Reactive Dye Development

Introduction by Martin Bide

The year 1856 saw the first synthetic dye, Perkin's mauve. In the next 50 years, chemists developed most of the dye classes we now recognize, including the first direct, sulfur, vat, and azoic dyes for use on cotton. Cotton dyers could generally choose bright colors, or good fastness to wet treatments: with few exceptions, they could not have both.

It was thus a major breakthrough when Imperial Chemical Industries (ICI) introduced the first reactive dyes which offered fast, bright colors of all hues. Their 'Procion' dyes were commercialized in 1956, exactly 100 years after Perkin's initial achievement. The dyes were based on a chlorotrazine reactive group, still the most widely used in today's reactive dyes. But once the principle was understood, rival dyestuff manufacturers developed dyes based on other reactive groups, such as vinyl sulfone, chloroquinoxaline, or chlorofluoropyrimidine— but most people found it easier to remember the manufacturers' trade names: Remazol, Cibacron, Levafix, Drimarene and so on. Over the years, continuous development has brought homo- and hetero-bifunctional dyes with higher levels of fixation, dyes suitable for printing, and dyes that need less salt, for example.

The novelty of these dyes in the mid-1950s meant that practical dyers required good technical service from the manufacturers to be able to use them effectively. Theoretically savvy AATCC members appreciated more detailed explanations and this paper is a good example of how companies like ICI would provide them. This was a time when dyemakers undertook research not only into new dyes, but also into underlying dyeing theory. Tom Vickerstaff, the author of this article from the January 27, 1958 issue of *ADR*, is still a familiar name from his 1951 book "The Physical Chemistry of Dyeing", the first comprehensive treatment of dyeing kinetics and thermodynamics.

This article introduces reactive dye concepts that are familiar today, but that were novel at the time: the relative rates of exhaustion and fixation, the effects of temperature and pH on each of them, and the reaction of some of the dye with water, rather than cotton, resulting in the need for extensive rinsing after dyeing to remove the hydrolyzed dye. Reactive dyes today have still not fully overcome that challenge, and dyers must use more water and energy for rinsing than they (and sustainability) would like.

Despite those challenges, the fast, bright colors they provide have made reactive dyes the most widely used dye type for cellulosic fibers. That technical and commercial success brought the original inventors of Procion reactive dyes, Rattee and Stephen, AATCC's Millson award for invention in 2000.

T. Vickerstaff, "Fast Dyes on Cellulosic Fibers", American Dyestuff Reporter, 47(2), 33-38, 1958.
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