Organic Chemical Process Encyclopedia

1969

Second Edition

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Marshall Sittig

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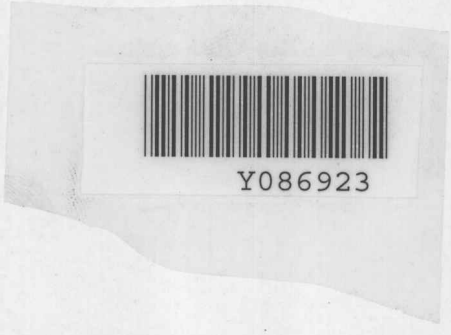

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PREFACE I

The rationalization of scientific investigation and technological innovation has brought problems of its own. The prestige of science and technology has grown; vast resources are committed to research and development; the number of researchers has swelled; and their output is prodigious — so prodigious that their output is as yet impossible to use fully.

That output — research reports, technical papers, test data, proceedings of meetings and symposia — is so vast, so fast, so quickly growing, and usually so ill-organized, that resources, talent and money are frequently wasted in duplicating work. That is the import of the "information explosion". Whether that power of that explosion can be harnessed depends upon how effectively the welter of technical data can be organized and presented to industry and the scientific community in usable form. Credit belongs to those who devote themselves to that job, and to that job Mr. Sittig has made an important contribution.

Lawyers, because they are constantly guided by precedent, depend daily on information retrieval — upon a superb classification of abstracts of decided cases in all American courts. In some areas of scientific research, however — and especially among creative people — one sometimes encounters prejudice against analogous state of the art surveys, inspired by the notion that creative minds should operate upon new problems unfettered by preconceptions. That may sometimes be true; often, however, such a survey stimulates the creative process. A suggestive statement of a problem and the implicit assumptions may open a path to its solution.

Chemical flow charts are, of course, directly usable for their immediate data. Annotated with data from the patent literature and other sources, they become a tool for research. With publications like this, the force of the information explosion may ultimately be harnessed and put to work.

David L. Ladd
Former U.S. Commissioner of Patents

PREFACE II

Marshall Sittig in his second edition of ORGANIC CHEMICAL PROCESS ENCYCLOPEDIA while laying emphasis upon patents which are of great interest especially to the petroleum and petrochemical industies, has gathered into one volume such patents that are available together with much data from periodical literature and books. The 711 flowcharts are alphabetically arranged and are supplemented by many key facts about each chemical all of which will enable a chemical engineer to better judge concerning whether it should be more exhaustively investigated. Therefore, I can commend to chemical engineers and others in the chemical process industries this publication by Marshall Sittig as a very convenient summary of information for the chemicals covered and as a sympathetic approach not only to chemical engineering flowsheets but to other literature. Marshall Sittig is a very painstaking author and his compilation will save much time particularly in the initial consideration of a particular chemical process.

Flowcharts have long been understood as the most succinct and helpful presentation of any chemical process whereby raw materials are converted into products of greater value for further fabrication or use by the consuming public. Generally such flowcharts start with the simple block type which serve a useful introduction. These are gradually evolved into detailed and complicated flowcharts or in many instances, to actual three dimensional models of the plant to be constructed. Frequently, after the initial block type basic presentation, the process is protected by patents. There may be five to ten intermediate flowcharts as the process is developed either on the drawing board or in conjunction with the operations in the pilot plant. In 1944, this writer cooperated with T.R. Olive on what became known as the CHEM AND MET FLOWSHEET BOOK but these flowcharts have long been out of date. However, in each issue of the periodical, CHEMICAL ENGINEERING, from month to month for many years, there appear even more useful flowcharts. In many of these present process flowcharts, pertinent data based upon industrial collaboration, are presented for plant design, equipment, operating conditions, test runs, yields, and economics — all kept up to date by actual professional visitations.

Marshall Sittig was one of my outstanding and progressive students and I am personally pleased to recommend his book.

R. Norris Shreve
Professor Emeritus of Chemical Engineering
Purdue University

PREFACE III

Marshall Sittig has produced this second edition one-volume industrial Beilstein which gives 711 flowcharts covering the manufacture of every important organic chemical, as of 1969. For these facts he has gone to the one place where they can be found, the patent literature. For this, all of us who are interested in industrial organic chemistry owe him a debt of gratitude. Measured by dollar value, the organic area is the major part of the chemical industry and here it is in its most accessible form.

Patents are not easy reading, at best, and are doubly hard for those unfamiliar with them. Most of us do not give them the attention they deserve until the patent examiner gives us a rude shock. Hence in this rapidly changing world of competitive processes, competitive raw materials, and competitive companies our knowledge tends to be obsolete.

This is a pity. We can not create progress intelligently unless we keep abreast of where we are. When someone takes most of the drudgery out of our learning processes we can only applaud — and buy his book!

H.B. Hass
M.W. Kellogg Division of Pullman, Inc.

FOREWORD

This second edition has been compiled due to heavy demand for another edition of this handy single-volume desk-top reference to organic chemical processes. It is hoped that it will prove invaluable to the chemical executive, investment counselor, chemical salesman, chemical engineering professor, patent attorney, equipment manufacturer, and to any serious student of the chemical process industries.

Emphasis has been placed primarily on petroleum chemicals since they account for a major percentage of all organic chemicals produced today. Primary emphasis has been placed on these materials because they are among the most important today and because they have the greatest growth prospects for tomorrow — because they are making headlines and offer excellent prospects for making dollars for practitioners of the processes described here — and for those who make and sell equipment, catalysts, solvents and control instruments for the conduct of these processes.

The earlier edition was well received and one professor of chemistry commented that if he had seen such a book during his college days he might have become a chemical engineer instead of a chemist. Other conversations in the U.S. and in England emphasized to this author that there is indeed much need for more attention to industrial chemistry, the practical middle ground between pure chemistry and pure chemical engineering which comes to resemble applied physics in many cases.

Thus, the intent here is to make the product names of organic chemicals "come alive" in terms of uses and to make the equations "come alive" in terms of actual operating temperatures and pressures and types of equipment in which the reactions are conducted.

The question arose as to where to look for a major source of process flow sheet information on a broad and comprehensive range of processes. The answer was found in the chemical patent art and 100% of the flow diagrams in this book have been taken from U.S. patents. Each patent number reference then permits the reader to obtain and study the full U.S. patent by purchasing a copy from the Patent Office in Washington, D.C. for 50 cents. If more information is desired, the patent may contain reference to other patents and even to other published literature. Reference to the original patent or even to the abstract of that patent in the "Official Gazette" gives the patent class and sub-class number, from which dozens or even hundreds of additional patent references may be obtained upon visiting the Search Room of the Patent Office in Washington, D.C.

Foreword

The data on the pages of this Encyclopedia have been gathered from the patents yielding the flow diagram, but have been supplemented from a wide variety of books, articles, pamphlets and manufacturer's bulletins. It is inevitable that some errors have crept in as a result and both author and publisher will welcome corrections which may be incorporated into subsequent editions of this work.

One of the most important aspects of today's organic chemical industry is the concept of alternative routes to a given product. The choice must be made on the basis of available raw materials, utility costs and labor costs at a given location, availability of process know-how, etc.

The choice of the proper route to an organic chemical product is equally important for someone planning a plant in an underdeveloped country, or planning one in a highly competitive industrial area. Here the importance of keeping abreast of the latest in technology, as represented by patents issuing today, is paramount. It is hoped that this volume, and succeeding editions of this volume, will help the reader to keep posted in this vital area.

The question of alternative routes often involves questions of interrelations of various feed products and end-products when various processes are practiced in a large integrated chemical production complex. It may involve the disposal of coproducts or the disposal of waste products in the light of increasing scrutiny on areas such as air pollution and stream pollution.

The equations at the head of each process page are the best attempt to describe each process. Although generally they are believed to be quite accurate, they may, in some cases, be only approximations to describe empirical observations about a process where precise stoichiometric data are lacking. The tabulations of feed materials and coproducts supplement the equations and indicate, for example, coproducts formed in minor quantities which are not indicated by the principal process equation.

Marshall Sittig
Princeton, New Jersey

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