

Abu Zahrim Yaser  
Mohd Armi Abu Samah  
Fazilah Ariffin  
A. K. Haghi *Editors*

# Controlling Environmental Pollution


Practical Solutions

 Springer

Abu Zahrim Yaser · Mohd Armi Abu Samah ·  
Fazilah Ariffin · A. K. Haghi  
Editors

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*Editors*

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## Preface

Environmental pollution is one of the most critical issues of our time, impacting public health, ecosystems, and global economies. In Chapter “Introduction”, Ariffin et al. emphasize that communities should adopt growth mindsets that enhance environmental sustainability by adapting to and profiting from severe environmental conditions. The book *Controlling Environmental Pollution—Practical Solutions* aims to give readers a comprehensive understanding of various types of pollution, particularly from the agro-based industry, medical industry, traffic, e-waste, polluted soil and water pollution. It also discusses innovative approaches to mitigating these pollutants while generating economic value. In Chapter “Environmental Pollution in Agriculture Sector; Current Trend and Future Impacts”, Salikin et al. offer an in-depth examination of chemical and anthropogenic pollution in agriculture, covering air contaminants, pesticides, fertilizers, heavy metals, microplastics, antibiotics, veterinary medications, and antibiotic resistance genes (ARGs). Chapter “Environmental Pollution in Biomedical and Pharmaceutical Sectors”, authored by Abd Kadir et al., addresses the various types of biomedical waste, their environmental and health impacts, relevant regulations and legislation, and the challenges of managing biomedical waste, particularly during and after the COVID-19 pandemic. In Chapter “Pollution by Microorganisms and Its Impact on the Food Safety”, Ab Rashid et al. provide comprehensive insights into the diverse sources and associated risks of microbial contamination in agricultural and aquacultural products. Mohd Aminuddin et al. explore the relationship between traffic-related pollution and the number of vehicles in Chapter “Relationship Between Traffic Density and Particulate Matter Concentrations”. Chapter “Indoor Air Quality Level in Mass Rapid Transit (MRT) Train in Malaysia”, by Samsuddin et al., examines the correlation between CO<sub>2</sub> concentrations, CO levels, relative humidity, temperature, and the number of train passengers. In Chapter “Length–Weight Relationship and Condition Factor of Native Fish Population in Kenyir Lake Basin: Environmental Health Impacts and Mitigations Strategies”, Abd Wahab et al. investigate the Length-Weight Relationship (LWR) and condition factor of three native species from the Kenyir Lake Basin, discussing the environmental impacts and mitigation strategies.

The world urgently needs practical solutions to its pollution challenges. In Chapter “Leveraging Environmental Epidemiology for Effective Pollution Control”, Nathanael and Oginawati delve into the foundational concepts and designs of environmental epidemiology (EE) studies, discussing how to interpret these studies and the multifaceted contributions of EE. They highlight its historical significance, current applications, and future potential. Chapter “Sustainable Approaches Mitigate Environmental Pollution”, by Mat Jalil, reviews various sustainable environmental protection approaches, including the use of nanotechnology, bioremediation, and green technology. Tun Ismail et al. emphasize the importance of household awareness regarding e-waste management practices in Chapter “Sustainable Electronic Waste Management Among Households in Kelantan, Malaysia”, noting that understanding and knowledge of e-waste management are crucial for effective assessment. In Chapter “Qualitative Contents Analysis on Current Practices Clinical Waste Management During Pandemic in Healthcare Establishment, Kelantan”, Mansor et al. employ a qualitative approach, conducting in-depth interviews with healthcare establishment (HCE) staff to explore clinical waste management (CWM) practices before and during the pandemic, and to compare how these practices have evolved over time. Chapter “Designed Landscape for Environmental Sustainability”, authored by Mohd. Hussain and Abu Samah, focuses on landscape design strategies that improve land management and reduce the environmental impact of urban living. Urban and rural areas require different pollution control strategies. Urban regions, with their dense populations and limited land area, demand more compact and efficient systems. These systems are typically costly to operate and require specialized expertise, posing a significant challenge for engineers and researchers to develop high-performance systems at a reasonable cost. In contrast, rural areas, with more available land, may use less compact systems.

Precious metals and nutrients can be recovered from wastewater and solid waste, providing both environmental benefits and potential profits. Natural processes have been explored extensively for this purpose. In Chapter “Advancements in Metal Recovery from Industrial Wastes: A Comprehensive Overview”, Abd Aziz et al. provide a comprehensive review of cutting-edge technologies for recovering precious metals from industrial waste streams. Mohamad and Harumain (Chapter “Harvesting Wealth: Phytomining as a Sustainable Solution for Mine Waste Management and Economic Prosperity”) discuss potential solutions for managing mine waste through phytomining. Abd Aziz et al. (Chapter “Recent Advances in Processed Water Hyacinth (*Eichhornia Crassipes*) for the Removal of Organic Contaminants from Water”) explores the complex mechanisms of adsorption using processed water hyacinth (PWH) for water remediation. Rahman (Chapter “Advancements in Constructed Wetland Technology for Enhanced Domestic Pollutants Removal: A Review”) highlights the potential of constructed wetlands (CWs) as a promising technology for domestic wastewater treatment. Bukar et al. (Chapter “Effect of Different Carbon Sources on Biosurfactant Production by Bacteria Isolated from Hydrocarbon-Contaminated Soil”) evaluate the impact of different carbon sources

on biosurfactant production using bacteria isolated from hydrocarbon-contaminated soil. In another study, Barakwan (Chapter “Utilization of Organic Solid Waste for Hydrocarbon Contaminated Soil Remediation Through Co-composting: A Review”) demonstrates that co-composting is effective in removing hydrocarbons from polluted soil. Rajin et al. (Chapter “Mesophilic Composting of Vegetable Waste Using a Passive Aerated Static Bioreactor: Simultaneous Production of Compost and Leachate”) assess the performance of vegetable waste composting using passive aerated static bioreactors at both laboratory and pilot scales. Hamsun and Umor (Chapter “Utilization of Spent Mushroom Compost (SMC) from *Volvariella Volvacea* Cultivation as a Plant Substrate for *Capsicum Annuum*”) explore the potential use of spent mushroom compost (SMC) from *Volvariella volvacea* cultivation as a plant substrate due to its high nutrient content. In Chapter “Limonite as a Feed Additive Reduces Methane Emissions During Ruminant In Vitro Fermentation”, Mohd Zainudin and Maeda assess the effect of limonite and tannin on enteric methane generation during in vitro rumen fermentation.

As rural populations age and young people migrate to cities due to a lack of interest in handling unclean waste, there may be an urgent need for automation in waste management systems, even if the original systems were more affordable without it. Automation could ease the workload and attract young people to work in rural areas. In Chapter “Conclusions and Future Perspectives”, Abu Samah et al. conclude that process automation using artificial intelligence (AI) will be critical in the near future. Similarly, small and medium industries require more affordable and simpler systems due to their limited financial resources.

This book is a testament to the collaborative efforts of experts from diverse fields who have contributed their knowledge and insights. We hope that the ideas and solutions presented here will inspire further innovation and action in the quest to control and mitigate environmental pollution for a more sustainable future. This book is intended to be an invaluable resource for academics, professionals, decision-makers, and students who are dedicated to finding sustainable solutions to the complex environmental challenges we face.

Kota Kinabalu, Malaysia

Abu Zahrim Yaser

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## About the Editors

**Abu Zahrim Yaser** is an Associate Professor in the Chemical Engineering Programme at Universiti Malaysia Sabah (UMS). Dr. Zahrim is the founder of the Kundasang Compost Living Lab and currently serves as Chairperson for the Research Cluster (Engineering and Technology). He graduated from Swansea University (UK) with a Ph.D. Since 2006, Dr. Zahrim has spearheaded multiple initiatives, and his research mostly focuses on waste processing technology. Dr. Zahrim has published 13 books, 29 book chapters, 54 journal articles, and over 50 other publications to date. With five copyrights on composting systems, his artistic creation, “Kompos” which was displayed at the Festival of Ideas (Ministry of Higher Education, Malaysia), has had over three thousand views. In addition to chairing numerous international and national seminars and conferences, he has given several keynote addresses and invited speeches on waste management and book/article publishing strategies. Dr. Zahrim has evaluated over 250 publications in his capacity as an active reviewer for multiple high-impact journals (Publont). Many communities in Sabah, Malaysia, including Nabawan and Kundasang, have embraced his inventions. Dr. Zahrim is a Professional Engineer (Ir.) registered with the Board of Engineers Malaysia and has been a visiting scientist at the University of Hull (UK). Dr. Zahrim is a recipient of the National Book Award (2023). His Scopus citations count is 1466, with an h-index of 18.

**Mohd Armi Abu Samah** obtained his Diploma in Forestry, B.Sc. in Environmental Science, M.Sc., and Ph.D. from Universiti Putra Malaysia (UPM), specializing in solid waste management with a focus on the composting treatment process. He previously worked as a Senior Research Officer at UPM before joining the IIUM Kuantan Campus as an Assistant Professor. Dr. Armi is actively involved in various research activities, serving as a co-researcher at UITM Shah Alam and as part of research teams at UMP, UPM, Uniza, and UMS. In addition to his academic endeavors, he writes books, magazines, proceedings, and journal papers, and serves as an invited

reviewer for both international and local journals. He has published over 80 papers in various international journals, including indexed and non-indexed journals such as Scopus and ISI. Dr. Armi has received several accolades for his work, including the Malaysia Productivity Corporation Award (MPC) in the "Practitioner" category. He is also involved in knowledge transfer projects on entrepreneurship management for the community, focusing on product pitching to boost market sales and setting up composting projects for communities. Additionally, he is a member of the Malaysia Board of Technologists (MBOT). Presently, Dr. Mohd Armi Abu Samah is an Associate Professor in the Department of Chemistry, Kulliyah of Science, IIUM Kuantan Campus.

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Abu Zahrim Yaser · Mohd Armi Abu Samah · Fazilah Ariffin · A. K. Haghi *Editors*

## **Controlling Environmental Pollution**

Practical Solutions

This book highlights current efforts and research on pollution management and advanced technology for pollution treatment. It presents an overview of various aspects of environmental pollution, including water resources management in minimizing the pollution effect. Recent achievements in air pollution monitoring and control including sustainable urban design are also discussed. Chapters in the book also focus on tackling food waste disposal and advanced techniques on pollution treatment. The book concludes with a discussion of a special case study on Malaysian agricultural industry efforts to tackle pollution.

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