'commonly used suspended and attached growth reactors, including combined carbon and ammonia oxidation, activated sludge, biological nutrient, removal, aerobic digester, anaerobic processes, lagoons, trickling filters, rotating biological contactors, fluidized beds and biological aerated filters.'

Grady's first text, published in 1986, had 14 printings and was adopted by more than 50 universities as a text. Given the thoroughness of the coverage, especially the comprehensive theoretical basis for each described process, that is not surprising. But the authors go beyond simple classical theory to present the various process models that mathematically describe processes, i.e. for aerobic growth in rotating disc contactors, the authors discuss (albeit briefly) six different mathematical models of the process.

The book was written for a 3-semester hour graduate level environmental engineering course. In a gross understatement, the authors state, ''In reality, the amount of information provided is more than can be covered comfortably.'' I fully agree: the book contains very thorough but detailed discussion of the processes; all are well-referenced, so well referenced, in fact, I thought at times I was reading a literature review of the topic being discussed.

No significant biological wastewater treatment topic is omitted from the book's 22 chapters. The author has placed these chapters under six main headings:

- Introduction and Background
- Theory: Modeling of Ideal Suspended Growth Reactors
- Applications: Suspended Growth Reactors
- Theory: Modeling of Ideal Attached Growth Reactors
- Applications: Attached Growth Reactors
- Future Challenges

The coverage is best described by the authors in the preface. ''Part I seeks to do three things. First, it describes the various 'named biochemical operations' in terms of their treatment objectives, biochemical environment, and reactor configuration. This helps to remove some of the confusion caused by the somewhat peculiar names given to some biochemical operations early in their history. Second, it introduces the format and notation that will be used to present the models describing the biochemical operations. Finally, it presents the basic stoichiometry and kinetics of the various microbial reactions that form the key for quantitative description of biochemical operations. In Part II, the stoichiometry and kinetics are used in mass balance equations to investigate the theoretical performance of biological reactors containing microorganisms growing suspended in the wastewater as it moves through the system. Part II is at the heart of the book because it provides the reader with a fundamental understanding of why suspended growth reactors behave as they do. In Part III, the theory is applied to the various named suspended growth biochemical operations introduced in Part I. In that application, however, care is taken to point out when practical constraints must be applied to ensure that the system will function properly in the real world. In this way, the reader obtains a rational basis for the design of biological wastewater treatment operations that incorporates knowledge that has been obtained through practice. In other words, we have sought to make Part III as practical as possible. Parts IV and V parallel Parts II and III in organizations, but focus on biochemical operations in which the microorganisms grow attached to solid surfaces. This mode of growth adds complexity to the analysis, even though the operations are sometimes simpler in application. Finally, Part VI looks briefly at the use of biochemical operations to remove xenobiotic organic chemicals from wastewaters. The intention is to introduce this topic so the reader can continue learning with the rest of us as we seek to solve the world's environmental problems''.

Each chapter ends with a summary of the key points in the chapter followed by numerous study questions (a section that includes problems). My only criticism of the book is that there are fewer numerical problems that I would like in a text.

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Adsorption Design for Wastewater Treatment, David O. Cooney, Lewis Publishers, Boca Raton, FL. 1998, $44.95, 190 pp., ISBN: 1-56670-333-6

Few books deal with a single water/wastewater treatment process. This one is an exception, in that the author discusses solely the use of activated carbon to adsorb contaminants from aqueous streams. Cooney wrote this book for ''...students and practicing engineers who wish to learn how to design batch adsorption units and fixed-bed adsorbers without having to delve into long, detailed, and largely theoretical treatises on adsorption.''

I was intrigued by the author's discussion in the preface of the other texts available on the topic and comparing their coverage to his own. The section is the best review of the textbook literature on this topic I have seen.

As a text, the author notes he was able to cover it completely in a 4-week period in a graduate level engineering course—and from my reading of the book, I would agree this timeframe is 'doable' but busy. As a text, faculty members will appreciate the numerous problems found at the end of each chapter.

The material presented is comprehensive (mathematical), treated theoretically, and approached practically (for design purposes).

The book centers on the following eight chapters:

- Adsorption for Wastewater Treatment
- Production and Properties of Activated Carbons
- The Nature of Adsorption
- Adsorption Equilibria
- Kinetics of Adsorption with Granular Adsorbents
- Design of Powdered Carbon Batch Contractors
- Theoretical Solutions for Fixed-Bed Adsorbers
- Design of Granular Carbon Fixed-Bed Adsorbers

My only criticism is that example problems are printed in paragraph form rather than line-by-line, making it difficult to follow the mathematical processes.

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