series of steps that help to meet the goal of minimizing waste toxicity and volume."

The steps in this process, the authors note, are as follows:

1. analysis of manufacturing processes;
2. wastes minimization and wastes characterization study;
3. determine treatment objectives;
4. select candidate technologies;
5. bench-scale investigations;
6. pilot-scale investigations;
7. prepare preliminary designs;
8. conduct economic comparisons;
9. final design;
10. solicitation of competitive bids for construction.

To illustrate their approach to cost estimation as a part of the above step-wise process, the authors provide a detailed cost estimate for five alternative processes for treating wastewater from an industrial plant producing microcrystalline cellulose from wood pulp. Details of both capital and O&M costs are provided in this excellent section.

I was surprised by the topic of material in Chapter 2 which is entitled "Fundamentals." In this chapter, the authors present ". . .a summarized version of the basic chemistry and physics on which treatment technologies are based, with the objective of showing that a command of these principles can enable quick, efficient identification of very effective treatment schemes for almost any given type of wastewater." The above statement I certainly agree with, but the inclusion of this topic in a design text seems out of place to me.

Chapter 3, entitled "Laws and Regulations," is a concise review of water and air laws. Solid and hazardous waste laws are discussed later in Chapter 5 which is entitled "Waste Characterization." Between these two chapters is the current "hot topic" of pollution prevention. Included in this chapter are short, practical examples of problems and solutions; this material which is provided in highlighted boxes added much to the chapter.

"Industrial Stormwater Management" was the title of Chapter 6. Discussion of that topic is not found in most texts. I found it useful and interesting.

Treatment processes are first discussed in Chapter 7 which deals with wastewater. Discusses in sequence were flow equalization, pH control, chlorination, coagulation, chemical oxidation, biological wastewater treatment (activated sludge, PACT, lagoons, attached growth systems, and anaerobic treatment), physical methods (screens, plate and frame filters, etc.), settling, sedimentation, sludge thickening, dissolved air flotation, ion exchange, and stripping.

Clearly, the authors have "touched all the bases" and although discussion is not in great detail, it is certainly sufficient to understand basic treatment technologies. The chapter is well endowed with pictures of equipment, plots of data analysis, and appropriate mathematical equations as needed. Almost 200 pages long, this chapter is the heart of the book.

The next two chapters are entitled "Treatment of Air Discharges from Industry" and "Solid Waste Treatment and Disposal." The material in these chapters is mainly descriptive with the inclusion of numerous diagrams and photographs of equipment to describe air pollution control and solid waste disposal systems.

The book ends with an industrial case studies chapter. Waste treatment processes for 13 representative industries are reviewed. "Discussion of the 13 representative industries is preceded by a discussion of three processes that are common to many different industries: vapor degreasing, chemical descaling (pickling), and rinsing."

My only criticism of the book is the lack of truly current references and the use of too many 20-year old reference articles. Admittedly, the material in these old citations is relevant but I would have preferred updated citations.

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Nanomaterials—Toxicity, Health and Environmental Issues, C. Kumar (Ed.). Wiley-VCH, Verlag GmbH & Co. KgaA, Weinheim, Germany (2006). 351 pp., Price: US$ 190.00, ISBN: 3-527-31385-0

Nanotechnology is a "new frontier" in science. It is having a widespread impact on engineering and, as this book notes, medicine also. "Nanotechnological advances . . .," the flyer accompanying the book notes, ". . . have resulted in new and improved diagnostic and monitoring microdevices, microsurgery tools and instruments, tissue engineering technology, drug delivery methods, and artificial organs."

This book is the fifth in a planned 10-volume series entitled "Nanotechnology for the Life Sciences."

The editor notes that "Some of the critical risk assessment issues that are currently being investigated by the health & environmental nano researchers are toxicology, exposure assessment, environmental and biological fate, transport, persistence, transformation, recyclables and overall sustainability of manufactured nanomaterials."

New information is coming out daily and will extend our knowledge of the topic. To this end, Kumar has solicited 12 chapters collaboratively written by 37 authors from 6 countries. The material is divided into three major sections. The first section of the book deals with toxicity aspects of nanomaterials which are ". . . the most commercially significant materials as they are used in cosmetics, sunscreens, dental materials, water filter processes, catalysis, glare-reducing coating for glasses, etc." The two chapters in this section are entitled:

- Biotoxicity of metal oxide nanoparticles
- Ecotoxicity of engineered nanomaterials

In the second section of the book, the contributors discuss the effect of nanomaterials on human health, noting the amount of background information is limited. To this end, five chapters comprise this section:

- Possible health impacts of nanomaterials
- Dosimetry, epidemiology and toxicology of nanoparticles
- Impact of ceramic and metallic nano-scaled particles on endothelial cell functions in vitro
- Toxicity of carbon nanotubes and its implications for occupational and environmental health
- Toxicity of nanomaterials – new carbon conformations and metal oxides

The final section of the book, and the one of greatest interest to me is ". . . dedicated to the investigations related to the impact of nanomaterials on the environment." The chapters in this section are entitled:

- Nanomaterials for environmental remediation
- Nanomaterials for water treatment
- Nanomaterials for the photocatalytic removal of endocrine-disruption chemicals in water
- Nanosensors for environmental applications
- Toxicology of nanoparticles in environmental air pollution

The material in these chapters is fascinating. I have extracted two passages for this review:

- "Nanomaterials offer many useful properties for environmental remediation: high surface area, enhanced interfacial reactivity, easy dispersibility, and facile sorption kinetics. Nanoparticle-based strategies have been built around alkaline earth oxide materials, zero-valent metals and crosslinked polymers. These different classes of materials offer widely different chemistries that can be tailored to address differing remediation needs, from DNAPLs to chemical warfare agents to PAHs. Hybrid nanostructured materials are also finding application in environmental chemistry."
- "The toxicology of engineered nanoparticles is a topic of increasing interest. However the existing toxicology database on nanoparticles rests almost entirely on combustion-derived nanoparticles in environmental air. This research reached a peak in the mid to late 1990s, focused around the 'ultrafine hypothesis.' This suggested that the combustion-derived nanoparticle component of PM was a key component of PM in causing adverse health effects, by virtue of its ability to cause oxidative stress and inflammation and translocate from the site of deposition. This review puts forward the evidence that nanoparticles do play a role on the adverse health effects of environmental particles and what the mechanism may be, in the belief that this may illuminate the toxicology of engineered nanoparticles."

This a groundbreaking book, one of the first that focuses on the environmental aspects of nanoparticles. The information in it will be of great interest to students and researchers interested in nanoparticle impacts and applications.

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