

Preface

The main purpose of this book is to bring alive the concepts forming the basis of the chemical process industry and to give a solid background for innovative process development. This is done by treatment of actual practical processes, which all present one or more challenges that chemical engineers have to deal with during the development of these particular processes and which are often still challenges. It is not the intention to treat the chemical process industry in an encyclopedic way. Concepts are emphasized rather than facts. Hopefully, this approach will stimulate students in chemical engineering and also those who play a large role in the field such as chemists, biologists, and physicists. In particular, it is intended to provide students with an innovative background. The next generation should invent and develop novel unit operations and processes!

From the wealth of processes a selection had to be made. We have attempted to do this in a logical way. Knowledge of some processes is essential for the understanding of the culture of the chemical engineering discipline. Examples are the major processes in the oil refinery, the production of base chemicals from synthesis gas, and catalytic purification of exhaust gases from cars. Chemical engineers have been tremendously successful in the bulk chemicals industry. However, in some other sectors this was not the case in the past, but today they are becoming more and more important. Major examples are fine chemistry and biotechnology. Therefore, these areas are treated in separate chapters. More recently, the emphasis has shifted to sustainable technology and, related to that, process intensification. These subjects are also touched upon.

In all chapters the processes treated are represented by simplified flow schemes. For clarity these generally do not include process control systems, and valves and pumps are also omitted in most cases.

It is expected that students after having read the book will be able to think in 'conceptual process designs'.

This book can be used in different ways. It has been written as a consistent textbook, but in order to give flexibility it has not been attempted to avoid repetition in all cases. In particular, it has been written such that dependent on the local interest and the personal taste of the lecturer a selection can be made, as most chapters have been written in such a way that they can be read separately. For instance, in the chapter on biotechnology, reactors are treated in some detail, although in previous chapters on bulk chemicals production and fine chemistry similar discussions on reactors are present.

It is not trivial how much detail should be incorporated in the text of a course book like the present one. In principle, the selected processes are not treated in much detail,

except when this is useful for explaining concepts. For instance, we decided to treat FCC in some detail because it is such a nice case of process development where over time catalyst improvements enabled improvements in chemical engineering and vice versa. We also decided to treat one process, viz., ammonia synthesis in some detail with respect to reactors, separation and energy integration. If desired this can be the start of a discussion on process integration and design. The production of polyethene was chosen in order to give an example of the tremendously important polymerization industry and this specific subject was chosen because of the unusual process conditions and the remarkable development in novel processes. Fine chemistry is treated in much more detail than analogous chapters in order to expose chemistry students to reactor modeling coupled to the practice they will be interested in.

In order to stimulate students in their conceptual thinking a lot of questions are asked throughout the text.

At the Technical University of Delft, the text is the basis for a course of two credit points in the third year. The contents are Chapters 1–3 (3.1–3.5), 4–6, 8, 10, 11, and 13. Chapter 3 is the starting point for an optional course ‘petroleum conversion’. All students do at least one design project. This book forms one of the bases for that. It is hoped that the text will help in giving chemical engineers sufficient feeling for chemistry and chemists for chemical engineering. Needless to say we would highly appreciate any comments from users.

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