

**THE INFLUENCE OF CHEMICAL PROPERTIES OF REACTIVE DYES ON
THE COLORED COTTON KNITTED FABRICS PHOTODEGRADATION**

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Reactive dyes are a primary class of colorants used for achieving uniformly dyed cotton fibrous materials, including fabrics and knitted textiles. They represent the first class of dyes capable of forming chemical covalent bonds with fibers. The general formula for reactive dyes can be expressed as $A\text{-Chr-(SO}_3\text{Na)}_n$, where A denotes the active center, Chr represents the chromophore that determines the dye's color, and $(\text{SO}_3\text{Na})_n$ are groups that provide solubility to the dye. Additionally, carboxyl and sulfoether groups also contribute to the water solubility of reactive dye molecules. The number of these groups is determined by the molecular size of the dye.

The structure of the chromophore system in reactive dye molecules governs properties such as color, lightfastness, fiber affinity, water solubility, and diffusion capacity. Meanwhile, the structure of the active system determines reactivity, the stability of the dye-fiber bond, and the dye's stability in dyeing solutions and printing pastes. Importantly, certain properties influenced by the chromophore system can be affected by the active system, and vice versa. Dyes with the same active group may exhibit different reactivity depending on their molecular structure.

For reactive dyes, chromophore groups typical of acid and other dye classes are used, including azo, disazo, anthraquinone, phthalocyanine, and others.

The active center is a part of the dye molecule that contains a reactive carbon atom and functional groups that ensure its activity in reactions with fibers. Currently, about 200 active groups are known to facilitate the chemical bonding of the chromophore to the fiber [1]. Based on the number of active groups, reactive dyes are classified as mono-, bi-, or polyfunctional.

The emergence of reactive dyes naturally raised the question of how the covalent bond between the dye and the polymer affects the lightfastness of the coloration. This issue holds both theoretical significances, by elucidating the role of the dye-polymer bond nature, and practical value, particularly in addressing the problem of light stabilization of colorations.

Analysis of early studies on this topic [2-4] indicates that the covalent bond between the dye and the polymer does not significantly affect the lightfastness of colorations. Instead, factors such as the chemical structure of the dyes, their state within the polymer substrate, the chemical and physical structure of the polymer, irradiation conditions, and other parameters have a more pronounced impact on lightfastness. However, it is worth noting that these studies primarily focused on monofunctional reactive dyes.

With advancements in dye chemistry, new bi- and even polyfunctional reactive dyes have been developed. A review of the literature reveals a lack of comprehensive studies on the lightfastness of colorations using these dyes.

To determine the dependence of lightfastness on the chemical structure of the

chromophore and the active group, as well as the number of reactive systems in the dye molecules, the kinetics of photodestruction of dyed cotton knitted fabrics were investigated. The 1+1 rib-knitted fabric was prepared using a unified combined technology and dyed with reactive dyes at the dye concentration of 1% by weight of the material.

Based on the conducted studies of the photodestruction kinetics of reactive dyes, which differ in the structure and number of their chromophores and active groups, the following conclusions can be drawn:

- azo dyes exhibit the lowest lightfastness compared to other investigated chromophore systems, regardless of the chemical structure of the active group.

- the reactive dyes studied can be ranked in terms of lightfastness, depending on the chemical structure of their active groups, in the following descending order: polyfunctional dyes with three active groups > bifunctional dyes with monochlorotriazine/vinyl sulfone active groups > monochlorotriazine > dichlorotriazine > vinyl sulfone.

- no clear correlation between the lightfastness of the colorations and their color was observed, as the structure of each individual dye molecule is determined simultaneously by the chromophore and the active group.

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