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SULFUR DYE COMPOSITIONS AND METHOD OF DYEING TEXTILE MATERIALS THEREWITH

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6 Claims. (Cl. 8—37)

This invention relates to dye compositions and methods and more particularly to dye compositions comprising as the principal constituents, thiosulfonic acids of sulfur dyestuffs in the form of their water-soluble salts and a bi- or poly-functional chemical substance capable of reacting by cross-linking with the thiosulfonic acids of the sulfur dyestuffs to give stable reaction products.

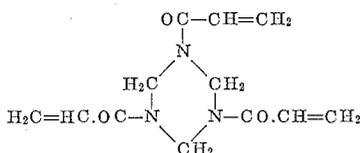
These dye compositions enable the use of a much simpler and less expensive method of application of such dyestuffs to textile materials.

It has been usual heretofore to dye textile materials with the thiosulfonic acids of sulfur dyestuffs but these prior procedures had the disadvantage of requiring the use of alkaline chemicals to effect reduction of the dyestuff with transformation of the thiosulfonic acid of the dyestuff into the substantive leuco compound of the sulfur dye which forms uneven dyeings as a result of its substantive character. Furthermore, the prior processes required a two-step process or method to complete the dyeing operation.

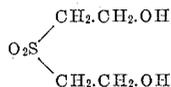
The dyestuff compositions and methods of the present invention have overcome the above mentioned prior art disadvantages, have markedly simplified the procedure and provided efficient dyeing of the textile material with good dry and wet fastness properties.

Illustrative but nonlimiting examples of the bi- or poly-functional chemical compounds which may be used as cross-linking agents with the thiosulfonic acids of sulfur dyestuffs in accordance with this invention are as follows:

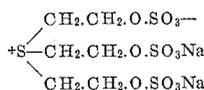
Di- or poly-epoxides or -chlorohydrines, the tris-acryloyl-hexahydro-1,3,5-s-triazine of the formula



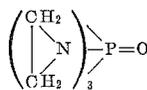
the bis-β-hydroxyethylsulfone of the formula



the di- through hexamethylol compounds of melamine, the dimethylol derivatives of urea, ethylene urea, and s-triazone or the alkyl ethers thereof, the di-sodium salt of the tris-(β-sulfato-hydroxyethyl)-sulfonium betaine of the formula



the bis- or poly-chloroacetyl compounds of di- or poly-amines, the tris-aziridinyl-phosphinoxyde of the formula



and the di- or poly-isocyanates or their bisulfite addition compounds.

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The textile material to be treated in accordance with this invention, may be in any of the usual forms, such as fibers, yarns, and woven or knitted fabrics. Likewise, the basic fiber of this material may be any of the presently known cellulosic textile fibers, e.g. cotton, rayon, linen. It is surprising that, when mixed fabrics consisting of a portion of cellulosic material and a portion of a synthetic fiber are dyed according to the invention, the synthetic portion is also dyed, which was not possible heretofore with the known processes.

The above-mentioned simplified and substantially less expensive process of the present invention avoids the usual necessity of reducing the dyestuff with alkaline sulfides, such as sodium sulfide or sodium hydrogensulfide. Instead, the present process uses thiosulfonic acids of sulfur dyestuffs in the form of their water-soluble salts in unreduced state and provides, for the first time, efficient dyeing of said textile materials therewith in a simpler manner and without the concurrent use of reducing agents. This is made possible by reacting the thiosulfonic acids of sulfur dyestuffs with a bi- or polyfunctional compound, such as above mentioned preferably in the presence of a catalyst, in place, on the textile material to be dyed, followed by a probable drying of the treated goods at controlled elevated temperatures and then heating of the treated material at substantially higher temperatures for a short period of time to bring about the reaction between the dyestuff and the bi- or polyfunctional compound. This sets the dye on the textile material in a stable uniform manner and may give a resin finish on the material where the bi- or polyfunctional compound used is a resin with inherent textile finishing properties. Illustrative examples for carrying out the process of the present invention in accordance with the above described principles and general procedures, are as follows:

EXAMPLE 1

A cotton fabric is impregnated with a solution containing 50 g./litre Hydrosol Fastgreen 3 B (Color Index: Solubilized Sulfur Green 2, CI No. 53572), 20 g./litre ethylene-glycol-bis-glycide ether and 5 g./litre calcined sodium carbonate, it is dried at 80° C. and then subjected to a dry heat treatment for 1 minute at 150° C.; subsequently the fabric is rinsed, oxidized in a liquor ratio of 1:20 for 10 minutes at 70–80° C. with a solution of 1 g./litre bichromate, 1 g./litre copper sulfate, and 2 cc./litre 60% acetic acid, and then finished by rinsing and drying. The dyeing thus obtained shows very good wet fastness properties, in particular a good fastness to washing with peroxide.

EXAMPLE 2

A mixed cotton-polyester fabric is impregnated with a solution containing 40 g./litre Hydrosol Fast-katechu RL (Color Index: Solubilized Sulfur Brown 52 CI No. 53321), 30 g./litre of a 65% solution of methyl-etherified trimethylol melamine, and 10 g./litre ammonium chloride, it is dried at 80° C., and then subjected to a dry heat treatment for 1 minute at 220° C. The fabric is then rinsed and dried. The dyeing shows good fastness to washing and to light.

EXAMPLE 3

A cotton fabric is impregnated with a solution containing 50 g./litre Hydrosol Fastyellow G (a thiosulfonic acid sulfur dyestuff) (Color Index: Solubilized Sulfur Yellow 5), 40 g./litre tris-acryloyl-hexahydro-1,3,5-s-triazine, and 10 g./litre calcined sodium carbonate, it is then dried at 100° C. and steamed for 1 minute at 150° C. Subsequently, the fabric is rinsed, oxidized with bi-

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chromate-coppersulfate-acetic acid as indicated in Example 1, rinsed again, and finished. The dyeing thus obtained shows good wet fastness properties.

EXAMPLE 4

A cotton fabric is impregnated with a solution containing 40 g./litre Hydrosol Fast-katechu RL (Color Index: Solubilized Sulfur Brown 52, CI No. 53321), 10 g./litre ammonium chloride, and 30 g./litre tris-(aziridinyl)-phosphin oxide, it is dried at 100° C. and then subjected to a dryheat treatment for 1 minute at 200° C. The fabric is then rinsed, oxidized with bichromate-coppersulfate-acetic acid as indicated in Example 1, rinsed again, and dried. The dyeing shows a good fastness to washing and to washing with peroxide.

A similarly favorable result is obtained by steaming the cotton fabric impregnated and dried according to this example for 40 seconds at 105° C. instead of subjecting same to the dryheat treatment.

EXAMPLE 5

A cotton fabric is impregnated with a solution containing 30 g./litre Hydrosol Fast-khaki AL (a thiosulfonic acid sulfur dyestuff) (Color Index: Solubilized Sulfur Green 19), 10 g./litre calcined sodium carbonate, and 20 g./litre of the tris-chloroacetyl compound of the diethylene-triamine, it is dried at 100° C., and subjected to a dryheat treatment for 1 minute at 200° C. The fabric is then rinsed and dried. The dyeing shows a very good fastness to washing and to washing with peroxide.

EXAMPLE 6

A cotton fabric is impregnated with a solution containing 50 g./litre Hydrosol Fast-olive BBN N (Color Index: Solubilized Sulfur Green 9, CI No. 53006), 30 g./litre of a 65% solution of methyl-etherified trimethylol-melamine, and 10 g./litre ammonium chloride, it is dried at 100° C., and then subjected to a dry heat treatment for 1 minute at 220° C.

Subsequently, the fabric is rinsed and dried. The dyeing shows good fastness to washing and light.

The fixation of the dyestuff can also be obtained with the same success, when in this example the impregnated and dried cotton fabric is steamed for 60 seconds at 105° C. instead of submitted to the dryheat treatment.

EXAMPLE 7

A mixed cotton-polyacrylonitrile fabric is impregnated with a solution containing 40 g./litre Hydrosol Fast-katechu RL (Color Index: Solubilized Sulfur Brown 52, CI No. 53321), 10 g./litre ammonium chloride, and 40 g./litre methyletherified trimethylol-melamine, it is dried at 80° C. and subjected to a dry heat treatment for 1 minute at 200° C. Subsequently, the fabric is rinsed and dried. The dyeing shows a good fastness to washing.

EXAMPLE 8

A cotton fabric is impregnated with a solution containing 40 g./litre Hydrosol Fastbrown BT (Color Index: Solubilized Sulfur Brown 16, CI No. 53286), 50 g./litre ethylene-bis-(2-hydroxy-3-chloro-1-propyl)-ether and 20 g./litre calcined sodium carbonate, it is dried at

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100° C. and subjected to a dry heat treatment for 1 minute at 220° C. Subsequently, the fabric is rinsed and dried. The dyeing shows a good fastness to washing and to washing with peroxide.

5 What is claimed is:

1. A water-soluble, unreduced dyestuff composition for dyeing textile materials, comprising as the principal constituents, water-soluble salts of thiosulfonic acids of sulfur dyestuffs and a polyfunctional cross-linking agent, which constituents react with each other at elevated temperatures to give stable reaction products and enable the dyeing of said textile materials without the use of alkali reducing agents.

2. A water-soluble, unreduced dyestuff composition as defined in claim 1 wherein the polyfunctional cross-linking agent is a resin and provides a resin finish on the treated textile material.

3. A water-soluble, unreduced dyestuff composition as defined in claim 1 in which the polyfunctional cross-linking agent is a member of the group consisting of diepoxides, poly-epoxydes, di-chlorohydrines, poly-chlorohydrines, tris-acryloyl-hexahydro-1,3,5-s-triazine, bis- β -hydroxy-ethylsulfone, poly-methylol melamine, dimethylol derivatives of urea, ethylene urea, and s-triazone, alkyl ethers of methylol compounds, tris-(β -sulfato-hydroxyethyl)-sulfonium betaine, poly-chloroacetyl compounds of polyamines, tris-aziridinyl-phosphin oxide and poly-isocyanates.

4. A method of dyeing textile materials comprising impregnating the textile material with an aqueous solution of salts of thiosulfonic acids of sulfur dyestuffs, and a polyfunctional cross-linking agent, drying the impregnated material and subjecting the dried material to an elevated temperature for a relatively short period of time sufficient to effect reaction between the polyfunctional cross-linking agent and the dyestuff.

5. A method of dyeing textile materials as defined in claim 4, and in which the impregnated textile material is dried at a temperature not substantially exceeding 80° C. and the dried material heated to temperatures of approximately between 150° C. and 200° C. for a few minutes to effect said reaction between the polyfunctional cross-linking agent and the dyestuff.

6. A method of dyeing textile materials as defined in claim 4, and in which the polyfunctional cross-linking agent is an etherified polymethylol melamine resin which provides a resin finish on the cloth in addition to reacting with the dyestuff to effect the dyeing of the textile material.

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