

how this business venture failed in Hyderabad and places around it since, to begin with the technology used was that of the filter candle. With modern technology of UV light-driven tubes, it will not be possible for any of these candle-based purifiers to compete and survive. Also, with LEDs and LDs of wavelengths below 350 nm, that can kill viruses, it is imperative that any society with access to electricity would not want to invest in candle purifier technology. The electric UV light-driven purifiers can be made compact also. This would put an end to the silver nanoparticle-based candle product. Sekhsaria describes this episode of candle based purifier technology development by a businessman. How he works hard to market it, but fails due to society's unacceptance as these filters are out of fashion. This leads to the product failure, although the product was nice. It shows how society's status ideas and culture can make or break a nice product.

Lastly, he touches upon one of the harshest social realities in India. The treatment of a girl child with retinoblastoma. At present, this disease is curable if the eye can be surgically removed. However, he finds that the parents would let the girl child die rather than give her proper treatment, giving the reason that no one will marry one-eyed women. Some of the most disturbing cases are described in the book. If nanotechnology can be used to cure this type of disease, it would be a boon to such patients. But in the quest of this nanoscale phenomenon, Sekhsaria hit upon this harsh reality and describes how social values and culture can decide treatment decisions, for the patient.

The book describes many cases in detail, but the most important point it makes is about the culture we have in India, mainly driven by poor economic conditions leading to scarcity of resources, and then some people still doing innovation. However, to compete and survive in the modern world and make usable and reliable products, it is not possible to continue with this type of jugaad culture, India has to change its policies and bring in innovation and encourage entrepreneurship.

Overall, the book is readable and enjoyable. It is an eye-opener in some aspects and looks at things in a different perspective. Most books till now on science or science-related matters have not looked at the social aspects of innovation that leads to successful or unsuccessful

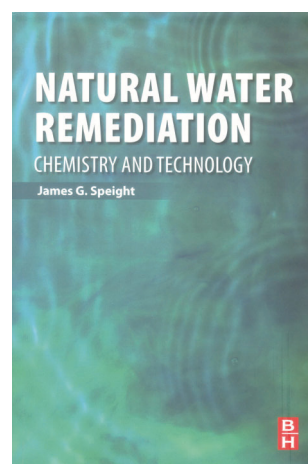
scientific programmes or products. Our old wisdom tells us that scientific research and technological innovation bring drastic change and society has no option but to constantly adapt and to evolve in response to it. This book gives a new perspective to look at innovation, science and technology development, and how society responds to it. It will be useful for Government policy to make suitable changes so that people do not rely only on jugaad type of innovation, but can actually get access to the complete modern technology, instruments, etc. and can design new machines. This will train the next generation of students, scientists and entrepreneurs. It is simply impossible to buy state-of-the-art equipment for every educational institution and get students trained.

In all, reading this book and listening to Sekhsaria's lecture has been a great experience and I encourage more readers to do the same. Please click on the following link to hear the lecture.

<https://youtu.be/RxkNEtdQcO4>.

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**Natural Water Remediation: Chemistry and Technology.** James G. Speight. Butterworth-Heinemann, an imprint of Elsevier, The Boulevard, Langford Lane, Kidlington, Oxford OX 1 GB, United Kingdom, 2020. Xii + 380 pages. Price: US\$ 120.00.

This book written by a well-known authority as a handy resource and reference book for engineers (environmental, civil and chemical) is a valuable and timely resource for researchers, practitioners and students as well. Water remediation is a hot topic now as water availability globally is finite. Water is considered as the elixir of life – without good quality available water, survival of human beings and other life forms is not possible. With the growing population of human beings (7.8 billion in 2020 and expected to reach 9.9 billion by 2025) and animals (1.4 billion livestock population) per capita water availability is declining steadily. Access to water particularly in the Asian nations, is becoming a big issue due to physical scarcity. In Africa, water scarcity is largely due to poor economic development, and not due to physical availability. The Third World war will be for water and the severity of the issue is evident every day in the media – many a times becoming the point of friction amongst neighbours (houses, villages – upstream and downstream, states/provinces and neighbouring countries) sharing water resources, thus disturbing the social fabric of the society through continued disputes for water. Countries in the tropics face the double challenge of managing water as evapotranspiration demand is far higher than the precipitation. Countries like India face the challenge of water scarcity as maximum (65% globally – varies with countries, e.g. India 80%) consumptive water use is for agriculture to ensure food availability for the ever-growing population. Also, with increasing incomes, the food habits are changing with more people shifting to animal-based diets, which has higher water footprint (15,000 l/day/person against 4500 l/day/person). As evident in India, groundwater use with 23–24 million borewells is directly associated with increased food production and increased industrialization. As a result the quantity and quality of water (surface and ground) are becoming a major issue threatening sustainable development. Along with increased demand for freshwater, the quality of natural water (surface as well as groundwater) is an issue due to increased pollution of rivers, seas and oceans as well as groundwater resources. With these challenges in hand, globally people are looking for solutions to adopt integrated water resources development

approach, where remediation of natural water can ease the problem of water availability as well as help in tackling the health and well-being of the citizens. This book is timely and can help planners as well as professionals in their endeavour.

The book chapters are largely well synchronized which gives the reader a complete understanding of water remediation. For budding researchers and post-graduate students, the book starts with a description of well-illustrated water systems. The chapter starts describing with ease the atmosphere, hydrosphere (groundwater, ice sheets, glaciers ponds and lakes, streams and rivers, wetlands, oceans), lithosphere (soil composition and soil pollution) and their interrelationships, as well as aquatic organisms and introduces the readers to the global water cycle. Readers would have benefitted if different groupings of micro-organisms such as aerobic, anaerobic, microaerophilic with different shapes, parasitism were indicated/mentioned. Chapter 2 describes the properties of water starting with structure, physical, chemical and electrical properties, and the importance of water as a solvent, medium and participant in most of the chemical reactions as well as being a large component of living organisms. Structure and bonding of water as well as molecular symmetry are described in simple terminology. General properties of water are provided for the reader, including thermal properties. Chapter 3 dwells in detail on water chemistry starting with hydrosphere, composition of water, acidity and alkalinity, reactivity of water with metals, hydrides, halogens, methane and oxygen. Next, it takes the reader to redox chemistry and then logically to water as a solvent.

Chapter 4 describes the thermodynamics of water starting with a definition and then gradually taking the reader to the states of water, thermodynamics, hydrogen bonds, electron structure along with adsorption-desorption. Once the water molecule, its stages and properties are described, readers are introduced to the sources of water pollution which is the main topic of the book. How contaminants based on their solubility can pollute surface and groundwater is described

in simple language. The sources of contaminants are mentioned and acid rain topic is introduced. The role of agricultural waste and the effect of climate change (global warming) on water resources are described. How climate change can have an impact on arid and semiarid areas such as northwest India, affecting water availability, agriculture, power generation and land degradation is discussed. Similarly, how the perennial rivers in India originating in the Himalaya and Hindukush ranges are being affected with the melting of snow, rise in the snowline and risk of flash floods are dealt with. Industrial waste, agrochemicals as pollutants as well as thermal pollution and urbanization as a cause for water pollution are introduced. Nutrient enrichment (natural and anthropogenic) and cultural eutrophication, and how nitrogen and phosphorus used as nutrients in agriculture become pollutants and support algal blooms leading to eutrophication are highlighted. Then the readers are introduced to crude oil spills, radioactive wastes and sewage, and their impact on chemical and biological oxygen demand is described. How specific water systems (rivers, lakes and streams, groundwater and oceans) are affected by pollutants and their effects on human health through diseases and phytotoxicity are illustrated, establishing the base for water remediation. The next chapter deals with crude oil in water systems as a pollutant, physical and chemical methods of remediation, biodegradation and bioremediation. Bioremediation is described in depth and it provides a good understanding of oil spills in water bodies and the strategy for handling such pollution. Chapter 7 deals with water and hydraulic fracturing, types of wells, methods of fracturing, chemicals used in hydraulic fracturing and their effect on water quality. Reservoir management and its various aspects are described, as well as the challenges involved in reservoir management.

Chapters 6 and 8 which describe the remediation technologies are a good source for the practitioners. They describe all the stages from sampling, testing methods, quality assurance and quality control standards, pollution and remediation. Readers could have benefitted if these two chapters were back-to-back de-

scribing all remediation technologies together. Under sampling it is indicated that sampling bottles need not be sterilized, but it overlooks the need for biological pollutants testing. Potential role of zeolites as a treatment is also introduced. Use of surfactants as well as biological treatment, phytoremediation and handling metal pollutants through ion-exchange technologies are informative for the readers. The concluding chapter aptly describes the ways of preventing pollution, environmental regulations, Clean Air Act, liabilities of the stakeholders, precautions to be taken during handling, transportation of pollutants as well as Resource Conservation and Recovery Act. Suitable options for substitution are described along with recycling, waste and water treatment, aptly concluding with management and mismanagement and the future.

Overall the book will help all the stakeholders involved in water management which is the burning issue worldwide due to decreased per capita availability and quality of water. However, several typos and repetitions in the chapters cannot go unnoticed by the readers. For example, typos like *cyclo* instead of *cycle* on p. 10; while on p. 11, a sentence starts with 'A cycle has no beginning and no end' and the same para third line mentions 'being a cycle there is a beginning or end' which can be confusing. On pp. 31–32, aquifer and artesian aquifer definitions are repeated, while on p. 36 under 'Bacteria' sub-heading, comma is missing between spheres, rods and spirals. Typos on p. 267 third line, third para, instead of 'the' it is 'he', on p. 282 third para, second line, instead of 'the ion exchange' it is 'thee ion exchange'. Figure 1.2 is repeated again as figure 2.3. Similarly, table 1.5 is repeated as table 2.3. Repetition of table 2.2 as table 4.1, figure 1.1 water cycle as figure 4.1, figure 3.1 as figure 4.3, and figure 1.2 as figure 5.2 is a memory test for the readers.

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