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Miller

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[54] **PROCESS FOR DYEING POLYESTER FIBER**

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[58] **Field of Search** ..... 8/179, 176, 21 C

[56] **References Cited**

UNITED STATES PATENTS

2,663,612	12/1953	Gibson	8/176 X
2,934,397	4/1960	Landerl	8/179 X
3,321,459	5/1967	Voltz et al.	8/179 X
3,519,377	7/1970	Kitamura et al.	8/176 X

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[57] **ABSTRACT**

A novel process for dyeing polyester fiber and polyester fiber articles comprising the steps of (1) forming an aqueous dye bath containing a small but effective amount up to 0.3 percent by weight, disperse dye, said dye bath being at a temperature between 25°C to 100°C; (2) immersing polyester fiber in the dye bath for a period of at least about 10 minutes; (3) rinsing the riber with water; (4) drying the fiber; and (5) exposing the dried fiber to dry heat at a temperature between 120°C to 230°C.

27 Claims, No Drawings

PROCESS FOR DYEING POLYESTER FIBER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a new process for dyeing polyester fibers such as polyethylene terephthalate.

2. The Prior Art

It is well known that the hydrophobic nature of polyester fibers ordinarily makes their dyeing a difficult practical problem. Heretofore, it has been noted that the disperse dyes which were originally developed for cellulose acetate have some affinity for polyester fibers, but that polyester fibers are much more resistant to dyeing with such dyes than is cellulose acetate. It has been generally assumed that under normal dyeing conditions almost no disperse dye is adsorbed by polyester fiber; see, for example, U.S. Pat. Nos. 2,647,104, 2,934,397, 3,022,131 and the Colour Index, 3rd Ed., published by the Society of Dyers and Colourists (England), pages 2479–81.

Heretofore, at least three recognized procedures have been employed for dyeing polyester fibers to obtain dark colors.

It is known, for example, that dark colorations may be obtained on polyester fibers if the dyeing baths are admixed with substances that exert a swelling action on the fibers. Such substances are generally referred to as "carriers." Typical carriers include chlorinated benzenes, di-phenyl, o-phenylphenol, methyl salicylate and benzoates. The so-called "carrier" process is not entirely satisfactory, however, since the addition of carriers renders the dyeing procedure more expensive and the colorings obtained by this method are commonly not as fast to light as desired. In addition, carriers often exhibit some degree of toxicity, often have strong odors, and can be difficult to remove from the fibers.

In a second procedure, the dyeing can be carried out at elevated temperatures above 100°C. If the dye bath employs an aqueous medium, high pressures are involved and elaborate equipment for containing such high pressures must be employed.

Probably the best known, and simplest process for dyeing polyester is known as the thermosol process or pad-thermofixation dyeing. This process comprises padding the fabric with an aqueous dispersion of a water insoluble dye, drying the padded fabric, and exposing the dried padded fabric to a high temperature. Upon drying, it was assumed that the dye particles were only deposited on the surface of the fabric, but at higher temperatures the dye penetrated the fabric and the dyeing process was thus completed. (See, U.S. Pat. Nos. 2,663,612 and 3,576,586, and Man Made Fibers, Vol. 3, edited by H. F. Mark et al, Interscience Publishers (1968), page 537). After the heat treatment, the fabric is generally soaped or washed to remove unadhered dye particles, and dried for subsequent use.

As used in the textile art, padding means physically applying to fabric a dye, for example, by passing the fabric through a dye path containing a high concentration of dye, generally, from about 2 to about 5 percent, by weight, of dye. On passage through the dye bath the fabric literally picks up a portion of the dye bath dye liquor. Often, the padding liquors are thickened with various materials, for example, sodium alginate to aid pick up. The fabric is then generally passed through

squeeze rolls to reduce the quantity of the padding liquor picked up by the fabric to a desired even level, for example, a liquor pick-up of 20 percent, by weight, of the fabric, or more, as for example 100 percent, by weight, of the fabric. Examples of padding liquors used in dyeing polyester fabric in the thermosol process are disclosed in U.S. Pat. No. 2,663,612, Example 1; U.S. Pat. No. 3,212,841, Column 2; and U.S. Pat. No. 3,321,459, Example 23.

The above mentioned thermosol process, therefore, essentially comprises depositing an amount of padding liquor on a fabric, drying the fabric to remove the aqueous portion of the padding liquor to obtain a surface deposition of dye particles on the polyester fabric and heat treating the fabric to fix the dye particles to the fabric.

Heretofore, polyester fiber could not be suitably dyed in the home because these known processes for dyeing polyester could not be employed with equipment ordinarily available in the home. Many articles are fashioned from polyester fiber, and blends of various fibers with polyester. For some time, therefore, there has existed a recognized need for a means for dyeing polyester fiber articles in the home.

SUMMARY OF THE INVENTION

It has now been surprisingly discovered that polyester fiber can be suitably dyed without the use of carriers in a process which requires no padding or high pressure equipment.

In summary, this novel process for dyeing polyester fiber comprises the steps of (1) forming an aqueous dye bath containing a small but effective amount up to 0.3 percent, by weight, disperse dye, said dye bath being at a temperature between 25°C to 100°C; (2) immersing polyester fiber in the dye bath for a period of at least about 10 minutes; (3) rinsing the fiber with water; (4) drying the fiber; and (5) exposing the dried fiber to dry heat at a temperature between 120°C to 230°C.

This novel process can be practiced with equipment ordinarily found in the home.

DETAILED DESCRIPTION OF THE INVENTION AND ITS PREFERRED EMBODIMENTS

It has been surprisingly found that polyester fibers can be dyed in a process comprising the steps of (1) forming an aqueous dye bath containing a small but effective amount up to 0.3 percent, by weight, disperse dye, said dye bath being at a temperature between 25°C to 100°C; (2) immersing polyester fiber in the dye bath for a period of at least about 10 minutes; (3) rinsing the fiber with water; (4) drying the fiber; and (5) exposing the dried fiber to dry heat at a temperature between 120°C to 230°C.

The present invention finds particular utility with filaments, staple fiber and fabrics prepared from polyester condensation polymers. The invention also finds particular use in dyeing such articles which are composed of sufficient polyester such that the dyeing characteristics of the articles are determined by the polyester. Thus, fiber blends of polyesters with other natural or man made fibers can be dyed according to the process of this invention. As used herein, fiber and fiber blends include articles fashioned from fiber and fiber blends, as for example, fabric and fashioned fabric such as sewn articles of clothing.

As used herein, the term polyester fiber means a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 85 percent, by weight, of an ester of dihydric alcohol and terephthalic acid. (This definition conforms to the generic definition of polyester fiber promulgated by the United States Federal Trade Commission under authority of the Textile Fiber Product Identification Act.) As used in this definition the dihydric alcohols ethylene glycol and 1,4 cyclohexane dimethanol are commercially important. Polyester fiber particularly suitable for use in the process of this invention is polyethylene terephthalate fiber.

The disperse dyes employed in the process of this invention are well known to those skilled in the art and are commercially available. Disperse dyes are water insoluble organic colors which are applied to fiber from near colloidal aqueous dispersion. As is well known, to prepare these water insoluble organic colors for use as textile dyes they must be suitably dispersed. This may be done by any of the several well-known methods: milling as in a ball-mill with dispersing agents such as lignin sulfonic acid materials, for instance. The resultant aqueous dispersion can be dried, as in a spray-dryer, or preserved and used as a paste. Standardization to any desired lower strength can be done with inert colorless diluents such as inorganic salts for powders, or water for pastes. Other materials such as preservatives, foam-control agents, and wetting agents are added as desired.

Dispersed pastes are made, for example, by wet milling the dye in conventional equipment in the presence of a dispersing agent, preferably sodium lignin sulfonate or sodium alkylnaphthalene sulfonate. Various other commercially available dispersing agents, such as sodium salts of carboxylated polyelectrolytes and the naphthalene sulfonates; e.g. the condensation products of sulfonated naphthalene and formaldehyde, such as sodium dinaphthylmethane disulfonate, are conveniently used. The disperse paste may be cut or standardized to a standard strength with water. The final color content of the finished paste averages from about 10 to 40 percent by weight color content.

Disperse powders are prepared, for example, by wet milling color in the presence of a dispersant, such as those mentioned hereabove, in equipment such as a ball mill, as for example, a Werner-Pfleiderer mill or attritor. The dispersed material is oven or spray dried and micropulverized if necessary to provide the dispersed powder. The color is cut or standardized to a standard strength in a blender with a diluent, such as sodium sulfate or dextrin. A wetting agent, such as, for example, sodium cetyl sulfate or an alkylphenoxy polyethanol may be added to aid in wetting out the product. Disperse powders are usually cut or standardized to from about 25 to 80 percent by weight color content (pure color).

The dye, when added to water with or without auxiliary agents, forms a near colloidal aqueous dispersion from which fiber or textile material is dyed.

Since disperse dyes contain a coloring component and varying useful amounts of a dispersing component, amounts of disperse dye mentioned herein will be on a 100 percent color basis, i.e., the amounts will refer to the coloring component — unless otherwise noted.

Disperse dyes include those dyes generally referred to as "acetate dyes"; see the Chemistry of Synthetic Dyes and Pigments, edited by H. A. Lubs (Rheinhold Publishing Corporation, 1955), pages 167–174. Especially suitable examples of known commercially available disperse dyes are disclosed in the Colour Index, Third Edition, Vol. 2, pages 2479–2741, published by the Society of Dyers and Colourists (England, 1971). Other examples of disperse dyes are disclosed in the following U.S. patents incorporated herein by reference: U.S. Pat. Nos. 2,757,064; 2,833,613; 3,934,397; 3,321,459 and 3,685,952.

An aqueous dye bath containing a small but effective amount up to 0.3 percent, by weight, disperse dye is useful in the process of this invention. For example, 0.0001 percent, by weight, disperse dye can be effective. An especially useful dye bath for use in the process of this invention contains from about 0.001 to 0.2 percent, by weight, disperse dye, and most preferably from about 0.001 to 0.1 percent, by weight, disperse dye. The most desirable amount of disperse dye to be employed, however, will depend upon the particular disperse dye employed and the particular coloration desired. The dye bath should be at a temperature of from about 25°C to about 100°C. While temperatures lower than 25°C can be employed, exhaustion of the disperse dye onto the fiber is impeded and is not desirable. Temperatures higher than about 100°C cannot be employed without the use of special pressurized equipment and therefore are undesirable. Especially preferred temperatures for the dye bath are between 50°C and 95°C, for example, a temperature between 50°C and 80°C.

The polyester fiber can be immersed in the dye bath in any suitable manner. Preferably, the polyester fiber is scoured and wetted prior to being immersed in the dye bath, and preferably the dye bath is agitated while the polyester fiber is immersed therein in order to insure a level dyeing.

The polyester fiber is immersed in the dye bath for a period of at least about 10 minutes in order to obtain coloration of the polyester fiber according to the process of this invention. Periods substantially shorter than 10 minutes will not provide optimum coloration. Immersing the polyester fiber in the dye bath for periods longer than 60 minutes can be satisfactory, but does not usually provide substantially enhanced coloration. A preferred period of immersion is from about 20 to 40 minutes, as for example, from about 25 to 35 minutes.

After the polyester fiber has been immersed in the dye bath for the required period of time, the fiber is then rinsed with water to remove dye bath liquor picked up by the fiber. Preferably the fiber is rinsed with tepid water, (20°C–40°C) and the rinsing is continued until the rinse water is free from color. Rinsing the fiber until the rinse water is substantially free from color is necessary in order to obtain fibers which are uniformly colored.

The immersion of the fiber in the dye bath in the process of this invention is clearly distinguished from the conventional padding operation in that (1) the dye bath liquor contains very low concentrations of dye, (2) any dye bath liquor physically picked up by the fiber is removed by rinsing such that squeeze rolls for adjusting the level of pick up are not required and (3) the fiber is rinsed to remove any dye bath liquor picked up by the fiber.

Generally after the rinsing operation the polyester fiber will exhibit either no color or a pale color which would generally be described by those skilled in the art as a tint, or a dull color.

The fiber is then dried, and exposed to dry heat. Surprisingly, on exposure to dry heat, color develops. In those fibers which exhibited no color after the fiber was rinsed color appears; in those fibers which exhibit a pale color after rinsing, the color becomes significantly deeper and more vibrant. Application of dry heat at a temperature between 120°C to 230°C, preferably for a period of from about 2 to 60 seconds will cause this surprising phenomenon. Exposing the polyester fiber to dry heat at a temperature from 176°C to 190°C for from 2 to 10 seconds has been found to be especially useful and convenient, and is preferred. The exposure to dry heat is preferably provided by contact with a smooth heated surface, for example, an ordinary home iron or a heated roller. Other suitable sources of dry heat can include ovens, and infra-red lamps. These sources of dry heat are less preferred than those mentioned above, and can lengthen the exposure time necessary to obtain good color.

It will be obvious to those skilled in the art that an advantage of process of this invention for dyeing polyester fiber is that it can be employed in commercial dyeing operations using conventional equipment.

It is a particularly noteworthy aspect of this invention, however, that the process of this invention allows satisfactory dyeing of articles composed of polyester fiber, for example, fabrics and garments, in the home. For example, a dye bath can be formed in any suitable vessel or a washing machine, using water at a temperature commonly available in the home, immersing the fabric for the required period of time, rinsing the fabric, drying the fabric in the conventional manner or employing a home clothes dryer and exposing the fabric to dry heat, for example, by ironing the article with a conventional electric home iron. Heretofore, no process for dyeing polyester fiber has been available which could be conveniently practiced in the home.

Yet another notable advantage of the process of this invention is that sewn articles fashioned from polyester fiber, for example, shirts, blouses and pants, can be dyed level employing the process of this invention. Such sewn articles could not be readily dyed to a level coloration employing prior art processes. Dyeing sewn articles fashioned from polyester fiber and polyester fiber blends according to this invention, therefore, represents a preferred embodiment of the invention disclosed herein.

As mentioned hereinbefore, a notable aspect of this invention for dyeing polyester is that the process can be suitably carried out using equipment commonly available in the home. Home dyeing of course, is not new. For many years, packaged dyes for use in the home have been made, sold and successfully used for coloring fabrics in the home. Since packaged dyes for home use are generally employed by laymen having little familiarity with the textile arts, such packaged dyes are often formulated to be "all purpose." More particularly, it is well known that certain dye classes are particularly suitable for dyeing certain specific fibers. Since the typical lay user cannot readily distinguish various fiber types, these all purpose packaged dyes have generally been formulated with several dye class types such that the resulting mixture is suitable for dyeing the commonly encountered fibers. Such packaged dyes have been especially successful in coloring natural fibers such as cotton and wool and processed fibers such as rayon and acetate. However, with the increasing use of polyester fibers which are hydrophobic densely packed fibers resistant to wetting with water and dye penetration, the presently available packaged dyes are less satisfactory because they do not produce a full color on these fibers with the result that either no color is obtained, or less than a full color, usually called a tint, is obtained. Such packaged dyes have been less than satisfactory not only on polyester fibers, but also with blends of polyester fibers with synthetic fibers, for example, polyester/rayon, polyester/nylon and polyester/rayon/nylon blends. In addition such packaged dyes have been less than satisfactory on blends of polyester with natural fiber, for example, polyester/cotton and polyester/wool wherein the polyester fiber content significantly influences the dyeing characteristics of the blend.

An important aspect of this invention is that it is now possible to provide all purpose packaged dyes which can be used in the home to successfully color substantially all of the commonly encountered fibers, fiber blends and articles fashioned from fibers and fiber blends now existing. More particularly, it will be possible for a layman to successfully color substantially any fabric or garment in the home, including those fashioned from polyester and blends thereof.

Suitable all purpose packaged dyes will include a disperse dye, such as employed in this invention, and in addition thereto one or more of the following dyes which are known to those skilled in the art to color one or more commonly encountered fiber types: acid dyes, basic dyes, direct dyes and pigments.

As is well known to those skilled in the art, certain adjuvants are commonly incorporated into dye baths and into packaged dye formulations to improve the results. Such adjuvants can of course be employed herein.

Examples of such adjuvants are as follows. Surfactants, particularly non-ionic surfactants, which can increase the compatability of the various ingredients in the dye bath. Useful non-ionic surfactants can include polyoxyethylene (4–10) nonyl phenol, polyoxyethylene (6–11) di-nonyl phenol and polyoxyethylene (6–10) dodecylphenol. One or a combination of inorganic salts, for example sodium chloride and/or sodium sulfate can be used to control the rate of color exhaustion from the dilute color solution in the dye bath to provide a more even color to the article being dyed. Such salts are commonly used in the art for this purpose. Aluminum and calcium salts with chloride or sulfate anion portions can also be effectively used for this purpose, though not commonly employed in the art. One or more anionic surfactants can be employed to produce better colloidal dispersion of disperse dyes in aqueous medium. Anionic surfactants with a low degree of sulfonation in relation to the total molecule are preferred, as for example, sodium lignin sulfonate. The pH of the dye bath can be advantageously adjusted to a pH range of 5.0 to 10.0. A suitable acid pH can be obtained by the addition of an acid, for example, citric acid; a suitable alkaline pH can be obtained, for example, by the addition of a nitrogen containing alkali such as ammonium hydroxide or morpholine. Perfume can be in-

cluded to make the dye product more pleasant to use.

Suitable dye compositions for use in this invention can include known dyeing adjuvants and can be compounded in a variety of physical forms, for example, such compositions can be provided as liquids, powders, pellets, spray dried granules, cakes and tablets. When formulated as a liquid, the dye composition will preferably include a small amount of a suspension aid, as for example, carboxymethyl cellulose.

The following examples present several specific preferred embodiments of the invention disclosed herein.

EXAMPLE I

DYEING POLYESTER FABRIC TO A PINK ROSE COLOR

A dye bath was formed by adding 1⅛ avoir. oz. (0.14 part by weight) of a dry dye composition designated as "Rose" to 16 gallons of water (267 parts by weight). The dye bath was maintained at a temperature of 60°C. Two pieces of 45 × 63½ inch Dacron polyester fabric (poly-condensate of terephthalate acid with ethylene glycol) weighing one pound (2 parts by weight) were laundered in an aqueous medium, rinsed, and added wet to the dye bath.

The dye bath was constantly agitated mechanically for 30 minutes. The fabric pieces were then removed from the dye bath and rinsed under a stream of tepid water until the stream of rinse water was free of color. The rinsed fabric pieces were then dried in an automatic dryer. The dried fabric pieces exhibited a dull rose tint. A surface of each of the dried fabric pieces was exposed to dry heat for a period of 10 seconds by ironing the fabric with an electric iron having an ironing surface temperature of 190°C. When the ironing was completed, each of the Dacron polyester fabric pieces surprisingly exhibited a distinctly deep and vibrant coloration which could be characterized as a pink rose color. The fabric was dyed to a bright, level pink rose shade which has excellent fastness to light and washing.

The dye composition designated as "Rose" comprised

	% by Weight
C.I. Disperse Red 4 (40% color content, 60% dispersant content)	1.33
C.I. Disperse Red 15 (39% color content, 61% dispersant content)	0.33
Sodium Chloride	98.34
	100.00

EXAMPLE II

DYEING POLYESTER FABRIC TO AN AQUA COLOR

A dye bath was formed by adding 4 fluid oz. (6.17 parts by weight) of a liquid dye composition designated as "Aqua" to 3 gallons (500 parts by weight) water. The dye bath was maintained at a temperature of 70°C. Two pieces of 45 × 63½ inch fabric composed of Dacron polyester fiber (poly-condensate of terephthalate acid with ethylene glycol) weighing one pound (20 parts by weight) were laundered in an aqueous medium, rinsed, and added wet to the dye bath. The dye bath was constantly agitated mechanically for 45 minutes. The fiber articles were then removed from the dye bath and rinsed under a stream of tepid water until the stream of rinse water was free of color. The rinsed fabric pieces were then suspended and allowed to dry at ambient conditions in a laboratory work room. The dried fabric pieces exhibited a dull, light aqua tint. A surface of each of the dried fabric pieces was exposed to dry heat for a period of 50 seconds by ironing one fabric with an electric iron having an ironing surface temperature of 180°C. When the ironing was completed, each of the Dacron polyester articles surprisingly exhibited a distinctly deep and vibrant coloration which could be characterized as an aqua color. The fabric was dyed to a bright, level aqua shade which has excellent fastness to light and washing.

The dye composition designated as "Aqua" comprised

	% by Weight
C.I. Disperse Blue 3 (40% color content; 60% dispersant content)	2.25
C.I. Disperse Yellow 3 (44% color content; 56% dispersant content)	0.25
Carboxy Methyl Cellulose	1.50
Sodium Chloride	19.00
Water	77.00
	100.00

EXAMPLE III

DYEING A POLYESTER-COTTON BLEND TO A PINK ROSE COLOR

When in Example I, a fabric comprising an 80:20 blend of Dacron polyester and cotton is employed instead of the fabric comprised of Dacron polyester, the same or similar results are obtained in that the fabric was dyed to a desirable pink rose coloration.

EXAMPLES IV – VIII

DYEING POLYESTER TO VARIOUS COLORS

When in Example I, the following preferred "all purpose" dye compositions are employed instead of the "Rose" dye composition, the same or similar results are obtained in that the fabric is dyed to a desirable coloration as indicated.

Example IV (Blue)	% by Weight
C. I. Acid Blue 113	0.07
C. I. Direct Blue 14	0.93
C. I. Disperse Blue 3	5.00
Sodium Chloride	94.00
	100.00
Example V (Yellow)	
C. I. Direct Yellow 44	1.20
C. I. Direct Orange 6	0.11
C. I. Disperse Yellow 3	3.33
C. I. Disperse Orange 58	0.14
Sodium Sulfate	95.22
	100.00
Example VI (Green)	
C. I. Direct Green 1	0.33
C. I. Direct Yellow 44	0.53

-Continued

Example IV (Blue)	% by Weight
C. I. Disperse Blue 3	2.80
C. I. Disperse Yellow 3	1.20
Sodium Sulfate	95.14
	100.00

Example VII (Pink)	
C. I. Acid Red 88	0.013
C. I. Direct Red 81	0.013
C. I. Direct Red 23	0.033
C. I. Disperse Red 4	0.466
Sodium Chloride	99.475
	100.000

Example VIII (Black)	
C. I. Direct Black 38	16.40
C. I. Disperse Red 17	0.80
C. I. Disperse Red 5	0.56
C. I. Disperse Orange 58	0.96
C. I. Disperse Yellow 23	0.80
C. I. Disperse Blue 3	28.00
Sodium Chloride	52.48
	100.00

Each of the disperse dyes employed in Examples IV – VIII consists of 40 percent color content and 60 percent dispersant content. Similar disperse dyes containing different color and dispersant content can provide similar results if the level of usage is adjusted proportionately.

EXAMPLES IX – X

When in Example II the following "all purpose" liquid dye compositions are employed instead of the "Aqua" dye composition, the same or similar results are obtained in that the fabric is dyed a desirable coloration as indicated.

Example IX (Golden Yellow)	
C. I. Direct Yellow 44	0.83
C. I. Direct Orange 6	0.08
C. I. Disperse Yellow 3	1.25
C. I. Disperse Orange 58	0.13
Carboxy Methyl Cellulose	0.70
Water	97.01
	100.00

Example X (Green)	% by Weight
C. I. Direct Green 1	0.10
C. I. Direct Yellow 44	0.16
C. I. Disperse Blue 3	0.87
C. I. Disperse Yellow 3	0.37
Carboxy Methyl Cellulose	0.77
Morpholine	0.10
Sodium Chloride	21.30
Water	76.33
	100.00

Each of the disperse dyes employed in Examples IX and X consists of 40 percent color content and 60 percent dispersant content.

EXAMPLE XI

When in Example III a dye composition disclosed in any of Examples IV – VII is employed instead of the "Rose" dye composition, excellent results are obtained in that the fabric is dyed a desirable coloration as indicated for the particular dye composition.

Clearly, in any of the above examples, an ordinary home washing machine can be employed to provida a vessel to form a dye bath for immersing the fabric, agitating the immersed fabric, and rinsing the fabric.

Each of the all purpose dye compositions disclosed in the above Examples can successfully color in addition to polyester fiber and polyester fiber blends, cotton, wool, rayon, acetate and nylon and blends thereof.

Each of the dyes employed in the above Examples is disclosed in the Colour Index, Third Edition (1971), Edited by the Colour Index Editorial Board, published by the Society of Dyers and Colourists (England).

Percents and parts herein are on a weight basis unless otherwise specified.

What is claimed is:

1. A process for dyeing polyester fiber comprising the steps of (1) forming an aqueous dye bath consisting essentially of a small but effective amount up to 0.3 percent, by weight, disperse dye, said dye bath being at a temperature between 25°C to 100°C at atmospheric pressure; (2) immersing polyester fiber in the dye bath for a period of at least about 10 minutes; (3) rinsing the fiber with water; (4) drying the fiber; and (5) exposing the dried fiber to dry heat at a temperature between 120°C to 230°C.

2. The process of claim **1** wherein the aqueous dye bath contains from about 0.0001 to 0.3 percent, by weight, disperse dye.

3. The process of claim **2** wherein the aqueous dye bath contains from about 0.001 to 0.2 percent, by weight, disperse dye.

4. The process of claim **1** wherein the dye bath temperature is from about 50°C to 80°C.

5. The process of claim **2** wherein the dry heat is at a temperature between 176°C to 190°C.

6. The process of claim **1** wherein the exposure to dry heat is from about 2 to 60 seconds.

7. The process of claim **1** wherein the fiber is immersed for a period of from about 10 minutes to 60 minutes.

8. The process of claim **7** wherein the fiber is wetted prior to immersion.

9. The process of claim **7** wherein the immersed fiber is agitated.

10. The process of claim **1** wherein the fiber is rinsed with water until the rinse water is free from color.

11. The process of claim **7** wherein the fiber is immersed in the dye bath for a period of about 20 to 40 minutes.

12. The process of claim **1** wherein the polyester is polyethylene terphthalate.

13. The process of claim **1** wherein the polyester fiber is a blend of polyester and natural fiber.

14. The process of claim **13** wherein the natural fiber is cotton.

15. A process for dyeing polyester fabric comprising the steps of (1) forming an aqueous dye bath consisting essentially of from about 0.0001 to 0.3 percent, by weight, disperse dye, said dye bath being at a temperature between 25°C to 100°C at atmospheric pressure; (2) immersing polyester fabric in the dye bath for a period of from about 10 minutes to 60 minutes; (3) rinsing the fabric with water; (4) drying the fabric; and (5) exposing the dried fabric to dry heat at a temperature between 120°C to 230°C for from about 2 to 60 seconds.

16. The process of claim **15** wherein the aqueous dye bath contains from about 0.001 to 0.2 percent, by weight, disperse dye.

17. The process of claim 15 wherein the dye bath temperature is from about 50°C to 95°C.

18. The process of claim 15 wherein the dry heat is at a temperature between 176°C to 190°C.

19. The process of claim 18 wherein the exposure to dry heat is from about 2 to 10 seconds.

20. The process of claim 18 wherein the fabric is wetted prior to immersion.

21. The process of claim 20 wherein the immersed fabric is agitated.

22. The process of claim 15 wherein the fabric is rinsed with water until the rinse water is free from color.

23. The process of claim 22 wherein the fabric is immersed in the dye bath for a period of about 20 to 40 minutes.

24. The process of claim 15 wherein the polyester is polyethylene terepththalate.

25. The process of claim 15 wherein the polyester fabric is a blend of polyester and natural fiber.

26. The process of claim 25 wherein the natural fiber is cotton.

27. The process of claim 15 wherein the polyester fabric is a sewn article.

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