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[54] **COAL TAR METHYL NAPHTHALENE FRACTION AND DIPHENYL CARRIER AND DYEING THEREWITH**
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ABSTRACT: This invention is concerned with a dye carrier and a dyeing process which utilizes said dye carrier. The dye carrier and process are particularly suitable for use in the dyeing of synthetic organic fibers. More specifically this invention is concerned with a dye carrier and process for the dyeing of synthetic organic fibers of the hydrophobic type by the use of a dye carrier which generally comprises biphenyl, methylnaphthalene and an emulsifying agent.

COAL TAR METHYL NAPHTHALENE FRACTION AND DIPHENYL CARRIER AND DYEING THEREWITH

The present invention is concerned with a process for dyeing synthetic fibers which have come into widespread use in recent years. Many of the widely used synthetic fibers are hydrophobic in nature and as such dyeing problems often result.

This invention is concerned with a dye carrier which is adapted to overcome the hydrophobic nature of these synthetic fibers while in a dyebath. Likewise, the invention is concerned with a dyeing process which is particularly suited for the dyeing of synthetic fibers.

In the last decade synthetic fibers have achieved widespread consumer acceptance. Typical examples of such synthetic fibers are polyester fibers such as Dacron, Kodel, Vycron, Terylene, Fortrel, Encron and Trivera. Other widely used synthetic fibers are materials based on cellulose acetate such as Arnel and Tricel. Still another example of widely accepted synthetic fibers are acrylic fibers such as Acrilan, Orlon and Creslan. Other suitable fibers for use in this invention are fibers formed from nylon and polypropylene. The vast majority of these synthetic fibers are hydrophobic in nature and as such dyeing problems often result.

These hydrophobic materials usually cannot be dyed by ordinary dyeing procedures as have been previously used for the dyeing of fibers such as cotton, wool, silk, regenerated cellulose, etc. When such ordinary dyeing procedures are used for the dyeing of hydrophobic synthetic organic materials, the dye usually does not penetrate the material and either no dyeing is obtained or a very poor quality dyeing results. If dyeing does result the color is usually not fast and tends to wash out of the textile. Due to these dyeing difficulties, the dyeing of hydrophobic synthetic fibers is presently effected by other methods such as, for example, by the use of a dye carrier in the presence of a swelling agent. These components tend to open the pores of the hydrophobic fibrous material and permit the dye to enter and remain there in a color fast manner.

While the carrier and dyeing processes of the subject invention are adapted for use in conjunction with a wide range of synthetic fibers, the invention is particularly suited to the dyeing of polyester fibers. Polyester fibers for use in accordance with this invention could generally be defined as synthetic polymeric polyesters such as highly polymeric linear polyesters, the molecules of which have reoccurring monomeric units connected by ester linkages. Dibasic acids, for example, aromatic acids, such as terephthalic acid, diphenyl-4,4'-dicarboxylic acid and/or dephenylsulfone-4,4'-dicarboxylic acid, dihydroxy compounds, for example, glycols, such as ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol and/or butylene glycol, as well as other diols, such as 1,4-cyclohexyldiol can be used as the monomers to form the polymeric polyesters. Typical commercial examples of such fibers are Dacron, Terylene, Fortrel, Trevira, Terlanca, Kodel, Vycron, etc. They are disclosed, for example, in U.S. Pat. No. 2,901,466 and British Pat. Nos. 578,079; 579,462; 588,411; 588,497 and 596,688.

While the above discussion generally indicates that the subject invention is admirably suited for the dyeing of synthetic fibers, it should be noted that this invention is also extremely useful in the dyeing of blends of synthetic fibers such as blends of polyester fibers and cellulosic fibers. The latter term includes native cellulose, such as linen or, more particularly, cotton, as well as regenerated cellulose, such as viscose and cuprammonium rayon.

As a result of the above described problems incurred in the dyeing of synthetic fibers, a tremendous amount of work was commenced to discover appropriate compounds and compositions which have the desired swelling action. These swelling agents or carriers, as they are usually called, are organic chemicals that have the property of greatly increasing the rate of dyeing of synthetic fibers and particularly polyester fibers when added to the dye beck. The observation that certain chemicals behave in this manner was made during the initial study of the dyeing of Terylene. In the past ten years extensive

research has been carried on relative to these carriers. This invention is concerned with a synergistic combination of chemicals which form an extremely desirable carrier.

As a result of this research a wide variety of organic compounds and compositions were found to accelerate the dyeing rate of synthetic fibers and in particular polyesters at temperatures up to 212° F. The most effective and widely used carrier at the present time is biphenyl. However, the use of biphenyl has many problems and drawbacks, which will be discussed in detail hereafter. Examples of other carriers which are currently being used are mono, di and tri chlorobenzene, chlorotoluenes, 0- or P- phenylphenol, carboxylic acids, such as benzoic acid and dichlorobenzoic acid, salicylic acid; amines such as diphenylamine have also been used. Mixtures of compounds have likewise been used as suitable carriers. For example, mixtures of phyenylmethylcarbinol and acetophene along with mixtures of tetraphydronaphthalene and cyclohexanol and finally methylnaphthalenes and butyl benzoate have also been utilized as carriers.

In addition to having a swelling action any suitable carrier for commercial use must have a high efficiency and it must be available at a relatively low cost. Likewise, the carrier must have no effect on the fastness property of the dyed fibers and it must not tend to degrade or discolor the fiber in question. Also the carrier must be readily removable after dyeing and it must be stable under conditions which are present in the dyebath. In addition to these properties, the carrier must naturally be compatible with the dyes thus being used. Finally the carrier must leave no residual odor in the finished textile and it must not be toxic.

The primary object of this invention is a high efficiency, low cost liquid carrier for use in conjunction with the dyeing of synthetic fibers.

Another object of this invention is a carrier which does not effect the fastness properties of the resulting dyed fibers and does not tend to degrade or discolor the resulting dyed fibers.

Still another object of this invention is a dye carrier which is readily removable after dyeing.

Another object of this invention also includes a dye carrier which is stable under dyeing conditions and which is compatible with dyestuffs.

Within the realm of the objects of this invention is a dyestuff carrier which has no residual odor and is not toxic.

Finally, the objects of this invention include all the other novel features which will be obvious from the specification and claims at hand.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As was stated above, this invention generally relates to a carrier for use in the dyeing of synthetic fibers and in particular to polyester fibers which comprises biphenyl, methylnaphthalene and emulsifiers. From the above discussion, it should be noted that the two principal components of the composition of this invention, namely biphenyl and methylnaphthalene, have both been previously used as dye bath carriers. Biphenyl is probably the most widely used carrier to date. To a much lesser extent methylnaphthalene has been previously used as a carrier. In accordance with this invention, these two components and an emulsifier are combined to produce a carrier which is far superior to either biphenyl or methylnaphthalene.

As was stated above biphenyl singularly is a widely used carrier. As a carrier biphenyl is usually used in a composition which generally comprises from about 85 percent to about 88 percent biphenyl and from about 12 percent to about 15 percent emulsifier. Even though this composition is relatively simple, many problems are incurred in its usage. For example, even though this prior art carrier composition is generally packed in polyethylene or lined bags the composition in question still tends to pack and weep as pressure and temperature cause a breakdown of the crystalline biphenyl structure. Likewise, the prior art compositions are hard to disperse and

require bath temperatures above 160° F. (the melting point of biphenyl). These prior art compositions also resist complete dispersion until the beck temperature reaches a slow boil. If the prior art composition was not carefully added to the beck, an uneven dispersion resulted which generally caused severe streaking and spots in the final dyed textile.

In addition to these problems, there was also the possibility that biphenyl would precipitate out of the dyeing solution. If at any time during the dyeing or rinsing operations the temperature of the bath dropped below 160° F., or even dropped sharply from 200° F., for example, to 170° or 180° F., there was danger that biphenyl would precipitate out.

As a preliminary to automation, many plants installed overhead drug rooms with a separate mixing tank for each beck and glass piping from the drug room to the beck. Carrier compositions were prepared in the drug room and piped to the beck through preheated pipes. Even with these precautions most plants were regularly plagued with clogged lines due to the tendency of biphenyl to precipitate out of the prior art solutions.

As a solution for the problems as described above which resulted from the use of biphenyl as a carrier, the applicants discovered a carrier composition which is superior to any known in the prior art. In contrast with the problems as described above, the carrier composition of this invention is dispersible in hot or cold water and it is almost foolproof in its handling properties. Likewise, the carrier composition of this invention produces color value dyestuff efficiency equal or better than the prior art biphenyl carriers. Due to the fact that the composition of this invention is soluble in hot and cold water, the use of storage tanks and automatic metering equipment is feasible. Finally, the carrier of this invention produces a finished dyed product which is far superior in all dye characteristics to those produced when the carrier compositions of the prior art are utilized.

The carrier composition of this invention is generally set forth in table I.

TABLE I

From about 25 to about 40 % biphenyl
From about 6 to about 12 % emulsifier
From about 69 to about 48 % coal tar distillate containing methylnaphthalene

A more preferred composition for use in accordance with the subject invention is as specified in table II.

TABLE II

From about 25 to about 30 % biphenyl
From about 2 to about 3 % nonionic wetting agent
From about 4 to about 6 % of an anionic wetting agent
From about 69 to about 61% coal tar distillate containing a major amount of methyl naphthalene

A most preferred composition for use in accordance with this invention is as described in table III.

TABLE III

About 25 % biphenyl
About 2 % nonionic wetting agent
About 4 % of an anionic wetting agent
About 69 % coal tar distillate containing a major portion of methylanapthalene

In the compositions as specified in table I, II and III, the methylnaphthalene is added as a coal tar distillate used as a source of methylnaphthalene are designated Oil No. 3 and Oil No. 4 as are described in Table IV are available commercially. Coal tar distillates for use in accordance with this invention are obtained by the distillation of coal tar at 230° to 250° C. Methylnaphthalene fractions of the type useful in this invention are described in Volume 9, p. 228 of the Encyclopedia of Chemical Technology by R. E. Kirk and O. F. Othmer, as is published by the Inter-Science Encyclopedia Inc., copyrighted 1952, under the subheading of Methylnaphthalene.

TABLE IV

	Oil 03	Oil 04
Pyridine Bases	0.01%	0.01%
Tar Acids		0.01
Limpid Oil	22.93	3.51
Naphthalene	18.82	4.40
Dimethylcoumarone	0.90	0.90
Quinoline	2.75	2.51
Beta Methyl Naphthalene	19.25	28.05
Alpha Methyl Naphthalene	28.85	31.96
Benzoic Acid	0.15	0.10
Diphenyl	0.81	0.92
2-6 Dimethylnaphthalene	1.75	2.50
Other C_{11} to C_{13} Subnaphthalenes	2.52	3.60
C_{12} to C_{16} Acetalnaphthene	1.25	1.53

The above described Oil No. 3 is a preferred product for use in accordance with this invention.

While the applicants are not sure how the components of this invention function, it is thought that the methylnaphthalene component of this invention tends to open the pores of the fiber to an optimum degree. When these fibers are in this optimum degree of porosity the biphenyl along with the dye enters the fiber whereupon dyeing is effected.

Methylnapthalene for use in accordance with this invention can come from any convenient source provided the level of methylnapthalene in the final product is adjusted to achieve the desired result and no objectionable contaminants are present. Coal tar distillates which contain a substantial percentage of methyl naphthalene and desirable or unobjectionable related compounds are preferred sources for methylnaphthalene. For purposes of definition, the term "substantially" means more than 30 percent of methylnaphthalene. and related compounds. The term "related compounds" includes any compound wherein a naphthalene nucleus contains one or more low molecular weight substitutes such as the lower alkyl radicals. Preferred sources for methylnaphthalene for use in accordance with this invention are coal tar distillates which contain from about 40 to about 60 percent methylnaphthalene and related compounds.

In connection with the methylnaphthalene component of the composition of the subject invention, it should be noted that it is preferred that the methylnaphthalene be a mono substituted product. Generally it could be stated that the lower the substitution rate on the naphthalene nucleus, the higher is the solubility of biphenyl. Accordingly, if the substitution rate on a naphthalene nucleus is minimized the possibility of precipitation problems with biphenyl will likewise be minimized.

The biphenyl as used in accordance with the subject invention is generally sold as a relatively pure product. Suitable biphenyl compositions for use in accordance with this invention are essentially pure products and are available from commercial sources.

The composition of this invention uses a mixture of nonionic and anionic wetting agents as an emulsifier. The nonionic wetting agent generally retards the flow of dye into the fiber and keeps the dye back from the fiber. In contrast, the anionic wetting agent accelerates the penetration of the dye into the fiber. The combination as used in accordance with this invention generally tends to produce level dyeing,

that is a dyeing process having a minimal streaking problems and maximum color value. These advantageous properties are achieved by the use of an emulsifier which comprises an nonionic and an anionic wetting agent in conjunction with the biphenyl and methylnaphthalene.

While a single wetting agent can be used in accordance with this invention, it is preferred that a combination of nonionic and anionic wetting agents be utilized. Generally, it is preferred that the ratio of anionic to nonionic wetting agents in the composition of this invention be on the order of 2 to 1.

Examples of suitable anionic wetting agents as used in accordance with this invention are condensation products of coconut fatty acids, tallow fatty acids, tall oil fatty acids, oleic acids with diethanol amine condensate and mixed isopropanol amine condensates. Salts such as triethanolamine, isopropanol amine, isopropyl amine, N-methyl-bis amine propyl amine, salts of dodecyl benzene sulfonic acid; alkali methyl hydroxides, triethanoamine and ammonium hydroxide soaps of oleic, stearic and tallow fatty acids.

Examples of suitable nonionic wetting agents for use in accordance with this invention are condensation products which are produced by the condensation of from about 25 to about 200 moles of ethylene oxide with hydrogenated and unhydrogenated castor oil; the condensation products of from about 4 to 9 moles of ethylene oxide with nonyl phenol condensate; the condensation of from about 7 to about 9 moles of ethylene oxide with a primary alcohol condensate; the condensation product as produced by the condensation of polyethylene glycol with coconut fatty acids and oleic acid.

It is within the purview of this invention to add to the compositions of this invention compatible materials which do not affect the basic and novel characteristics of the composition of this invention. Among such materials are coloring agents, including dyes and pigments, fillers and similar additives. Additives such as antioxidants, antistatic agents, stabilizers and antifoaming agents, may also be added. The upper limit of the quantity of additives is usually about 50 weight percent of the product.

As is mentioned above, antifoaming agents can be added to the composition of this invention. In this connection, it should be noted that the compositions in question are particularly advantageous in that they have a very low foaming tendency. Due to this fact, defoaming agents are usually not required. Because of this low foam tendency lightweight materials readily sink into dyebaths which utilize the composition of this invention.

The composition of this invention generally produces a dyed product which is superior to that produced when the prior art compositions are utilized as carriers. When the composition of this invention is utilized, roll or crease marks are virtually eliminated.

The composition of this invention can be easily removed from the dyed textile. Simple rinsing removes enough carrier that the balance is readily exhausted in a conventional carpet dryer. This easy removal property is particularly important in that if the carrier is not removed from the dyed textile crocking often results.

The carrier of this invention can be used in conjunction with disperse, acid, basic and premetallized dyes. Examples of specific dyes that can be used in accordance with this invention are listed in table IVA.

TABLE IVA

Basic Yellow 11	CI-48055
Basic Yellow 13	Not Assigned
Basic Yellow 15	Not Assigned
Basic Yellow 16	Not Assigned
Basic Blue 4	CI-51004
Basic Blue 35	Not Assigned
Basic Red 16	Not Assigned
Basic Green 4	CI-42000
Acid Yellow 17	CI-18965
Acid Yellow 23	CI-19140
Acid Yellow 40	CI-18950
Acid Yellow 73	CI-45350
Acid Red 14	CI-14720
Acid Red 35	CI-17045
Acid Red 73	CI-27290
Acid Red 85	CI-22245
Acid Red 88	CI-15620
Acid Blue 25	CI-62055
Acid Blue 40	CI-62125
Acid Blue 45	CI-63010
Acid Blue 113	CI-26360
Acid Blue 158	CI-14880
Acid Green 25	CI-61570
Disperse Yellow 23	CI-26070
Disperse Yellow 54	Not Assigned
Disperse Blue 3	CI-61505
Disperse Blue 7	CI-62500
Disperse Blue 27	CI-60767
Disperse Red 55	Not Assigned
Disperse Red 60	Not Assigned

These dye designations are in accordance with international color index names as are compiled by the American Association of Textile Chemist and Colorists, Research, Triangle Park, North Carolina and the Society of Dyers and Colorists, Manchester, England.

Generally it could be said that disperse dyes are preferred for use in accordance with this invention.

Dye concentrations for use in accordance with this invention can be from about 0.1 to about 10 percent as based on the weight of textile. It is understood by one skilled in the art that the exact makeup of the dyebath per se can vary considerably due to such things as the nature of the textile being dyed, the nature of the dye, the operating temperature, the carrier concentration, etc.

Due to the fact that the biphenyl component of the composition of this invention is soluble in the composition of this invention at a wide range of temperatures the temperature of the dyebath when the carrier is added is not critical. Generally, in accordance with this invention, the carrier can be added at any convenient temperature. The operating temperature of the dyebath in accordance with this invention is usually 212° F. for open systems or up to 250° F. for pressurized systems. The weight of carrier used in accordance with this invention can vary from about 2 to about 15 percent as based on the weight of the textile being dyed. A more preferred range is from about 7 to about 12 percent with a most preferred concentration being 10 percent.

The following examples will illustrate the subject invention. These examples are given for the purpose of illustration and not for purposes of limiting this invention. (All parts percent are given by weight unless otherwise specified).

EXAMPLES

The data for examples 1 to 20 are enumerated in table VIII below. In preparing the samples for examples 1 to 20 the first procedure was to prepare a plurality of base solvent blends. The solvent blends as utilized in examples 1 to 20 are represented by 1 to 4 in table V.

TABLE V

Base Solvent Blends
1. 100 % mixed Methyl Naphthalenes (Oil 03)
2. 65% Oil 03/35% biphenyl
3. 75% Oil 03/25% biphenyl
4. 100% biphenyl

Likewise, in examples 1 to 20 a plurality of anionic and nonionic wetting agent combinations were utilized. These combinations are described in table VI and were given identification numbers of from 1 to 3. In these combinations the ratio of anionic to nonionic wetting agent was 2 to 1.

TABLE VI

1. A two to one ratio of an isopropyl amine salt of dodecyl benzene sulfonic acid with 36 moles of ethylene oxide on castor oil.

2. A two to one ratio of a coconut fatty acid diethanol amine condensate product with 36 moles of ethylene oxide on castor oil.

3. A two to one ratio of a coconut fatty acid diethanol amine condensate product with a partially hydrogenated castor oil plus 25 moles of ethylene oxide.

A disperse dye system was then prepared for use in examples 1 to 20 in accordance with table VII.

TABLE VII

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10 grams polyester carpet (tufted polyethylene terephthalate).
2 % Acetic Acid (glacial) based on carpet weight.
0.47% Disperse Blue GLF CI-60767 (Eastman) based on carpet weight.
0.081% Disperse Red FFBL (Eastman) based on carpet weight.
0.510% Disperse Yellow 4RL (Eastman based on carpet weight.
500 grams water—hardness of 1 gram.

The actual dyeing procedure for use in examples 1 to 20 is specified in points 1 to 10 below:
1. 500 cc. of water 70°–80° F. **and acetic acid was added to a dye cup**.
2. The dyestuff was predispersed in warm water and added to the dye cup.
3. The carpet sample was then immersed into the dye cup and agitation of sample started.
4. The carrier formulation was then added to dye cup.
5. Heat was applied to dye cup and the temperature of dyebath was raised as rapidly as possible to the boil.
6. The carpet sample was allowed to remain in dyebath for one hour at a slow boil (212° F. Max.), with constant and uniform agitation.
7. At the end of one hour the dye cup was removed from the heat source and its contents flooded with hot (195° F.) water for two minutes followed by a cold rinse for two minutes.
8. The carpet samples were removed from the rinse bath and air dried 72°–75° F.).
9. The dye concentration used in these examples was as specified in table VII.
10. 10 percent carrier as based on the weight of the textile was utilized in these examples.

The carpet samples as produced in accordance with examples 1 to 20 were rated for

Trueness of Shade
: As compared with fiber dyed at 240°–250° F. under pressure without use of carrier.

Uniformity of Shade
: As related to shade at tip of tuft to bottom of tuft, also referred to as tippiness.

Levelness of Shade
: As related to shade at any one point on carpet compared to any other point.

Depth of Shade
: Actually the amount of dye (on shade) taken up by fiber (actual darkness). In order to establish a norm for depth of shade samples of polyester yarn were dyed under pressure at elevated temperatures without the use of a carrier. The average of the samples was given an arbitrary rating for color depth of 100%.

Lightfastness
: As per standard test procedure using Atlas Electrical Devices Fadeometer—using carbon ARC—Standard Test Method AATCC 16A-1964 —Continuous light.

Dye Penetration
: As determined by microscopical evaulation—relates to amount of dye reaching core or fiber. An "A" rating indicates complete penetration with B, C & D showing increased ring dyeing.

Odor
: Test panel evaluation of carpet odor as related to residual carrier—after carpet has air dried for 24 hours at 70° F./40–50% RH.

Crock Test
: AATCC (American Association of Textiles, Colors and Chemist) Standard Crock Test procedure—Standard Test Method—AATCC—8-1961-AATCC Crockmeter Method.

Dyebath Stability
: Relates to amount of carrier precipitation or oiling on surface of dyebath at temperature shown.

The rating system as used in accordance with examples 1 to 20 is as follows:

LEGEND

A	Excellent
B	Acceptable
C	Acceptable Marginal
D	Unacceptable
+B	Blue Cast
Y	Yellow Cast
R	Red Cast

The data for examples 1 to 20 are listed in table VIII.

TABLE VIII

Example	Composition: Base solvent carrier (percent)	Composition: Wetting agent (percent)	Dye bath stability: <160° F.	Dye bath stability: >160° F.	Trueness of shade	Uniformity of shade	Levelness of shade	Depth of shade (percent)	Lightfastness: 40 hrs.	Lightfastness: 80 hrs.	Dye penetration	Carpet odor	Crock: Wet	Crock: Dry
1	1 (80)	1 (20)	A	A	C-Y	A	A	B (100)	A	B	A	A	B	B
2	1 (91)	1 (9)	A	A	C-Y	A	A	B (100)	A	A	A	A	B	A
3	1 (94)	1 (6)	A	A	C-Y	A	A	B (100)	A	A	A	A	B	A
4	1 (80)	2 (20)	A	A	C-R	A	A	B (100)	A	A	B	A	D	C
5	1 (91)	2 (9)	A	A	C-R	C	C	B (100)	A	A	C	A	C	B
6	2 (80)	2 (20)	B	A	C-R	B	B	A (110)	A	A	C	B	B	B
7	3 (80)	2 (20)	A	A	C-R	B	B	A (110)	A	A	C	B	B	A
8	2 (91)	3 (9)	A	A	D-R	C	C	A (110)	A	A	B	B	C	C
9	3 (91)	3 (9)	A	A	D-R	C	C	A (110)	A	A	B	B	C	C
10	2 (80)	1 (20)	A	A	A	A	B	A (125)	A	A	A	A	C	B
11	3 (80)	1 (20)	A	A	A	A	B	A (125)	A	A	A	A	C	B
12	2 (91)	1 (9)	B	A	A	A	A	A (125)	A	A	A	A	B	A
13	3 (91)	1 (9)	A	A	A	A	A	A (125)	A	A	A	A	B	A
14	2 (94)	1 (6)	A	A	A	A	A	A (125)	A	A	A	A	A	A
15	3 (94)	1 (6)	A	A	A	A	A	A (125)	A	A	A	A	A	A

16	4 [1]	[2]	D	C	B-B	C	C	A (110)	A	B	C	C	C	C
17	4 [3]	[2]	D	C	C-B	D	C	A (125)	A	C	C	C	B	C
18	4 (80)	1 (20)	C	B	B-B	B	B	A (125)	A	C	C	B	B	C
19	4 (91)	1 (9)	C	B	B-B	C	B	A (125)	A	B	C	B	B	B
20	4 (94)	1 (6)	D	C	D-B	D	C	A (125)	A	B	C	B	B	C

[1] Commercial carrier: Product as sold by Tanatex Chemical Industries, Lyndhurst, New Jersey, under the trademark Carrolid ELF.
[2] Unknown.
[3] Commercial carrier: Product as sold by Charlotte Chemical Laboratories, Charlotte, North Carolina, under the trademark Polycarrier M-1.

As is represented in table VIII, examples 1 to 5 generally represent prior art compositions wherein the carrier is generally a methylnaphthalene base material. Examples 6 to 15 are carrier compositions in accordance with this invention, wherein methylnaphthalene is used in conjunction with biphenyl. Examples 16 to 20 are generally prior art biphenyl compositions wherein the principal carrier component is biphenyl.

From the comparison between the data of examples 1 to 5 and that of examples 6 to 15, it can be seen that the prior art methylnaphthalene base compositions do a creditable job of dyeing textiles. However, it is to be noted that in all instances in examples 1 to 5, the depth of shade achieved only a "B" rating at 100 percent color depth. In comparison, in examples 6 to 15 all samples achieved an "A" rating on depth of shade with a minimum color depth of 110 percent. In most of the examples of this group, the color depth rating was 125 percent. A significant gain over the 100 percent of the methylnaphthalene compositions.

As stated above, examples 16 to 20 generally relate to biphenyl compositions. While these prior art compositions generally do a creditable job with regard to depth of shade and the amount of color reproduction, they are drastically inferior to the combination methylnaphthalene-biphenyl compositions of examples 6 to 15 in dye penetration, carpet odor, levelness of shade and wet and dry crock. Likewise, the compositions of examples 16 to 20 are inferior in dyebath stability. In all instances in these examples there was a distinct tendency for biphenyl to precipitate out.

As can be seen from the data of the above listed examples, the methylnaphthalene-biphenyl composition of this invention for use as a carrier is superior to either the known methylnaphthalene compositions or the known biphenyl compositions. The composition of the invention has superior dye stability properties and it generally produces a dyed textile having across-the-board properties which are superior to those produced when the prior art carriers are utilized.

We claim:

1. A dye bath carrier composition containing from about 25 to about 40 percent of biphenyl, from about 69 to about 48 percent of a coal tar distillate containing a substantial percentage of methylnaphthalene, obtained by the distillation of coal tar at 230° to 250° C. and from about 6 to about 12 percent of a wetting agent.

2. The carrier composition of claim 1 containing from about 25 to about 30 percent of biphenyl, from about 69 to about 65 percent of a coal tar distillate containing a substantial percentage of methylnaphthalene from about 2 to 3 percent of a nonionic wetting agent and from about 4 to about 6 percent of an anionic wetting agent.

3. The carrier composition of claim 1 containing about 25 percent biphenyl, about 69 percent of a coal tar distillate containing from about 40 to about 60 percent methylnaphthalene and 2 percent of a nonionic wetting agent and about 4 percent of an anionic wetting agent.

4. The composition of claim 1 wherein the wetting agent comprises a mixture of anionic and nonionic wetting agents wherein the ratio of anionic to nonionic wetting agents is about 2 to 1.

5. The carrier composition of claim 1 containing 35 percent biphenyl, 56 percent of a coal tar distillate which contains a substantial percentage of alpha and beta methylnaphthalene, 6 percent of an anionic wetting agent comprising the isopropyl amine salt of dodecyl benzene sulfonic acid and 3 percent of a nonionic wetting agent which is produced by the reaction of 36 moles of ethylene oxide with castor oil.

6. A dyeing process comprising the steps of:

a. Applying a dyestuff dispersion in a suitable solvent to textile material

b. adding a carrier formulation comprising from about 25 to about 40 percent of biphenyl, from about 69 to about 48 percent of coal tar distillate containing a substantial percentage of methylnaphthalene obtained by the distillation of coal tar at 230° to 250° C., and from about 6 to about 12 percent of a wetting agent, to said dyestuff dispersion; and

c. applying heat to the carrier dyestuff dispersion of a period of time sufficient to cause the dye to penetrate into the fibers of the textile.

7. The dyeing process of claim 6 wherein the carrier formulation utilized comprises from about 25 to about 35 percent of biphenyl, from about 69 to about 53 percent of a coal tar distillate containing a substantial percentage of methylnaphthalene, from about 6 to about 12 percent of an emulsifier, and wherein from about 2 to about 15 percent of the carrier is utilized as based on the weight of the textile.

8. The dyeing process of claim 6 wherein the carrier formulation utilized comprises from about 25 to about 30 percent of biphenyl, from about 69 to about 65 percent of a coal tar distillate containing a substantial percentage of methylnaphthalene, from about 2 to about 3 percent of a nonionic wetting agent, from about 4 to about 6 percent of an anionic wetting agent, and wherein from about 7 to about 12 percent of the carrier is utilized as based on the weight of the textile.

9. The dyeing process of claim 6 wherein the carrier formulation utilized comprises about 25 percent biphenyl, about 69 percent of a coal tar distillate containing from about 40 to about 60 percent methylnaphthalene about 2 percent of a nonionic wetting agent and about 4 percent of an anionic wetting agent, and wherein 10 percent of the carrier is utilized as based on the weight of the textile.

10. The dyeing process of claim 6 wherein the carrier formulation utilized comprises 35 percent biphenyl, 56 percent of a coal tar distillate which contains a substantial percentage of alpha and beta methylnaphthalene, 6 percent of an anionic wetting agent comprising the isopropyl amine salt of dodecyl benzene sulfonic acid and 3 percent of a nonionic wetting agent which is produced by the reaction of 36 moles of ethylene oxide with castor oil and wherein 10 percent of the carrier is utilized as based on the weight of the textile.

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