

## CONTENTS

	PAGE
Preface .....	v
Contents of Volume II .....	xiii
List of Abbreviations .....	xiv
Notes .....	xvi
<b>I. Introduction</b> .....	<b>1</b>
HISTORY OF THE SYNTHETIC DYES, 2-10	
INDUSTRIAL ORGANIZATION, 10-18	
NAMES OF COMMERCIAL DYES, 18-19	
CHEMICAL AND ENGINEERING ASPECTS OF DYESTUFF PRODUCTION, 19-20	
WORLD WAR II AND AFTER, 20-23	
<b>II. Raw Materials</b> .....	<b>24</b>
COAL-TAR DISTILLATION, 24-42—Aromatic compounds present in coal tar. Coal-tar constituents used in the dyestuff industry—benzene, toluene, naphthalene, phenol, anthracene, carbazole.	
LOW TEMPERATURE CARBONIZATION, 42-43	
AROMATIC HYDROCARBONS FROM PETROLEUM, 43-45	
TESTS AND STANDARDS OF PURITY, 45-47—Benzene, toluene, naphthalene, anthracene, phenol, cresols, carbazole.	
SYNTHESIS OF PRIMARY MATERIALS, 47-49	
<b>III. Intermediates</b> .....	<b>50</b>
SULFONATION, 51-52—General methods. Benzenesulfonic acid, Benzene- <i>m</i> - disulfonic acid. Toluenesulfonic acids. Naphthalenesulfonic acids. Anthraquinonesulfonic acids.	
CHARACTERIZATION OF THE SULFONIC ACIDS, 62-64	
HALOGENATION, 64-69—Chlorobenzene. Di- and trichlorobenzenes. Chlor- ination of toluene and the xylenes. Other halogenations.	
NITRATION, 69-79—General methods. Nitrobenzene. <i>m</i> -Dinitrobenzene. Nitrotoluenes. Chloronitrobenzenes. Chloronitrotoluenes. $\alpha$ -Nitro- naphthalene. Nitroanthraquinones.	
AMINATION, 79-91—General methods. Aniline. Toluidines. Xylidines. Phenylenediamines. Naphthylamines.	
AMINOANTHRAQUINONES, 91-95	
THE TOXICITY OF AROMATIC AMINES, 95	
SECONDARY AND TERTIARY AMINES, 95-103—Alkylation methods. Mono- and dimethylaniline. Mono- and diethylaniline. Benzylaniline. Diphenylamine. Methyl- and ethylnaphthylamines.	
ALKYLAMINO- AND ARYLAMINOANTHRAQUINONES, 104-105	
NITROANILINES, 105-108	
HYDROXYLATION, 108-117—General methods. Phenol. Cresols. Alkyl- phenols. Chlorophenols. Resorcinol. $\alpha$ - and $\beta$ -Naphthols. Hydroxy- anthraquinones.	

## NITROPHENOLS, 117-119

ARYL ETHERS AND THEIR DERIVATIVES, 120-124—Nitroanisoles. Anisidines. Nitroanisidines. Cresidine. Aminodiphenyl ethers.

BENZIDINE AND SIMILAR DIAMINES, 124-132—Benzidine and its derivatives. Other diamines used as intermediates for direct cotton dyes. Diamines used for wool dyes.

## DIPHENYL AND ITS DERIVATIVES, 132-133

## ALDEHYDES AND KETONES, 133-137

CARBOXYLIC ACIDS, 137-153—Benzoic acid. Phthalic anhydride. Terephthalic acid. Salicylic acid. Anthranilic acid. Naphthalic acid. Hydroxynaphthoic acid and other *o*-hydroxycarboxylic acids used as intermediates for the Naphtol AS series. Acid chlorides.

QUINONES, 153-165—*p*-Benzoquinone. Chloranil. Anthraquinone and its derivatives.

NAPHTHOLSULFONIC ACIDS, 165-170—Mono-, di-, and trisulfonic acids of  $\alpha$ - and  $\beta$ -naphthol. Identification.

## DIHYDROXYNAPHTHALENES AND THEIR SULFONIC ACIDS, 170-171

NITROBENZENE- AND ANILINE-SULFONIC ACIDS, 172-176—Sulfanilic and metanilic acids and their derivatives. Toluidinesulfonic acids.

AMINOPHENOLS AND AMINOPHENOLSULFONIC ACIDS, 176-181—Amino-salicylic acid.

## NITRONAPHTHOLS AND AMINONAPHTHOLS, 182-183

NAPHTHYLAMINESULFONIC ACIDS AND AMINONAPHTHOLSULFONIC ACIDS, 183-197—Sulfonation of  $\alpha$ - and  $\beta$ -naphthylamine. Naphthionic acid. 1-Amino-2-naphthol-4-sulfonic acid. *H*-, *J*-, and  $\gamma$ -acids and their derivatives. Characterization of naphthylamine- and aminonaphthol-sulfonic acids.

## SULFONYL CHLORIDES AND THEIR DERIVATIVES, 197-202

## FURAN AND PYRAN DERIVATIVES, 202

## ALIPHATIC COMPOUNDS, 202-209

## IV. Diazotization and Diazonium Salts ..... 210

DIAZOTIZATION METHODS, 210-214

THE MECHANISM OF DIAZOTIZATION, 214-215

CONSTITUTION AND REACTIONS OF DIAZONIUM SALTS, 216-222—Constitution. Types of reactions. Sandmeyer and other reactions. Action of alkali. Estimation.

STABILIZED DIAZONIUM SALTS, 222-227—Classification. Diazonium sulfates, double salts, arylsulfonates.

STABILIZED DIAZO COMPOUNDS FOR PRINTING COMPOSITIONS, 227-233—Anti-diazotates. Diazoamino compounds. Diazosulfonates.

PHOTOCHEMISTRY OF DIAZO COMPOUNDS, 233-234

DIAZO PHOTOGRAPHS AND PRINTS, 234-239

## V. Classification of Dyes ..... 240

## VI. Application of Dyes ..... 248

TEXTILE FIBERS, 250-266—Cotton. Rayons. Wool. Silk. Nylon. Miscellaneous fibers.

IDENTIFICATION OF TEXTILE FIBERS, 266-268

	PAGE
DYES CLASSIFIED ACCORDING TO DYEING PROPERTIES, 268-275—Acid, acid-mordant, basic, direct cotton, azoic, mordant, vat, sulfurized vat, solubilized vat, sulfur, oxidation, cellulose acetate, and dispersed dyes.	
PREPARATION FOR DYEING, 275-276	
COTTON DYEING, 277-280	
DYEING OF VISCOSE AND CUPRAMMONIUM RAYON, 280-281	
DYEING OF ACETATE RAYON, 281-282	
WOOL DYEING, 282-285	
SILK DYEING, 285-286	
NYLON DYEING, 287	
JUTE DYEING, 287-288	
UNION DYEING, 288	
TEXTILE PRINTING, 288-292—Styles of printing.	
PIGMENT PRINTING, 292-293	
AUXILIARY AGENTS USED IN DYEING, 293-294	
STRIPPING OF DYED AND PRINTED MATERIALS, 294-295	
FASTNESS TESTS AND STANDARDS, 295-298—Fastness to light, washing, perspiration.	
NONTEXTILE USES OF DYES, 298-303	
<b>VII. Color and its Measurement</b> .....	<b>304</b>
EMISSION AND ABSORPTION OF LIGHT, 305-306	
STANDARD LIGHT SOURCES, 306-308	
SELECTIVE ABSORPTION OF LIGHT, 308-316—Measurement of light absorption. The human eye and color vision.	
MEASUREMENT OF COLOR, 316-322—Chromaticity diagram. Munsell and Lovibond systems.	
<b>VIII. Color and Chemical Constitution</b> .....	<b>323</b>
EARLY THEORIES, 323-328—Chromophores and auxochromes. Quinonoid theory. Dilthey, Wizinger and Stieglitz theories.	
INTERPRETATION OF ABSORPTION SPECTRA, 328-331	
ENERGY LEVELS AND THE ABSORPTION SPECTRA OF MOLECULES, 331-334	
RESONANCE IN ORGANIC CHEMISTRY, 334-341—Examples of resonance structures. Inductive and resonance effects. Dipole moments.	
CHROMOPHORES AND AUXOCHROMES, 341-348—Definition and explanation. Influence of alkyl groups and chlorine on light absorption.	
ELECTRONS AS QUANTIZED OSCILLATORS, 348-358—Nearly linear oscillators. Polyenes, Cyanines. Polyphenyls. Acid-base indicators.	
INSULATING GROUPS, 358-362—Bands of partial oscillation.	
LIGHT ABSORPTION AND THE GEOMETRY OF MOLECULES, 362-371	
SECOND ORDER BANDS, 371-375	
STERIC FACTORS, RESONANCE AND COLOR, 376-378	
USE OF QUASI-CLASSICAL METHODS FOR CALCULATING ABSORPTION SPECTRA, 378-380	
DENEGARACY OF LIMITING STRUCTURES IN RELATION TO ABSORPTION, 380-389—Vinylene shift. Additional-double-bond stabilization of rings. Depth of color in relation to the energy difference between extreme and intermediate structures.	

	PAGE
QUANTUM-MECHANICAL TREATMENTS, 389-396—Benzene and polynuclear aromatic compounds. Aromatic heterocyclics. Unsymmetrical cyanines. Idealized systems.	
INTENSITIES OF ABSORPTION BANDS, 396-400	
<b>IX. Nitroso Dyes</b> .....	401
Nitrosoresorcinol, Nitrosonaphthols	
<b>X. Nitro Dyes</b> .....	405
<b>XI. Azo Dyes—General</b> .....	409
THE COUPLING REACTION, 411-441—Mechanism of coupling. Coupling positions: phenols, amines, aminonaphthols and their sulfonic acids. Coupling in pyridine solution. Coupling of naphthols and naphthylamines. Coupling on an aliphatic or alicyclic carbon atom. Coupling with hydrocarbons. Coupling with heterocyclic compounds. Coupling of natural phenolic coloring matters. Coupling of oxycellulose, wool and silk. Replacement reactions in coupling. The coupling reaction in quantitative analysis.	
CONSTITUTION OF AZO DYES, 441-452—Azophenol-quinonehydrazone tautomerism. Chelation in <i>o</i> -hydroxyazo compounds. Color changes of azo dyes. Fission of the azo linkage.	
THE COLOR OF AZO DYES, 452-463—Monoazo dyes. Dyes with more than one azo group. The effect of auxochromes and of sulfonic groups.	
CLASSIFICATION OF AZO DYES, 464-468	
DYEING AND FASTNESS PROPERTIES OF AZO DYES, 468-479—General considerations. Azo dyes for wool, silk, leather, cotton, viscose. Miscellaneous azo dyes.	
<b>XII. Monoazo and Disazo Dyes</b> .....	480
MONOAZO DYES, 480-495—Benzene derivatives. Naphthalene derivatives.	
DISAZO DYES, 495	
PRIMARY DISAZO DYES, 495-498	
AMINOAZOBENZENE AND AMINOAZONAPHTHALENE DERIVATIVES, 498-506	
DERIVATIVES OF TETRAZOTIZED DIAMINES, 506-509—Structural features of diamines as first components for direct cotton dyes.	
DIRECT COTTON DYES FROM BENZIDINE AND ITS DERIVATIVES, 509-514	
DYES FROM DIAMINES OTHER THAN BENZIDINE DERIVATIVES, 514-516	
ACID COLORS FROM TETRAZOTIZED DIAMINES, 517-519	
<i>m</i> -PHENYLENEDIAMINE DERIVATIVES, 519-520	
BASIC AZO DYES, 520-522	
<b>XIII. Mordant Azo Dyes</b> .....	523
Classification	
AZOSALICYLIC ACIDS, 524-528—8-Hydroxyquinoline derivatives.	
DYES FROM DIAZOTIZED <i>o</i> -AMINOPHENOLS, 528-534—Derivatives of <i>o</i> -aminophenol and 1-amino-2-naphthol-4-sulfonic acid. Metachrome colors.	
SOLUBLE CHROMIUM COMPLEXES OF MORDANT AZO DYES, 534-540—Methods of preparation. Azo dyes corresponding to the Neolan and Palatine Fast colors. Application.	
NEUTRAL DYEING METAL COMPLEXES, 540-541	

RECENT TRENDS, 541-543	
METAL COMPLEXES FOR LEATHER DYEING, 543-544	
COPPER COMPLEXES OF DIRECT COTTON DYES, 544-550	
<b>XIV. Constitution of Metal-Dye Complexes</b> .....	551
Coordination compounds of chromium and copper. Chelate compounds.	
COORDINATION OF THE AZO GROUP, 554-557	
<i>o</i> -HYDROXY- AND <i>o,o'</i> -DIHYDROXYAZO DYES, 557-563—Copper complexes.	
Chromium complexes.	
OXIDIZABLE <i>o</i> -HYDROXY AND <i>o,o'</i> -DIHYDROXYAZO DYES, 563-565	
AZOSALICYLIC ACIDS, 565-567—Chromium compounds. Copper compounds.	
Cobalt and iron compounds.	
THE METAL-DYE-PROTEIN COMPLEX, 567-569	
<b>XV. Trisazo and Polykisazo Dyes</b> .....	570
TRISAZO DYES, 570-576—Benzidine derivatives. Aminoazobenzene derivatives. Miscellaneous.	
TETRAKISAZO DYES, 576-578	
POLYKISAZO DYES, 579	
<b>XVI. Urea and Cyanuric Acid Derivatives</b> .....	580
UREA DERIVATIVES, 580-582	
1,3,5-TRIAZINE DERIVATIVES, 583-588—Preparation of cyanuric chloride.	
Cyanuric chloride condensations. Constitution of some Chlorantine	
Fast colors. Cyanurated dyes in patents.	
<b>XVII. Direct Cotton Dyes Aftertreated on the Fiber</b> .....	589
DIAZOTIZATION AND DEVELOPMENT, 590-595—developed dyes for discharge printing.	
COUPLING WITH DIAZONIUM SALTS, 595-597	
TREATMENT WITH FORMALDEHYDE, 597-599	
CATION-ACTIVE ORGANIC COMPOUNDS, 600-601	
TREATMENT WITH COPPER SALTS, 601-605	
TREATMENT WITH DICHROMATE, 605-606	
<b>XVIII. Pyrazolones</b> .....	607
PHENYLHYDRAZINE DERIVATIVES, 607-608	
DERIVATIVES OF 1-PHENYL-5-PYRAZOLONE-3-CARBOXYLIC ACID, 608-612	
DERIVATIVES OF 1-PHENYL-3-METHYL-5-PYRAZOLONE, 612-620—Acid dyes.	
Mordant dyes. Direct cotton dyes.	
MISCELLANEOUS PYRAZOLONE DERIVATIVES, 620-621	
<b>XIX. Thiazoles</b> .....	622
<b>XX. Stilbene Dyes</b> .....	628
DYES FROM <i>p</i> -NITROTOLUENE- <i>o</i> -SULFONIC ACID, 628-631	
DYES FROM THE CONDENSATION OF AMINES WITH <i>p</i> -NITROTOLUENE- <i>o</i> -SULFONIC ACID, DINITRODIBENZYLDISULFONIC ACID AND DINITROSTILBENEDISULFONIC ACID, 631-634	
DYES FROM 4-NITRO-4'-AMINOSTILBENE-2,2'-DISULFONIC ACID, 634-635	
THE BLANKOPHORS, 635-636	
<b>XXI. Azo Dyes for Cellulose Acetate</b> .....	637
THE IONAMINES, 637-639	

	PAGE
DISPERSED DYES, 639-646—Constitution of Celliton and Cellitazol dyes.	
THE SOLACET DYES, 646-648	
DYEING METHODS, 649	
<b>XXII. Azoic Dyes</b> .....	<b>650</b>
CHEMICAL CONSTITUTION OF NAPHTOLS, 651-653	
" NAPHTOLS " FOR YELLOW SHADES, 653-654	
PREPARATION OF NAPHTOLS, 655-656—Arylamides of BON acid. Acetoacetic arylamides.	
HYDROLYTIC FISSION OF THE NAPHTOLS, 656-659	
ESTIMATION OF THE NAPHTOLS, 659	
FAST BASES AND FAST SALTS, 659-666—Constitution. Fluorine compounds. Sulfones. Nitriles. Blue Bases. Black Salts.	
AZOIC SHADES, 666-668—Technically important azoic combinations.	
AZOIC DYEING, 668-673—Naphtholation. Development. Aftertreatment. Application to fibers other than cotton.	
SUBSTANTIVITY OF THE NAPHTOLS, 673-681	
FASTNESS PROPERTIES OF AZOIC SHADES, 681-688—Fastness to rubbing, alkali, light and chlorine.	
AZOIC COLORS IN PRINTING, 688-695—Printing compositions. Rapid Fast, Rapidogen and Rapidazol colors.	
IDENTIFICATION OF AZOIC DYES, 695-696	
RECENT TRENDS, 696-701	
PIGMENTS, 701-704	