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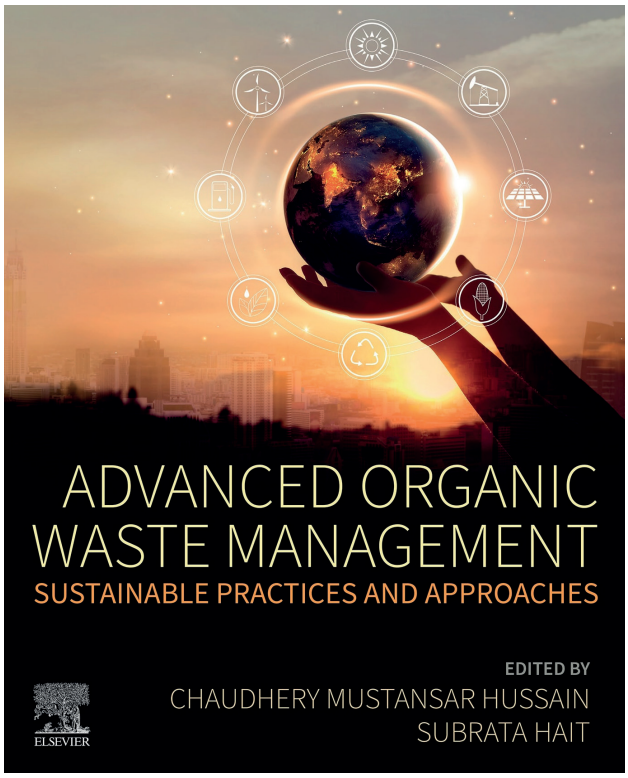

ADVANCED ORGANIC WASTE MANAGEMENT: SUSTAINABLE PRACTICES AND APPROACHES

Edited by: Chaudhery Mustansar Hussain, Subrata Hait

The book Advanced Organic Waste Management: Sustainable Practices and Approaches is divided into six thematic parts which are further subdivided into a total of twenty-eight chapters that explicitly outline the problems related to organic waste and how to manage them sustainably. In the first part, organic waste is defined and characterised and the issues related to their disposal are discussed. Parts two and three cover resource recovery and energy recovery methods which play a major role in waste reduction and valorisation. The fourth part of the book tackles the issue of environmental management of organic waste from an institutional point of view. Taking into consideration the stakeholders involved, the roles they have to play and their interactions with one another, as well as the tools they have at their disposal, all for a sustainable and cost-effective management. In the next part, practices that promote circular bioeconomy are described, that is, an economy powered by natural sources. In this light, concepts such as zero waste, zero landfill, smart waste management and smart cities are evidenced. The book concludes with a final part devoted to the contemporary topic - the COVID-19 pandemic: its impact on food supply and biomedical waste; its impact on waste generation (both quantitative and qualitative); its impact on the waste management infrastructure; and strategies for waste management going forward.

The first chapter provides the reader with a comprehensive understanding of the nature of the waste under discussion. First, the authors classify municipal solid waste (MSW) based on source and type which is important for understanding composition and quantity of solid wastes, as well as the effect of urbanization and income levels of the country in order to facilitate designing, planning, upgrading or operating solid waste management (SWM) systems. Then a characterisation based on physical and chemical properties is provided for understanding the behaviour of waste in degradation procedures. In addition, waste is depicted as a source of wealth and income. Worldwide, around 1.3 billion tons of food are wasted annually. Given that food is usually produced under extensive use of energy and nutrients, making money from waste could be an incentive to resolve SWM issues and simultaneously boost up the economy of all countries worldwide. Waste valorisations systems that may contribute to this resolution are introduced.

The second chapter delves into environmental pollution hazards and health hazards associated with the practice of open dumping, such as: slope failure, groundwater contamination, greenhouse gas emission, vector diseases etc. Special attention is given to developing countries where the quantum of everyday MSW is high and requires a decentralized approach to minimize the burden on the existing unstable MSW management system. This instability on MSW management systems can be reduced by segregating the organic waste biomass before dumping and treating this fraction in decentralized processes such as anaerobic digestion (AD) and composting processes.

Part 2 whose theme is resource recovery from organic waste, is composed of chapters 3 to 12 and each chapter dissects the various components relevant to this topic. In chapter 3, composting and vermicomposting are introduced to the reader. With the aid of case studies and scientific trials one comes to understand what kinds of substrates are suitable for composting, what conditions are optimal for the composting procedure and what parameters to monitor. Chapter 4 takes a more specific stance, describing composting techniques used in urban areas of Indian cities. With an organic fraction accounting for 40–85%

Managing editor:
Roberto Raga
email: roberto.raga@unipd.it

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of the waste, India stands to gain from the development of composting techniques applicable to the urban scene. Remaining in the framework of composting in the developing world, chapter 5 expatiates on the use of floral waste as a substrate for composting. This is especially relevant in this context because India generates approximately 4.74×10^6 tons/day of flower waste and as such constitutes a major fraction of MSW. Case studies of composting techniques and conditions suitable for flower waste and dependent on the quantity are discussed. Next, chapter 6 follows up with a review on integration of composting techniques in the valorisation of industrial solid waste. Focus is placed on paper mill sludge generated in the paper manufacturing industries. Studies revealed that composting of paper mill sludge was time consuming and attempts at speeding up the process resulted in a nutritionally low product. This chapter suggests integrative composting techniques to reduce biodegradation time. Chapter 7 focuses on vermicomposting, that is composting with the added action of earthworms. Not only is the reader enlightened about the benefits of vermicomposting but also about the environmental and health remediating properties of earthworms. Several vermicomposting companies have come up in the world in the last few years and in this chapter, one understands the social, economic and environmental benefits that drive all these countries to carry an interest in vermicomposting. Some problems encountered during vermicomposting of organic wastes are exposed and solutions suggested. In chapter 8, the authors compare the current vermicomposting methods for sludge treatment and discuss the problems in vermicomposting operation, based on the recent studies. Going further, chapter 9 discusses the constraints faced when composting in low temperature regions. When the compost pile temperature falls below 20 °C, the microbial activity drastically hibernates. In this chapter therefore, techniques to combat this problem are elaborated. In chapter 10 and 11, vermicomposting is suggested as a solution to plant invasion which is an emerging problem for both developed and developing countries. In Australia, weeds cost an estimated 3.3 billion AUD each year to grain growers. Vermicomposting of specific weeds is discussed, detailing the experimental design, sampling and analysis, statistical analysis and the degradation of allelochemicals from weed biomass. In chapter 12 which concludes part two, another organic waste substrate subjectable to vermicomposting for sustainable waste recovery is discussed – palm oil mill waste. Crude palm oil production generates fibres and shells and an effluent as waste which in all constitute 70% of the fresh fruit bunches. Palm oil mill waste vermicompost as a soil amendment is put forward as well as the bioenergy potential of the palm oil mill waste to be used as biofuel.

Part 3, made up of chapters 13 to 19, is focused on energy recovery from organic waste. AD of the organic fraction of MSW has gained significant attention in recent years due to dual benefits of waste diversion from landfill and bioenergy recovery along with control of greenhouse gases. Chapter 13 provides the reader with information regarding what type of feedstock is suitable for AD, and for each one, the biogas yield in m^3/kg of dry matter and the expected C:N ratio. Also, in this chapter, one discovers on the one hand the challenges faced in the optimization of waste through AD and on the other, the technologies that can be used to improve AD. Chapter 14 answers questions such as: what factors affect biogas production? That is, what are the optimal temperature, pH and C:N for AD? How important is the presence of toxic and trace elements? What kind of bioreactors should one use and when? In chapter 15, the reader is brought up to speed with the latest progress in the research regarding optimization of the AD process. Experimentation on co-digestion and various waste pre-treatment methods are recounted. Chapter 16 introduces the concept of solid-state AD and a comparison between this and wet AD is made at the level of feasibility, available technologies, drawbacks and substrate and product characteristics. Petroleum refinery sludge is generated from mechanical treatment of petroleum refinery wastewater. Considering the fact that 1 kg of crude oil can generate 10-20 g of oily sludge and that the disposal of excess sludge will be proscribed in near future because of their environmental impact, there is an urgent need for utilization of this waste to ward off their hazard potential. Chapter 17 presents a review on the use of this petroleum refinery sludge for the generation of biogas, presenting therefore an alternative to the current disposal methods as well as an opportunity for energy recovery. Wastewater treatment plants also generate sludge which needs further treatment. Chapter 18 discusses present and future research on hydrothermal pre-treatment of this sludge and points out commercial systems presently on the market.

Part 4 provides environmental management tools for organic waste. SWM integrated with sustainable development goals results in enhanced social livelihood, economic growth, and a clean environment. The challenges and opportunities associated with such an approach are presented in chapter 20 while Chapter 21 reviews the role of remote sensing and geographical information systems in an integrated SWM.

In Part 5, where innovative practices for circular bioeconomy in organic waste management are discussed, chapters 22 and 23 introduce the concept and philosophy of zero waste, management tools and the role of each stakeholder for the implementation of this concept. Environmental education is suggested as an important tool for behavioural change to adhere to environmental needs. Going further, chapters 24 and 25 present another concept – smart waste management and smart cities. Achievement of sustainable development using technology and incorporation of smart infrastructure in conjunction with objectives of sustainable development are discussed here, as well as necessary changes and paradigm shifts needed to overcome the existing gaps in waste recovery. To conclude this part, chapter 26 describes the challenge of waste management of rural slaughterhouses in developing countries, characteristics and treatment alternatives of slaughterhouse waste and achievement of circular bioeconomy in this context.

The book ends with part 6, subdivided into chapters 27 and 28. The main focus here is transition towards sustainability, factoring in the impacts of COVID-19 on the waste management sector. While chapter 27 depicts the impact

of COVID-19 on waste management, chapter 28 goes further to discuss the challenges and opportunities of this new status quo and strategies to attain sustainability going forward.

On the whole, the book delivers an exhaustive presentation of matters related to organic waste management. It is designed to guide novices and professionals, researchers, practitioners, educators, prospective investors and curious readers to the management tools, challenges and perspectives of organic waste management.

Paula Tan
University of Padova (IT)
e-mail: paulangofin.tan@phd.unipd.it

ABOUT THE EDITORS

Chaudhery Mustansar Hussain

He is an Adjunct Professor, Academic Advisor, and Lab Director in the Department of Chemistry & Environmental Sciences at the New Jersey Institute of Technology (NJIT), Newark, USA. His research is focused on environmental management, nanotechnology, advanced materials, and analytical chemistry of various industries.

Subrata Hait

Subrata Hait, Associate Professor, Indian Institute of Technology Patna, India Subrata Hait, PhD is an Associate Professor in the Department of Civil and Environmental Engineering at Indian Institute of Technology (IIT) Patna, Bihar, India. His current research interests include waste treatment and resource recovery, solid and hazardous waste management, composting and vermicomposting of organic waste, e-waste management. He has authored many papers at his credit in various international journals in addition to several book chapters. Apart from serving as a reviewer for different international journals published by the leading publishers including Elsevier, Dr. Hait is serving as an Academic Editor of PLOS One and an Editorial Board Member of SN Applied Sciences.

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