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Book reviews

Biogranulation Technologies for Wastewater Treatment, J.-H. Tay, S.T.-L. Tay, L. Yu, S.K. Yeow, V. Ivanov. Elsevier, Oxford, UK (2006). 307 pp., Price: US$ 154.00, ISBN: 0-08-045022-9

This book is the sixth in Elsevier's Waste Management Series. It discusses a topic completely new to me—biogranulation processes. The book provides "... information on the current status of development and application of wastewater treatment biotechnology-based microbial granulation."

In the preface to this book, the authors describe microbial self-aggregation as a condition in which "... microbial cells are organized into dense and fast settling granules with a diameter from 0.5 to 10 mm." (Later in the preface, they caught my attention saying, in error, the granules have sizes from 0.2 to 7 m.)

Anaerobic granules have several advantages over aerobic granules according to the authors. These advantages include:

1. aggregation leads to heterogeneous community and facilitates syntrophic relationships, especially interspecies hydrogen and formate transfer;
2. granulation protects cells from predators, such as anaerobic ciliates;
3. under unfavorable conditions for growth (e.g. extreme pH), a more favorable micro-environment can be maintained within the aggregates so that metabolism can be sustained;
4. the diffusion of substrates and fermentation products can be facilitated due to the formation of the channels in the granule.

The titles of the diverse chapters, which I quote to illustrate the coverage of the topic, are as follows:

1. Mechanisms and models for anaerobic granulation
2. Factors affecting anaerobic granulation
3. Applications of anaerobic granulation
4. Mechanisms of aerobic granulation
5. Factors affecting aerobic granulation
6. Structure of aerobically grown microbial granules
7. Microorganisms of aerobic microbial granules
8. Nutrient removal by microbial granules
9. Removal of phenol from wastewater by microbial granules
10. Seeds for aerobic microbial granules
11. Biosorption properties of aerobic granules
12. Conclusions: current status and direction of research

In the preface, the authors note "The reader can find the description of granulation process in upflow anaerobic sludge blanket reactor (UASB), expanded granular sludge bed reactor (EGSBR), hybrid anaerobic reactor (HAR), anaerobic continuous stir tank reactor (ACSTR), anaerobic baffled reactor (ABR), anaerobic sequencing batch reactor (ASBR), and anaerobic migrating blanket reactor (AMBR). The main problem associated with the granular sludge systems is the long start-up period required by the development of anaerobic granules."

One of the fascinating pieces of information in the book was a description of the layers in aerobically grown microbial granules that were grown in a column SBR with a medium containing ethanol or acetate. These layers include: (1) aerobic ammonia-oxidizing bacteria, (2) facultative anaerobic enterobacteria, (3) obligate anaerobic bacteria, (4) channels and pores by penetration of 0.1 μm microspheres, (5) layer of active biomass, (6) polysaccharides, and (7) core of dying cells in the center of the granule.

Of major interest to me were the two chapters discussing nutrient and phenol removal. Much of the data in these two chapters, indeed in the whole book, are from the authors' own work.

Not being familiar with the topic, I am unable to make a "value judgment" on the scope and coverage of this topic with the exception to say that it is novel, interesting and groundbreaking.

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