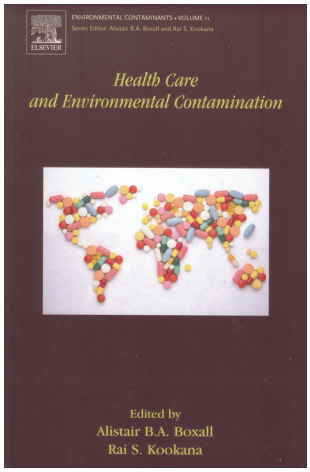

Health Care and Environmental Contamination. Alistair B. A. Boxall and Rai S. Kookana (eds). Elsevier, Radarweg 29, PO Box 211, 1000 AE Amsterdam, The Netherlands. 2018. xi +267 pages. Price: US$ 175.00.

This book under review deals with the important aspect of managing health care waste and its influence on the environment. It provides a fluidic view of current production practices, the source, effects and management of waste through aptly phrased 'sustainable pharmacy', and through policy regulations and risk assessment. The book also provides a systematic approach that can help in developing the United Nations Sustainable Development Agenda through effectively monitoring and managing pharma waste. In all countries across the world health care is a major sector that is growing with a large consumer base, and countries like India need to assess the risk due to existing conditions and manufacturing technologies and supply chain mismanagement. Consumers are the most affected due to either mismanaged availability of pharma products or being illiterate to understand the effects of bioactive compounds that may affect the environment and humans.

Chapter 2 highlights the usage of both personal care and pharma products and their contribution of chemical pollutants to land and aquatic environments. The authors mention about the practice across the globe to mix pharma waste with municipal sewage. Wastewater treatment plants help remove all effluents, but the process by which this is done determines its capacity of removal. Chapter 2 also describes different methods of treatment of municipal sewage contaminated by pharma and personal care effluents such as conventional activated sludge (CAS), sequential batch reactor (SBR) and ultraviolet (UV). However, these cannot remove the entire effluent category of harmful chemicals. Chapter 3 deals with the chemical composition and transformation of these chemicals. It explains how the different environments are effected with transformation through photolysis, hydrolysis and biological degradation. This chapter also explains how bio-solids are becoming a valued resource due to their application as a resource utility in agriculture sector and for maintaining the availability of water through reuse. The chapter concludes with aspects of the need to define risks to humans and environmental health through understanding the contaminants and their fate.

Chapter 4 discusses about ecotoxicology and health care. It mentions that current tools to estimate bioaccumulation and ecotoxicology are inadequate and more work is being focused on developing biological characteristics read across for mammalian safety, fish plasma modelling and behavioural ecotoxicology. Models and tests have been explained to help the reader understand these aspects in detail to end such opportunities in science and to end this environmental pollution. Chapter 5 focuses on terrestrial ecotoxicity. It gives an introduction on how the pharma waste enters municipal waste through various sources. Readers would be able to relate this to their everyday lifestyle and activities around them. This can cause soil ecotoxity through invertebrate and entering the dairy products and increasing hydrophobicity and plant ecotoxity through uptake by plants and affecting the consumable range of vegetables. The chapter also packs in aspects of how future directions of research have to be rooted.

Wildlife has also been exposed to such hazards, including birds, mammals, amphibians, etc. Chapter 6 focuses on how ecotoxicity would affect wildlife and in turn the risk of exposure that needs immediate attention. It also mentions that there will be harmful transfer of the hazards through wildlife as vectors. Authors address the environmental exposure effect through analysis of each category and its effects. Chapter 7 focuses on the effects of pharma industries on human health. This chapter is an important aspect of the book as it clearly distinguishes direct and indirect effects of the pharma industry. It highlights the need for work on antibiotics and selective resistance to bacteria and transfer to microorganisms through environmental routes.

Chapter 8 starts with the challenge of how antibiotics and their resistance can be combated. It explains why antibiotic genes can be considered an environmental contaminants that can be through water exposure, human exposure and so on. It points out how hospitals are vulnerable to bacterial growth that can be transported through any medium that is most suited. Chapter 9 briefly mentions how pandemic diseases are caused and their prevention. It captures the reader's attention with minute details of pandemic spread and causes with effects of using antibiotics and highlights what may be the possible options to various pandemics such as cholera, typhoid, malaria, tuberculosis, etc. Chapter 10 mainly focuses on the aspects pointed out in chapter 8 – hospital waste, its disposal and effects. It clearly defines 'clinical waste' and provides a detailed view on characterization, handling, segregation and transport of such waste. The chapter also explains the options available for waste management such as landfill, destruction process and low-temperature sterilization process, while weighing the pros and cons of each activity and treatment level. It also explains the need for a legal framework for handling and disposing such waste without causing harm to the environment, especially in low-income countries.

Chapter 11 focuses on methods in reducing contaminants in health care products. It discusses of how a legislative context and regulatory requirement has to be framed. It also provides some materials available online to check the precautionary details before health care products are prescribed. The chapter then focuses on details of alternative to antibiotic medicines with few case studies because of over prescription and over dosage. It brings to the forefront an issue that has not been discussed in earlier chapters – about source segregation of urine and its beneficial aspects.

Chapter 12 discusses different management strategies and how a sustainable pharmacy can be set up involving new business models, stakeholder interaction, stakeholder participation, design goals, etc. Chapter 13 focuses on aspects of

how policy regulation and risk assessment have to be framed. Regulatory framework needs to be strengthened with new directives with stringent testing norms before releasing it to market. The chapter also compares US EPA and EU ERA methods of determining regulatory mechanisms, testing procedures, etc. It stresses on how environmental regulation needs to be more binding so that the flow of toxic materials into humans is stopped. Finally, the need to dispose and curb the usage of life-expired medicines, such as take-back schemes and disposal methods.

This book articulates ecotoxicity, effect of pharma and need for good legislative and regulatory framework supported by documentation of necessary case studies and process explanation. Though the book has sufficiently covered all aspects as expressed by the title of the book, it lacks deeper understanding needed for further research and insights.

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