# IDENTIFICATION OF THE COMMERCIAL DYESTUFFS, BEING VOL. III OF A METHOD FOR THE IDENTIFICATION OF PURE ORGANIC COMPOUNDS BY A SYSTEMATIC ANALYTICAL PROCEDURE BASED ON PHYSICAL PROPERTIES AND CHEMICAL REACTIONS

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SAMUEL PARSONS MULLIKEN

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Trieste

# IDENTIFICATION

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## A METHOD

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## THE IDENTIFICATION OF PURE ORGANIC COMPOUNDS

### BY A SYSTEMATIC ANALYTICAL PROCEDURE BASED ON PHYSICAL PROPERTIES AND CHEMICAL REACTIONS

CONTAINING CLASSIFIED ORIGINAL DESCRIPTIONS OF
NEARLY 1700 SYNTHETIC AND NATURAL DYESTUFFS
REFERENCES TO MANY ALLIED BRANDS
SUGGESTIONS ON THE EXAMINATION
OF DYESTUFFS IN MIXTURES AND
A COLOR STANDARD

BY

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# PREFACE.

A special volume on the identification of commercial dyestuffs formed no part of the writer's original plan for his "Method for the Identification of Pure Organic Compounds." Its publication was first conceived when it became apparent that successful analytical tables for the dyestuffs could only be prepared from original descriptions of properties and reactions made expressly for such use, and that most of the experimental material required for an investigation on the scale involved could only be procured in the form of commercial products. The better opportunity for a rational adaptation of tests and procedures to the circumstances under which they would be used afforded by a mode of publication that would bring the descriptions of a large body of industrially important substances within the covers of a single volume, instead of allowing their dispersion according to qualitative elementary composition through separated "orders," was also recognized as a practical argument having greater weight in this instance than would be conceded to it elsewhere. Other causes influential in shaping the scope and character of this volume are reserved for statement in the sketch of the development of systematic methods for dyestuff identification forming its introductory chapter.

At the completion of this portion of the "Method," it again becomes the writer's privilege to express his grateful acknowledgments to friends who have contributed to the result. Among these are his former students, Messrs. W. Burns, J. B. L. Orme, J. H. Link, C. N. Draper, W. B. Gonder, J. S. Coye, R. E. Drake, J. A. Kydd, J. McGowan Jr., L. G. Beers, R. E. Blankenbuehler, W. C. Kerr, and H. P. Trevithick, by whom, beginning in 1905, numerous indispensable preliminary studies of methods and procedures were made as thesis investigations. The greater part of the data in the analytical tables is due to the painstaking experiments of the writer's former assistant, Mr. U. Tsukakoshi, and much of their verification to the equally careful work of Mr. H. P. Ireland. Among those whose kindly criticism or coöperation has been helpful on many occasions, the names of Professor L. N. Olney of the Lowell Textile School, Professor F. H. Thorp of the Massachusetts Institute of Technology, and Mr. W. D. Livermore, chief chemist of the American Woolen Company, demand special mention. The uniformly courteous and satisfactory response of all the great color companies to calls made on them through their American representatives for samples and reasonable information, and the renewed permission of the Milton Bradley Company of Springfield, Mass., to make use of their excellent color standard with an increased number of colors, are further instances of practical coöperation which are recalled with pleasure and appreciation.

Finally, in answer to numerous inquiries, and at the suggestion of his patient publishers, the writer once more hazards the information that the issue of Volume II of this "Method," devoted to the identification of organic compounds of nitrogen not provided for in the present volume, is still held in prospect at a date which must await future announcement.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, April, 1910.

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* The numerals in parentheses refer to test numbers — not pages.

## CHAPTER IV.

# THE IDENTIFICATION OF COMMERCIAL DYESTUFFS.

## CHAPTER I.

## INTRODUCTORY.

### *HISTORICAL SKETCH OF THE DEVELOPMENT OF GENERAL METHODS FOR THE IDENTIFICATION OF DYESTUFFS.*

The latest edition of Metz's Year Book for Colorists and Dyers contains a list of 4300 brands of coal-tar dyestuffs said to find application in the United States. Assuming this unofficial census to be approximately accurate, and further admitting that two-thirds of these colors may well be mixtures, that half of those which are essentially homogeneous are listed more than once under different trade names, and that of the residue only half are of more than the slightest commercial interest, several hundred definite chemical species still remain which are liable to be met with at any time in colored industrial products of recent manufacture in this country. It is evidently of much economic importance to the general manufacturer and consuming public, and to the true interest of the honest color maker and dealer, that convenient and reliable analytical methods should be found for the identification of all these dyestuff species.

A general solution for this problem, in which the gradation in properties in the passage from species to species is so subtle, and the terminology so kaleidoscopic and often intentionally confusing, offers peculiar difficulties. These can only be overcome by the aid of a very comprehensive and systematic procedure based on classified descriptions in which the differential characteristics have in every case been determined by direct experiment, and in which the distinction between suspected and established identity of alleged equivalent brands is everywhere sharply drawn. And even then, in periods like the present, when genuine new species appear on the market in such rapid succession, it is inevitable that the analyst must at the best be resigned to advance slightly in the rear of the march of invention.

Thus far three types of analytical procedure capable of comprehensive application have been outlined. The first gives special prominence to simple chemical tests and color reactions; the second, to the absorption spectra of solutions; while the third, which is known and is available only in a few large textile dyeing establishments, depends chiefly on comparative match dyeing. These methods overlap one another more or less. Their development is due to the labors of a small group of investigators and is worthy of brief recital.

The first attempt to provide a method for the identification of the modern dyestuffs comprehensive enough in scope to demand special notice, was made by Otto N. Witt, the originator of the chromophore theory. Witt's list of colors, which he describes as " comprising most of the dyestuffs which are now or have recently been upon the market, with the exception of anthracene derivatives," contained considerably less than one hundred brands, and their tabulated descriptions published in