

The Chemistry of Synthetic Dyes

**EDITED BY
K. VENKATARAMAN**

VOLUME V

The Chemistry of SYNTHETIC DYES

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Edited by

K. VENKATARAMAN

*National Chemical Laboratory
Poona, India*



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PREFACE

For a few years I considered writing an entirely new edition of "The Chemistry of Synthetic Dyes." As a result of discussions with many friends and colleagues who are familiar with the two volumes, I decided that the urgent need was not for a revision, because very little of the material had become obsolete, but for the addition of supplementary material covering the developments from 1950.

The progress made in the chemistry of synthetic dyes in the last twenty years is amazing. The discovery of reactive dyes is one major advance. There has also been extensive research on intermediates, disperse dyes, cationic dyes, cyanine dyes, and pigments, which has led to much new chemical knowledge. Consequently I realized that it was no longer possible for a single author to give accurate and authoritative accounts of the progress made in each specialized area of synthetic dyes. I have been very fortunate in the response I have had to my invitations to contribute to the additional volumes. The chapters have been written by acknowledged authorities who have worked for many years on the topics they have covered; their names have been associated with many patents and papers.

The additional volumes not only cover synthetic dyes of nearly all types, but also raw materials, intermediates, and such fundamental topics as color and electronic states of organic molecules, measurement of color, photochemistry of dyes, and physical chemistry of dyeing. A separate chapter on fluorescent brightening agents has also been included because of their close relationship to synthetic dyes.

These volumes are intended primarily for chemists and technologists who are concerned with the synthesis of dyes and their applications, but since most of the chapters constitute essays in synthetic organic chemistry, they should be of interest to organic chemists in general. An important feature is the very thorough coverage and critical assessment of patent literature as well as publications in scientific journals. The record of achievement presented in these volumes also indicates the direction of future research.

I am deeply indebted to the authors for accepting my invitation. I must also thank the companies who made it possible for their leading scientists to spare the necessary time. The plan for this multiauthor effort took concrete shape during ten days I spent in the Research Department of Farbenfabriken Bayer; I am greatly indebted to Professor Petersen, Dr. Delfs, and their colleagues for valuable suggestions. I am grateful to Dr. R. R. Davies of the Research Department, Imperial Chemical Industries (Dyestuffs Division), Manchester, who has helped

me in many ways. My thanks are also due to Dr. R. B. Mitra, Mr. J. V. Rajan, Dr. N. R. Ayyangar, and Mr. V. Parameswaran for assistance in the editorial work. Academic Press has handled production of the volumes with its usual efficiency, and it is a pleasure to thank the staff for their cooperation. Finally, I wish to make grateful acknowledgment of the hospitality of the National Chemical Laboratory provided by the Director, Dr. B. D. Tilak, and the Director-General of Scientific and Industrial Research, Dr. Atma Ram, without which I could not have undertaken this project.

K. VENKATARAMAN

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LIST OF ABBREVIATIONS

Manufacturing companies (CI abbreviations have generally been followed):

AAP	Koppers Co. Inc., Pittsburgh, Pennsylvania (American Aniline Products Inc.)
ACC	Augusta Chemical Co., Augusta, Georgia
Acna	Aziende Colori Nazionali Affini A.C.N.A., Milan, Italy
B & BASF	Badische Anilin- und Soda-Fabrik A.G., Ludwigshafen a. Rhein, Germany
BrC	British Celanese Ltd., Spondon, England
CCC	American Cyanamid Co., Bound Brook, New Jersey
CFM	Cassella Farbwerke Mainkur A.G., Frankfurt a. Main, Germany
Chinoin	Chinoin Gyogyszer-es Vegyeszeti Termelek Gyara, RT, Budapest, Hungary
CIBA	CIBA Ltd., Basle, Switzerland
CL	Celanese Corporation of America, New York
CN	Compagnie Nationale de Matières Colorantes et de Produits Chimiques du Nord réunies Etablissements Kuhlmann, Paris, France
DGS	Deutsche Gold- und Silber Scheideanstalt vormals Roessler, Frankfurt, Germany
DH	Durand & Huguenin S. A., Basle, Switzerland
Dow	Dow Chemical Co., Midland, Michigan
DuP	E. I. Du Pont de Nemours & Co., Wilmington, Delaware
EKCo	Eastman Kodak Co., Rochester, New York
Ethicon	Ethicon Inc., Somerville, New Jersey
FBy	Farbenfabriken Bayer A.G., Leverkusen, Germany
FH	Farbwerke Hoechst A.G., Frankfurt/Main-Hoechst, Germany
Filature Provoust	Filature de Laine Provoust, Roubaix, France
Fran	Compagnie Française des Matières Colorantes, Paris, France
FW	Farbenfabrik Wolfen, Kr., Bitterfeld, Germany
G	General Aniline & Film Corporation, New York
Gy	J. R. Geigy S. A., Basle, Switzerland
HCC	Hodogaya Chemical Co. Ltd., Tokyo, Japan
HH	Hardman and Holden Ltd., Manchester, England
HWL	Hickson & Welch Ltd., Castleford, England

IC	Interchemical Corporation, Hawthorne, New Jersey
ICI	Imperial Chemical Industries Ltd., Manchester, England
IG	I. G. Farbenindustrie A.G., Frankfurt a. Main, Germany
K	Kalle & Co., A.G., Biebrich, a. Rhein, Germany
Kewanee	Kewanee Oil Co., Bryn Mawr, Pennsylvania
KYK	Nippon Kayaku Co. Ltd., Tokyo, Japan
LBH	L. B. Holliday & Co., Huddersfield, England
MCI	Mitsubishi Chemical Industries Ltd., Tokyo, Japan
MDW	Mitsui Chemical Industry Co. Ltd., Tokyo, Japan
MLB	Farbwerke vorm. Meister, Lucius & Brüning, Hoechst a. Main, Germany
NAC	Allied Chemical Corporation, New York, New York
Nepera	Nepera Chemical Co., Inc., Harriman, New York
NSK	Sumitomo Chemical Co., Ltd., Osaka, Japan
OBM	Otto B. May, Inc., Newark, New Jersey
PCC	Peerless Color Co., Passaic, New Jersey
PHO	Phoenix Color & Chemical Co., Paterson, New Jersey
Pitt	Pittsburgh Coke & Chemical Co., Pittsburgh, Pennsylvania
RL	Rohner Ltd., Pratteln, Switzerland
S	Sandoz Ltd., Basle, Switzerland
TE	Eastman Chemical Products (Eastman Kodak Co.), Kingsport, Tennessee
Ube-Ditto	Ube-Ditto Kasai Ltd., Osaka, Japan
UCC	Union Carbide Corporation, New York, New York
VGF	Vereinigte Glanzstoff-Fabriken A.G., Wuppertal-Elber- feld, Germany
Vond	N. V. Fabriek van Chemische Producten, Vondelingen- plaat, Holland
Whitten	H. A. Whitten Co., New York, New York
YDC	Yorkshire Dyeware & Chemical Co. Ltd., Leeds, England

Journals, Reports, and Books:

1961 *Chemical Abstracts List of Abbreviations* has been generally followed. The following special abbreviations have also been used.

BIOS	British Intelligence Objectives Sub-Committee Final Report
CA	Chemical Abstracts
CI	Colour Index, 2nd edition, 1956
CIOS	Combined Intelligence Objectives Sub-Committee Report
CIS	Colour Index, 2nd edition, Supplement 1963
CSD	The Chemistry of Synthetic Dyes, Academic Press, 1952

FIAT	Field Intelligence Agency Technical Report
PB	Technical Report of the Office of the Publication Board, Office of the Technical Services of the U.S. Department of Commerce
Ullmann	Ullmanns Encyclopädie der Technischen Chemie

Patents:

AustP	Austrian Patent
BeP	Belgian Patent
BP	British Patent
CP	Canadian Patent
CzechP	Czechoslovakian Patent
DAS	Deutsche Auslegeschrift
DBP	Deutsche Bundespatente
DP	Dutch Patent
DRP	Deutsche Reichspatente
EGP	East German Patent
FP	French Patent
IP	Indian Patent
JP	Japanese Patent
PolP	Polish Patent
RP	Russian Patent
SAP	South African Patent
USP	United States Patent

THE CHEMISTRY OF SYNTHETIC DYES
VOLUME V

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CHAPTER I

NAPHTHOQUINONOID DYES AND PIGMENTS

B. D. Tilak

NATIONAL CHEMICAL LABORATORY
POONA, INDIA

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I. Introduction

Whereas several pigments related to 1,4-naphthoquinone have been isolated from vegetable and animal sources, synthetic naphthoquinone dyes are mainly derived from 1,4-naphthoquinone and its 2,3-dichloro derivative. 2,3-Dichloro-1,4-naphthoquinone (I) is more commonly used because of its ease of preparation and its high chemical reactivity.

Among dyes derived from 1,4-naphthoquinone and (I), Naphthazarin (Brilliant Alizarin Black B) (II), its derivatives, and Indanthrene Yellow 6GD, a vat dye, are the only ones used for dyeing textiles. Indanthrene Yellow 6GD is nontendering and possesses good lightfastness (4-5). It is synthesized by condensing (I) with the azine (III) obtained by condensation of nitrosoated naphthosultam with *o*-phenylenediamine.

