

## **Handbook Biological Wastewater Treatment**

The subtitle of the “Handbook Biological Wastewater Treatment - Design and optimisation of activated sludge systems” quite accurately describes the contents of this book: it supplies the means to design an activated sludge system, culminating into a cost-based design approach. The clear and concisely structured book guides the reader step-by-step through ever more complex wastewater treatment processes. The well-worked examples demonstrate the modelling approach and -logic and allow the reader to familiarize him- or herself with the presented theory.

Actually, it’s quite a miracle that this handbook has been published at all. Mr. Van der Lubbe started his career at the environmental consultancy firm of mr. Van Haandel in Brazil. He was given a hardcopy of a draft version of the handbook, for comments and review. A long time after having returned to Holland, he found out that the book had never been published (apart from a Portuguese edition). The computer containing the English manuscript had been stolen: the often used and somewhat battered paper manuscript now suddenly had become a priceless item. The authors decided to join forces to publish a thoroughly revised and updated edition of the handbook. On the internet ([www.wastewaterhandbook.com](http://www.wastewaterhandbook.com)), a substantial part of the book is available for download, together with a number of spreadsheets examples of the design of different system configurations.

The handbook starts with a general introduction of the activated sludge system to refresh the reader’s knowledge about this subject. Chapter 2 deals with characterization of organic material present in wastewater and bacterial metabolism. Chapters 3 to 5 form the main core of the book, in which design models are presented for the removal of organic matter (COD), nitrogen and phosphorus (chemical and biological) from wastewater. In a clear and highly didactic manner the basic principles of the processes are explained, followed by mass balances, stoichiometrics, kinetics and model equations. Well-worked examples trigger the reader to start the design of their own wastewater treatment plants, using the presented process models. Steady state conditions are assumed to reduce model complexity and allow for design optimization. The authors use a different model notation than that used in the IWA models, which will take a little time and effort getting used to.

A significant portion of the handbook is devoted to recent developments in wastewater treatment. Chapter 7 is dedicated to MBR (including a very extensive design example) and contains a section on aerobic granular sludge. In the chapter on nitrogen removal recent processes as Anammox, Sharon and Babe are extensively discussed and evaluated. In Chapter 5 the last step in the activated sludge process, final settling, is designed and optimized using the solids flux theory. In Chapter 8 and 9 design models are presented for sludge stabilisation and -digestion (both aerobic and anaerobic) and pre-treatment (UASB and primary settling).

In the final chapter, the theory and models developed for the main treatment units are integrated into a single cost based design model. Compared to the ASM models, the model kinetics have been simplified by deliberately omitting those parameters, which do not directly influence system design. For example the oxygen concentration is deleted from growth equations of heterotrophic bacteria, as it is presupposed that the engineer will ensure that sufficient oxygen will be present in the aerated zone. Part of the chapter deals with the basis of design: cost data, effluent requirements and treatment objectives, system selections and constraints. When the design basis has been defined, the design model is applied to five common wastewater treatment configurations, resulting in optimal and most economical system design (tank volumes, fluxes and flows, concentrations etc). Of course the design process is again explained by extensive calculation examples. For accelerate understanding, the reader can use the Excel spreadsheets available on the website.

## **Conclusion**

It's a good book, very (sometimes maybe a little too) complete and as such recommended as a study and design guide for students and engineers. The principles involved in system selection and design models are explained. The detailed calculation examples are very useful for practical applications. It will take some effort to get used to the model notation, but fortunately a symbol list is included in the spreadsheets. The website offers great added value and will offer you extensive pre-views of the book.

## **Merle de Kreuk (TU Delft)**

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*For more info, visit <http://www.wastewaterhandbook.com>*