,Per Halkjaer Nielsen,C. M. Lopez-Vazquez,Damir Brdjanovic,2016-05-15 Over the past twenty years the knowledge and understanding of wastewater treatment has advanced extensively and moved away from empirically based approaches to a fundamentally based first principles approach embracing chemistry microbiology and physical and bioprocess engineering often involving experimental laboratory work and techniques Many of these experimental methods and techniques have matured to the degree that they

have been accepted as reliable tools in wastewater treatment research and practice For sector professionals especially a new generation of young scientists and engineers entering the wastewater treatment profession the quantity complexity and diversity of these new developments can be overwhelming particularly in developing countries where access to advanced level laboratory courses in wastewater treatment is not readily available In addition information on innovative experimental methods is scattered across scientific literature and only partially available in the form of textbooks or guidelines This book seeks to address these deficiencies It assembles and integrates the innovative experimental methods developed by research groups and practitioners around the world Experimental Methods in Wastewater Treatment forms part of the internet based curriculum in wastewater treatment at UNESCO IHE and as such may also be used together with video records of experimental methods performed and narrated by the authors including guidelines on what to do and what not to do The book is written for undergraduate and postgraduate students researchers laboratory staff plant operators consultants and other sector professionals

Biological Phosphorus Removal Activated Sludge Process in Warm Climates Cao Ye Shi, 2011-03-15 Special Offer Cao Ye Shi Author Set Buy all three books together and save a total 76 Biological Phosphorus Removal Activated Sludge Process in Warm Climates presents the results of detailed research on the Enhanced Biological Phosphorus Removal EBPR activated sludge process under warm climate conditions 20oC 30oC which is part of the R D program of Public Utilities Board PUB Singapore The investigations and studies presented in this book are application oriented but at the same time the studies aim at an insightful understanding of the EBPR with the knowledge of the latest development in academic field The focus points are EBPR performance of laboratory scale and full scale activated sludge processes under the site conditions in warm climates The carbon competition and distribution between PAO and GAO and denitrifiers in the process The stoichiometry and kinetics of P release COD uptake in the anaerobic environment and P uptake in the aerobic environment under different temperatures and operating conditions PAO and GAO population fractions shift and dominance studies using FISH and batch tests The inter relationships between the system performance process design and the microbial community EBPR for industrial wastewater high ratio of feed COD P treatment under warm climates Together with the preceding book Biological Nitrogen Removal Activated Sludge Process in Warm Climates published by IWA in 2008 this book fills the gap of biological nutrient nitrogen and phosphorus removal in warm climates and provides unique experiences and knowledge for Process and design researchers and engineers in wastewater research students and academic staff in Civil Sanitation Environment Departments as well as Managers Engineers and Consultants in water companies and water utilities Visit the IWA WaterWiki to read and share material related to this title <http://www.iwawaterwiki.org/xwiki/bin/view/Articles/SELECTIONOFDOMESTICWASTEWATERTREATMENTSYSTEMSINWARMCLIMATEREGIONS>

Treatise on Water Science, 2010-09-01 Water quality and management are of great significance globally as the demand for clean potable water far exceeds the availability Water science research brings together the natural and applied sciences

engineering chemistry law and policy and economics and the Treatise on Water Science seeks to unite these areas through contributions from a global team of author experts The 4 volume set examines topics in depth with an emphasis on innovative research and technologies for those working in applied areas Published in partnership with and endorsed by the International Water Association IWA demonstrating the authority of the content Editor in Chief Peter Wilderer a Stockholm Water Prize recipient has assembled a world class team of volume editors and contributing authors Topics related to water resource management water quality and supply and handling of wastewater are treated in depth Enhanced Biological Phosphorus Removal from Waste Water M. Florentz, J. Sibony, 1985 Waste Water Treatment Technologies - Volume II Saravanamuthu Vigneswaran, 2009-09-25 Water and Wastewater Treatment Technologies theme is a component of Encyclopedia of Water Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias The Theme on Water and Wastewater Treatment Technologies deals in three volumes and covers several topics with several issues of great relevance to our world such as Urban Wastewater Treatment Characteristics of Effluent Organic Matter in Wastewater Filtration Technologies in wastewater treatment Air Stripping in Industrial Wastewater Treatment Dissolved air flotation in industrial wastewater treatment Membrane Technology for Organic Removal in Wastewater Adsorption and Biological Filtration in Wastewater Treatment Physico chemical processes for Organic removal from wastewater effluent Deep Bed Filtration Modelling Theory And Practice Specific options in biological wastewater treatment for reclamation and reuse Biological Phosphorus Removal Processes For Wastewater Treatment Sequencing Batch Reactors Principles Design Operation And Case Studies Wastewater stabilization ponds WSP for wastewater treatment Treatment of industrial wastewater by membrane bioreactors Stormwater treatment technologies Sludge Treatment Technologies Wastewater Treatment Technology For Tanning Industry Palm Oil And Palm Waste Potential In Indonesia Recirculating Aquaculture Systems A Review Upflow anaerobic sludge blanket UASB reactor in wastewater treatment Applied Technologies In Municipal Solid Waste Landfill Leachate Treatment Water Mining Planning and Implementation Issues for a successful project Assessment methodologies for water reuse scheme and technology Nanotechnology for Wastewater Treatment These three volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts Managers and Decision makers and NGOs **Mathematical Modelling and Computer Simulation of Activated Sludge Systems** Jacek Makinia, Ewa Zaborowska, 2020-03-02 Mathematical Modelling and Computer Simulation of Activated Sludge Systems Second Edition provides from the process engineering perspective a comprehensive and up to date overview regarding various aspects of the mechanistic white box modelling and simulation of advanced activated sludge systems performing biological nutrient removal In the new edition of the book a special focus is given to nitrogen removal and the latest developments in modelling the innovative nitrogen removal processes Furthermore a new section on micropollutant

removal has been added The focus of modelling has been shifting in the last years to models that can describe the performance of a whole plant plant wide modelling The expanded part of this new edition introduces models describing the most important processes interrelated with the mainstream activated sludge systems as well as models describing the energy balance operating costs and environmental impact The complex process evaluation including minimization of energy consumption and carbon footprint is in line with the present and future wastewater treatment goals By combining a general introduction and a textbook this book serves both intermediate and more experienced model users both researchers and practitioners as a comprehensive guide to modelling and simulation studies The book can be used as a supplemental material at graduate and post graduate levels of wastewater engineering modelling courses Biofuels Krzysztof Biernat,2015-09-30

The edited volume presents the progress of first and second generation biofuel production technology in selected countries Possibility of producing alternative fuels containing biocomponents and selected research methods of biofuels exploitation characteristics also aviation fuels was characterized The book shows also some aspects of the environmental impact of the production and biofuels using and describes perspectives of biofuel production technology development It provides the review of biorefinery processes with a particular focus on pretreatment methods of selected primary and secondary raw materials The discussion includes also a possibility of sustainable development of presented advanced biorefinery processes

Innovative and Integrated Technologies for the Treatment of Industrial Wastewater Antonio Lopez,Claudio Di Iaconi,Giuseppe Mascolo,Alfieri Pollice,2011-12-15 Innovative and Integrated Technologies for the Treatment of Industrial Wastewater deals with advanced technological solutions for the treatment of industrial wastewater such as aerobic granular biomass based systems advanced oxidation processes integrated with biological treatments membrane contactors and membrane chemical reactors Wastewater from pharmaceutical chemical and food industries as well as landfill leachates are specifically considered as representative of major problems encountered when treating industrial streams The economic and environmental sustainability of the above solutions are also reported in the book and compared with the alternatives currently available in the market by life cycle assessment LCA and life cycle costing LCC methodologies The implementation of the considered solutions at large scale could support and enhance the competitiveness of different industrial sectors including the water technology sector in the global market Innovative and Integrated Technologies for the Treatment of Industrial Wastewater also makes a contribution towards defining new concepts processes and technologies in wastewater treatment with potential benefits for the stable quality of effluents energy and operational costs saving and the protection of the environment new sets of advanced standards for wastewater treatment new methodologies for the definition of wastewater treatment needs and framework conditions new information supporting development and implementation of water legislation **Microbial Ecology of Activated Sludge** Robert Seviour,Per Halkjaer Nielsen,2010-01-15 Microbial Ecology of Activated Sludge written for both microbiologists and engineers critically reviews our current understanding of

the microbiology of activated sludge the most commonly used process for treating both domestic and industrial wastes The contributors are all internationally recognized as leading research workers in activated sludge microbiology and all have made valuable contributions to our present understanding of the process The book pays particular attention to how the application of molecular methods has changed our perceptions of the identity of the filamentous bacteria causing the operational disorders of bulking and foaming and the bacteria responsible for nitrification and denitrification and phosphorus accumulation in nutrient removal processes Special attention is given to how it is now becoming possible to relate the composition of the community of microbes present in activated sludge and the in situ function of individual populations there and how such information might be used to manage and control these systems better Detailed descriptions of some of these molecular methods are provided to allow newcomers to this field of study an opportunity to apply them in their research Comprehensive descriptions of organisms of interest and importance are also given together with high quality photos of activated sludge microbes Activated sludge processes have been used globally for nearly 100 years and yet we still know very little of how they work In the past 15 years the advent of molecular culture independent methods of study have provided tools enabling microbiologists to understand which organisms are present in activated sludge and critically what they might be doing there Microbial Ecology of Activated Sludge will be the first book available to deal comprehensively with the very exciting new information from applying these methods and their impact on how we now view microbiologically mediated processes taking place there As such it will be essential reading for microbial ecologists environmental biotechnologists and engineers involved in designing and managing these plants It will also be suitable for postgraduate students working in this field

Wastewater Engineering: Advanced Wastewater Treatment Systems Hamidi Abdul Aziz,Amin

Mojiri,2014-04-01 As the global population grows and many developing countries modernize the importance of water supply and wastewater treatment becomes a much greater factor in the welfare of nations Clearly in today s world the competition for water resources coupled with the unfortunate commingling of wastewater discharges with freshwater supplies creates additional pressure on treatment systems Recently researchers focus on wastewater treatment by difference methods with minimal cost and maximum efficiency This volume of the Wastewater Engineering Advanced Wastewater Treatment Systems is a selection of topics related to physical chemical and biological processes with an emphasis on their industrial applications It gives an overview of various aspects in wastewater treatments methods including topics such as biological bioremediation electrochemical membrane and physical chemical applications Experts in the area of environmental sciences from diverse institutions worldwide have contributed to this book which should prove to be useful to students teachers and researchers in the disciplines of wastewater engineering chemical engineering environmental engineering and biotechnology We gratefully acknowledge the cooperation and support of all the contributing authors

Innovative Wastewater Treatment & Resource Recovery Technologies: Impacts on Energy, Economy and Environment Juan M. Lema,Sonia Suarez

Martinez,2017-06-15 This book introduces the 3R concept applied to wastewater treatment and resource recovery under a double perspective Firstly it deals with innovative technologies leading to Reducing energy requirements space and impacts Reusing water and sludge of sufficient quality and Recovering resources such as energy nutrients metals and chemicals including biopolymers Besides targeting effective C N Re Thinking which implies a substantial flowsheet modification and Re Imagining with completely new conceptions Tools are presented for Modelling Optimising and Selecting the most suitable plant layout for each particular scenario from a holistic technical economic and environmental point of view

Technologies for the Treatment and Recovery of Nutrients from Industrial Wastewater Val del Río, Ángeles,Campos Gómez, José Luis,Mosquera Corral, Anuska,2016-10-21 The production of wastewater from various human and industrial activities has a harsh impact on the environment Without adequate treatment the disposal of this wastewater poses a threat to the quality of water globally Technologies for the Treatment and Recovery of Nutrients from Industrial Wastewater investigates emergent research and best practices within the field of wastewater management Highlighting novel technological tools in wastewater treatment effective nutrient removal technologies and innovative solutions to quality water preservation practices this book is a critical reference source for professionals scientists academics and students

Selected Water Resources Abstracts ,1991 **Phosphorus: Polluter and Resource of the Future** Christian Schaum,2018-03-15 This comprehensive book provides an up to date and international approach that addresses the Motivations Technologies and Assessment of the Elimination and Recovery of Phosphorus from Wastewater This book is part of the Integrated Environmental Technology Series **Biological Wastewater Treatment** C. P. Leslie Grady Jr.,Glen T. Daigger,Nancy G. Love,Carlos D. M. Filipe,2011-05-09 Following in the footsteps of previous highly successful and useful editions Biological Wastewater Treatment Third Edition presents the theoretical principles and design procedures for biochemical operations used in wastewater treatment processes It reflects important changes and advancements in the field such as a revised treatment of the microbiology and kinetics of nutrient removal and an update of the simulation of biological phosphorous removal with a more contemporary model See what s new in the Third Edition A chapter devoted to the description and simulation of anaerobic bioreactors Coverage of applications of submerged attached growth bioreactors Expanded discussion of modeling attached growth systems Increased information on the fate and effects of trace contaminants as they relate to xenobiotic organic chemicals A chapter on applying biochemical unit operations to design systems for greater sustainability The book describes named biochemical operations in terms of treatment objectives biochemical environment and reactor configuration introduces the format and notation used throughout the text and presents the basic stoichiometry and kinetics of microbial reactions that are key to quantitative descriptions of biochemical operations It then examines the stoichiometry and kinetics used to investigate the theoretical performance of biological reactors containing microorganisms suspended in the wastewater The authors apply this theory to the operations introduced

taking care to highlight the practical constraints that ensure system functionality in the real world The authors focus on further biochemical operations in which microorganisms grow attached to solid surfaces adding complexity to the analysis even though the operations are often simpler in application They conclude with a look to the future introducing the fate and effects of xenobiotic and trace contaminants in wastewater treatment systems and examining how the application of biochemical operations can lead to a more sustainable world

Enhanced Biological Phosphorus Removal From Wastewater Water Science And: Bestsellers in 2023 The year 2023 has witnessed a noteworthy surge in literary brilliance, with numerous engrossing novels captivating the hearts of readers worldwide. Lets delve into the realm of bestselling books, exploring the engaging narratives that have captivated audiences this year. Enhanced Biological Phosphorus Removal From Wastewater Water Science And : Colleen Hoover's "It Ends with Us" This touching tale of love, loss, and resilience has gripped readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This spellbinding historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids absorbing storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Enhanced Biological Phosphorus Removal From Wastewater Water Science And : Delia Owens "Where the Crawdads Sing" This evocative coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens spins a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and gripping novel that will keep you guessing until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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Enhanced Biological Phosphorus Removal From Wastewater Water Science And Introduction

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