Then I started reading some entries on equipment I had been working with during the last few years. I read the entries on cooling towers, on pumps, on extruders, on distillation, on compressors, just to mention a few and the bad feeling did not disappear, although it remained difficult to pinpoint what the real problem was I had with the book. I gave the book to my son, who is a technician, specialised in reading comics, and he helped me to find what is wrong.

This book certainly presents a rather complete listing of process equipment as used by chemical engineers in all their diverse fields of activity. The equipment is listed alphabetically, which could make it easy to find, if only the listing had been on the main equipment name. Unfortunately, this book does it on the adjective! For example, Twin Screw Extruders are found under T, while under the heading Extruders (under E) there is no reference to the existence of Twin Screw Extruders. In general, cross-references between entries are lacking and, even worse, analogies between processes are not mentioned (Is an absorption column really completely different from a distillation column?). Furthermore, the entries are rather incomplete about types of equipment within a category. For example, structured packings are not mentioned at all, neither under distillation nor under absorption.

Most of the text is used to explain how a piece of equipment works in such a general way, without dealing with the principles that govern its performance, that the value of the book for an engineer in actual practice is very questionable. References are generally lacking and most of the referenced literature is rather old.

The book contains a lot of illustrations to elucidate the text, but most of them are of very bad quality. This is where my son helped me out: a lot of illustrations have apparently been picked from other publications and have been adapted in size and/or form to fit the space. This has led to distorted equipment (ellipses instead of circles) and gives the impression that process equipment is full of ellipsoidal rotors, pulleys, vessels etc. Some figures contain so much detailed information in a small picture that they are unreadable and some illustrations are really misleading. The typical operating scheme of a centrifugal pump, showing a pump with a suction line extending into a pit below the pump is an example of this (It suggests that centrifugal pumps would be selfpriming; the text explains that that is not the case.). The editing of the figures is of such an unbelievably low quality that I do not understand the gratitude the author expresses to the publisher in the preface 'for their fine production of this work.'

It is the combination of the above features that explains in hindsight my bad feelings during my first browsing through the book. This book does not even deserve browsing.

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PII: S1385-8947(00)00181-9

The Chemistry and Technology of Furfural and its Many By-products

Karl J. Zeitsch; Elsevier, 2000, 358 pp, US$ 235.00 (hardback), ISBN: 0-444-50351-X

There has been increasing interest in producing chemicals and fuels from renewable resources or biomass, especially with today's environmental concerns. Among the several bio-chemicals manufactured commercially, furfural is important for its wide applications with over 200,000 t annual production in the world and for its unique availability from agricultural wastes and forest residues. Karl J. Zeitsch's book may help promote new technology and applications of furfural.

This comprehensive book precisely describes the chemical mechanism and technology of furfural production, its by-products, and its many derivatives. The first eight chapters concentrate on the mechanism and kinetics of furfural generation from pentosan and its loss by resinification and condensation. Chapters 9 through 13 review various developed and potential furfural processes by hydrolysis, distillation and wastewater treatment. The remaining, Chapters 14 through 32, cover by-products of acetic acid and diacetyl and many furfural derivatives. Appendices list properties of covered chemicals, some details of analysis, operation conditions, and furfural applications.

Based on a clear picture of the kinetics of furfural formation and loss, Zeitsch addresses the low yield of furfural in commercial processes, which can only reach 50–60% of the laboratory value. In the temperature range 140–180°C used in the industry, the furfural yield is limited by the loss reactions of resinification and condensation with intermediates during the hydrolysis. He also attributes the low yield to the furfural being in a liquid phase at these low temperatures. In the elucidation of furfural existence in liquid phase, however, mass transfer and complete phase equilibrium principles are not employed. Many furfural processes are reviewed with emphasis on Quaker Oats and Rosenlew. However, several processes used in China, Italy and Russia are lacking. Zeitsch strongly suggests higher temperature hydrolysis because the furfural loss reactions can then be subdued. Consequently, three potential processes carried out at 200–240°C: Supertherm, Stake, and Suprayield, are discussed. Besides production from biomass directly, the production of furfural from sulfite liquor, a waste in a paper mill, is described. This adds value to the book since these special processes are rarely published in books on furfural.

In the section on by-products, Zeitsch presents acetic acid first, then moves to diacetyl and its derivative, acetoin. The recovery of by-product acetic acid includes various processes: extraction, freezing, azeotropic distillation, extractive distillation and re-circulation. One of Zeitsch' major contributions covers the recovery of diacetyl and 2,3-pentanedione. Followed by the explanation of formation mechanisms and processes of the by-products in furfural reactors, Zeitsch details the recovery techniques by extractive

distillation, cryogenic crystallization and multi-azeotropic distillation. The inclusion of byproduct production makes this furfural book unique and also sheds useful light on improvement of furfural processes by enhanced by-products.

Many furfural derivatives, which include furan resins, THF, THFA, furan, furoic acid, methyl furan, maleic acid, difurfural, pyrazines, hydroxyfuranone, furan dialdehyde, and xylose, are reviewed briefly without providing production technologies. However, furfural alcohol and polytetrahydrofuran (PTHF) are more focused. The production of furfural alcohol is described in both vapor phase and liquid phase processes. The synthesis of PTHF from THF is illustrated in laboratory experiments using three commercial catalysts, but little information on industrial processes is provided.

While reading through the book, I was impressed by the spotlighting of specific details, such as the inline measurement of furfural, the discoloration of furfural, the acid strength change with temperature, and several corrosion control examples. This can only come from insightful thought and long term experience in the furfural industry. Compared to the reviews on furfural in several encyclopaedias, Dunlop and Peters' 'The Furans', and several furfural books in Chinese and Russian, this book presents clear reaction mechanism and kinetics. The format is very readable. For the readers interested in engineering and economic analyses, they should look for additional sources. In summary, this monograph is a very good technical book for the furfural industry. Anyone concerned with how furfural processes function or are interested in the field can learn much from it.

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PII: S1385-8947(00)00182-0

Coulson and Richardson's Chemical Engineering, Volume 6, Design, 3rd edition

R.K. Sinnott, Butterworth-Heinemann, 1999, 1045+xxv pp, £29.99 (paperback), ISBN 0-7506-4142-8

Let us be clear from the outset: this is an especially useful book for every student of chemical engineering and it meets its aim of having relevance to most present-day undergraduate design projects. The specialist will find omissions and maybe even a bias towards the thinking of the era of the book's first publication in 1983 (the cover picture of old-fashioned computer displays reinforces this view). However, this remains one of the most easily digested and comprehensive collections of practical information on chemical process design available. Undoubtedly, Perry's Handbook contains much more detail and theory, but you could not contemplate reading more than a very small section at a time. Other books deal more thoroughly with particular aspects, such as control or distillation. The danger with a book of this kind is that, with successive editions, gaps are filled and topics are treated with increasing depth until eventually the author's original intention is overwhelmed by the sheer size of the volume. At over 1000 pages, 'Volume 6' (as it is commonly referred to by students) is nearing this stage.

Ten of the book's 14 chapters deal with process design, starting with consideration of the design method per se and covering balance calculations, flowsheeting, control, costing, materials selection, safety and the environment. Of the remaining chapters, three deal with equipment design with particular emphasis on heat transfer and separation columns, and the other deals with mechanical design. There are 10 appendices providing a wealth of practical data including physical properties and corrosion charts, along with drawing symbols, specification sheets and example projects. The book is well written and clearly presented.

The book has a strong emphasis on continuous chemical and petrochemical processing. This accords well with the traditional undergraduate design project. However, the traditional project is increasingly being called into question as reflecting less and less the kind of design work most commonly carried out by today's graduate chemical engineers. Batch processes only get rare mentions in the book, revamps not at all, unsteady-state balances get a brief treatment but readers are referred elsewhere for details. One of the problems facing many educators in the UK is how to break away from design work on classical continuous processing. A chapter dealing with modern processes, especially for complex materials, foods and high value batch products, would have been a welcome and timely addition to the new edition.

Most chapters end with extensive lists of reference material. This is particularly useful in expanding on topics too complex for full treatment in the text but the bias is to works from the 1960s and 1970s, with very few post 1990. There may be a case for including some original references but is Dantzig's 1963 paper on the Simplex method seriously a better source than a modern text on linear algebra (which would include additionally the more recent developments in that subject)? For references to be useful, students must also have a realistic chance of finding them, yet most of the books published before the 1990s are out of print and may not even be in the libraries. Furthermore, older publications have often been reworked, augmented and presented more accessibly in recent books. In other cases, the references are just plain out of date: this is particularly so for the computer-related topics and it is disappointing still to find no reference to the IChemE's guidelines on computers, now in its 3rd edition. [1]

Returning to the positive, the book has excellent chapters on the practicalities of developing a process design. In the space of a short review, it not possible to do it full justice, so

[1] IChemE CAPE Subject Group, *Good Practice Guidelines on the Use of Computers in Chemical Engineering*, 1999, available free from http://CAPE. icheme. org/.