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[54] **DYEING SYNTHETIC HYDROPHOBIC FIBERS WITH LOWER ALKYL BIPHENYL CARRIERS**

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[51] **Int. Cl.** **D06p 1/68**

[58] **Field of Search** ..... 8/94, 174, 175, 162 R

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[57] **ABSTRACT**

A technique for coloring hydrophobic textile fibers with a disperse or basic dyestuff utilizing an alkyl biphenyl carrier.

6 Claims, No Drawings

DYEING SYNTHETIC HYDROPHOBIC FIBERS WITH LOWER ALKYL BIPHENYL CARRIERS

The present invention is directed to a technique for dyeing or printing hydrophobic material with a disperse or basic dyestuff utilizing a carrier to aid penetration of the dyestuff into the fiber. The embployed carrier is an alkyl biphenyl.

The present invention is directed to improvement in the method of dyeing textile fibers which do not readily absorb water. The hydrophobic nature of the fiber makes the dyeing of this material difficult and poses practical problems. For example, polyester fibers or fabrics are customarily dyed with disperse acetate dyes or other similar dyes, specially developed for this polyester fiber. The nature of these dyes is described in the "Chemistry of Synthetic Dyes and Pigments" edited by H. Lubs, Rheinhold Publishing Corp., 1855, p. 167 to 174. However, under normal dyeing conditions, almost no color is absorbed by the hydrophobic fiber. A few acetate dyes will color the fabric at the boiling point of water, but penetration of the dye is very poor.

Techniques have led to problems and to bypass the costs and complexity in dyeing, the prior art has also turned to specific carrier components, Thus, in order to obtain satisfactory utilization of the dyestuffs, especially when deeper shades are to be obtained in dyeing and printing, the fixation of the dyestuff is either carried out at elevated pressures at temperatures over 100°C, or by the thermosol process at temperatures below the softening or melting point of the fabric, e.g., at about 200°C for polyester fibers. A preferred technique is the use of dyeing auxiliaries, so-called "carriers" which aid in providing an easier penetration of the dyestuff into the fiber.

Generally speaking, dyeing under pressure at elevated temperature is undesirable due to the expense and complex procedures employed. Also, use of extreme elevated temperatures poses practical problems.

The use of carriers in dyeing techniques on hydrophobic fibers allows satisfactory results at temperatures approaching the boiling point of water without use of elevated pressure. Illustrative of several prior art carriers employed are chlorinated benzene, and various derivatives of benzene. An example of a closely related compound of the present invention is a biphenyl carrier.

While the prior art carriers in most instances have produced generally satisfactory results, these carriers may posses an undesirable degree of toxicity or may be a solid compound and possess problems upon addition to the dyebath.

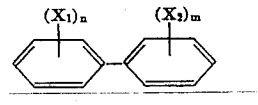
As set forth, a closely related compound to that in the present invention is biphenyl which has distinct disadvantages. This compound is known to be toxic which causes problems in use and in disposal. Additionally, biphenyl is in dry form, a solid, and added at temperatures close to the boiling point of the dyebath. Recrystallization of this carrier can take place if the temperature is lowered, leading to speckiness or spots on the textile fiber.

The carriers of the present invention function in desirable manner of the prior art in facilitating penetration of the dyestuffs into the fiber. The carrier in the dyebath permits an efficient drawing rate of the dyestuff into the fiber and aids in permitting good fastness with uniform shade in the dyeing operation. However,

the disclosed carrier is a non-toxic agent and is in liquid or easily dissolvable solid form which bypasses serious shortcomings including dissolving and recrystallization problems of prior art carriers.

DESCRIPTION OF THE INVENTION

In accordance with the present invention, dyeing of synthetic hydrophobic fibers is facilitated by a novel carrier composition which contains a lower alkylated biphenyl of the following formula:



wherein X_1 is an alkyl containing one or two carbon atoms, X_2 is hydrogen or an alkyl containing one or two carbon atoms, and both *n* and *m* are separately from one another, integers of 1 to 3.

The alkyl biphenyls of the present disclosure reduce appreciably the cost of dyeing hydrophobic synthetic fibers by increasing the utilization and effectiveness of the dyestuff. The carrier in the dyestuff permits an efficient drawing rate of the dyestuff and aids in permitting good fastness with uniform shades in the dyeing operation. The carriers diclosed function in the prior manner of facilitating penetration of the dyestuff into the fiber. Conventional techniques of employing the dyestuff may be employed, such as by the beck, jig, paddle, padder, package machine, and other dyeing method. Examples of suitable carriers of the present invention are methyl biphenyl, ethyl biphenyl, and dimethyl biphenyl.

The process of the present invention is preferably directed to the dyeing and printing of shaped structures, that is textile fibers made of hydrophobic polymers. As employed herein, a fibrous material includes fibers, yarns, threads, fabric, ribbons, tapes and tabs. A suitable example of a hydrophobic fibrous material is a polyester, such as a high melting polyester containing six membered carbocyclic rings or acid modified carbocyclic rings receptive for cationic dyes. Illustrative of the polyesters that may be employed are polyethylene terephthalate. HOwever, the general technique of the present invention employing the novel carrier disclosed herein is also applicable to other hydrophobic synthetic materials containing a variety of ester groups in the molecule and being difficult to dye, such as cellulose triacetate and bicarpolyurethane. Generally speaking, hydrophobic fibers may be dyed using the present carrier and a wide variety of suitable substrates may be employed.

The types of dyestuffs that may be employed in the present invention are known in the art as disperse and basic dyestuffs. As illustrative of suitable disperse dyestuffs are the Color Index C.I. disperse dyes. Illustrative of the basic dyestuffs that may be employed in the present invention are Index C.I. Basic Dyes.

The carrier is applied in the form of a solution emulsion or illustratively emulsfying agents may be represented by the following formulae; in which R designates an alkyl group and M is a metal salt such as sodium, potassium, ammonium, or a derivative of ammonia etc.

R — COOM (1)

wherein R is an alkyl group containing 8 to 24 carbon atoms.

$$ROSO_2OM \quad (2)$$

wherein R is an alkyl group containing 8 to 24 carbon atoms.

$$RSO_3M \quad (3)$$

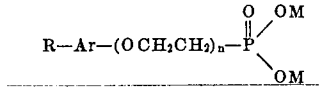
wherein R is an alkyl group containing 12 to 18 carbon atoms.

$$R - Ar - SO_3M \quad (4)$$

wherein R is an alkyl group containing 3 to 18 carbon atoms and Ar is an aromatic nucleus selected from benzene, naphthalene, anthracene, etc.

$$R - Ar - (OCH_2CH_2)_n - OSO_2M \quad (5)$$

or



wherein R is an alkyl substituent on a benzene ring containing 1 to 18 carbon atoms and Ar is a benzene nucleus and *n* is at least one and as high as 10.

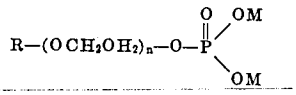
$$R - Ar - (OCH_2CH_2)_n - OH \quad (6)$$

wherein R is an alkyl group containing 1 to 18 carbon atoms. Ar is a benzene nucleus and *n* is a number from 4 to 40.

$$R - (OCH_2CH_2)_n\,OH \quad (7)$$

wherein R is an alkyl group containing 8 to 24 carbon atoms and *n* is a number from 4 to 40.

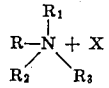
$$R - (OCH_2CH_2)_n - OSO_3M \quad (8)$$



wherein R is an alkyl containing 8 to 24 carbon atoms and *n* is a number equaling 1 to 4.

$$R - C - C - (OCH_2CH_2)_nOH \quad (9)$$

wherein R is a fatty radical containing 8 to 24 carbon atoms and *n* is a number equaling 4 to 40.



(10)

wherein R is an alkyl or amide group containing 8 to 24 carbon atoms, R_1 is hydrogen alkyl or an arakyl group, R_2 is hydrogen or an alkyl group containing 1 to 8 carbon atoms, R_3 is hydrogen, alkyl or arakyl group, and X is an anionic radical, e.g., choloride, sulfate, or sulfate derivative.

Representative of specific emulsifying agents which may be employed are lauryl dimethyl, benzyl ammonium chloride, Turkey red oil, sodium lauryl sulfate, sodium dodecyl benzene sulfonate, triethanolamine salt of lauryl sulfate, ethoxylated nonylphenol.

An example of a preferred emulsifying agent is the triethanolamine salt of lauryl sulfate.

There are various procedures for dyeing or printing the synthetic material with a disperse or basic dyestuff and the emulsified carrier. One technique for dyeing comprises adding the dyestuff, such as disperse dyestuff, and emulsified carrier to the dyebath containing the synthetic material. Another method comprises applying the emulsified carrier prior to the dyeing process. This can be done simultaneously during the prescouring operation. The pretreated material is then rinsed and entered into a fresh dyebath containing only the dyestuff. If printing is employed, it may be carried out in the usual manner by adding the carrier emulsion to the printing paste and printing the fabric on a roller or screen printing unit. The dye is fixed by exposing to steam or heat treatment.

The amount of dyeing carrier composition to be added to the dyebath may be varied within relatively wide limits and depends primarily upon the dry weight of the hydrophobic synthetic materials being dyed. Within the broad aspect of the present invention, from about 1 to 15 percent by weight of the dyeing carrier may be employed based on the dry weight of the hydrophobic synthetic material. More satisfactorily, about 2 to 10 percent of the dyeing carrier will be employed.

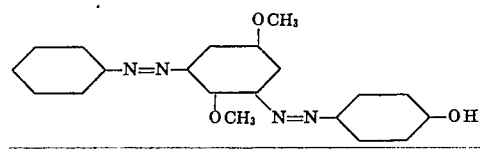
The disclosed carrier of the present invention is not only restricted to be applied alone as the sole carrier in the present disclosure, but can be incorporated into other carriers which are well known in the prior art, such as o-phenyl phenol, methyl salicylate, biphenyl, chlorinated benzene or naphtalenes, methyl naphtalenes and alkyl benzoates, such as for example to an extent of 50% conserving the original characteristics of the employed carrier.

The physical form of the alkyl biphenyl carrier is a liquid or easily dissolvable solid. Illustratively the melting point of 2-methyl biphenyl, 3-methyl biphenyl and 4-methyl biphenyl are respectively 0°C, 4.5°C and 49.5°C. In the case of 4-methyl biphenyl which is a solid at room temperature, a eutectic mixture of this component with disclosed biphenyls may be employed which yields a liquid at room temperature.

The invention will be further illustrated in greater detail by the following specific examples.

EXAMPLE 1

The dyeing carrier is prepared from 70 parts of 3-methyl biphenyl, 15 parts of the triethanol amine salt of dodecylsulfate and 15 parts water; 8 percent of the emulsion, based on the dry weight of a "Dacron" polyester fabric, are added at 40°C to a dyebath containing 2 percent of the dyestuff of the following formula.

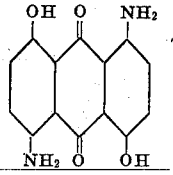


The polyester fabric is then loaded in a beck at a liquor ratio 30:1. Running the fabric 10 minutes at 40°C, the temperature is raised within 30 minutes, to the boil and kept 1½ hours at this temperature. A full orange shade is obtained with very good fastness properties.

EXAMPLE 2

The same as Example 1, but with 3 percent of the dyestuff of the following formula:

Disperse Blue 71

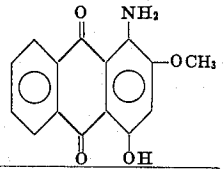


A strong blue shade is obtained with very good lightfastness.

EXAMPLE 3

The same as Example 1, but instead of 3-methyl biphenyl, 4-methyl biphenyl is used. 2.5 percent of the dyestuff of the following formula:

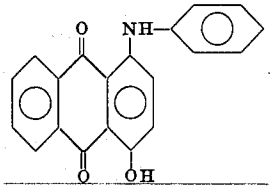
Disperse Orange 21



Instead of 8 percent only 6 percent of the carrier emulsion is used. The fabric is dyed in a vivid pink, with excellent lightfastness.

EXAMPLE 4

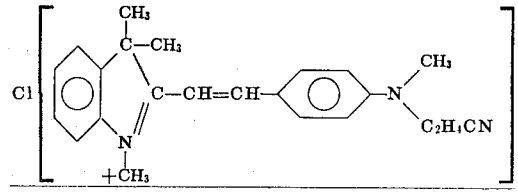
A printing paste containing 10 percent of a carrier emulsion, containing instead of the same amount of 3-methyl biphenyl a mixture of the 3-isomeric methyl biphenyls. 2.5 percent of the dyestuff of the following formula:



3 percent alginate thickener; 20 percent mineral spirit; was printed and submitted to a 1 minute curing at 350°F. After rinsing and soaping a vivid reddish blue was obtained.

EXAMPLE 5

A fabric of acid modified polyester, trade name "Dacron 64" is dyed according to example 1 with 1.5 percent of the dyestuff of the following formula.



Instead of 30 percent tri-ethanolamine laurylsulfate 30 percent of ethoxylated nonylphenol with 12 mol ethylenoxy is applied. A brillant pink is obtained with good general fastness properties.

Several embodiments of this invention have been illustrated and described herein, but it will be apparent to those with skill in the art that additional modifications may be made without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a process for coloring a textile fiber with a disperse or basic dyestuff with the aid of a carrier, the improvement wherein the carrier comprises 2-methylbiphenyl, 3-methylbiphenyl, 4-methylbiphenyl or mixtures thereof.

2. The process according to claim **1** wherein the textile material is polyethylene terephthalate.

3. The process according to claim **1** wherein the textile material is cellulose acetate.

4. The process according to claim **1** wherein the textile material is acid modified polyethylene terephthalate.

5. The process according to claim **3** wherein the dyestuff is a disperse dye.

6. The process of claim **1** wherein said alkyl biphenyl carrier includes 4-methyl biphenyl employed in a eutectic mixture.

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