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[54] ONE PASS CONTINUOUS DYEING OF POLYESTER/CELLULOSIC FIBERS A PLURALITY OF COLORS

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

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[57] **ABSTRACT**

The process for dyeing polyester/cellulosic textiles which comprises applying to the textile a basic dyestuff and a disperse dyestuff, subjecting the resulting textile to steam under pressure, applying a dyestuff for the cellulosic component before or after said steam treatment and washing the dyed textile. Also, the resulting dyed textile.

6 Claims, No Drawings

ONE PASS CONTINUOUS DYEING OF POLYESTER/CELLULOSIC FIBERS A PLURALITY OF COLORS

This invention relates to a process for dyeing polyester/cellulosic textiles and more particularly relates to a one-pass continuous process which provides novel two- and three-color effects with such textiles.

Heretofore two- and three-color effects have been achieved with polyester/cellulosic textiles by batch dyeing. Although the conventional thermosol process which employs dry heat achieves excellent disperse color utilization through high color transfer from the cellulosic component to the polyester fibers, basic dyestuffs do not transfer in the same way. This results in a low degree of basic dye utilization, and as a consequence, undesirable dull stains on the other fiber components. In addition, dye fastness deficiencies result.

The present invention provides a novel process for dyeing polyester/cellulosic textiles with advantages and benefits over known dyeing processes. Furthermore, the present invention provides a one-pass continuous process for the dyeing of such fiber blends. Moreover, the process of the invention permits the dyeing of such blends in a one-pass continuous dyeing process resulting in a high degree of color utilization. The color fixation of the basic dyeable fiber component may be as high as 75 percent for deep black and up to 98 percent in pastel shades with the other components being practically white after proper cleaning.

The process for dyeing polyester/cellulosic textiles of the present invention comprises applying to the textile a basic dyestuff and a disperse dyestuff, subjecting the resulting textile to steam under pressure, and washing the resulting dyed fabric. A dyestuff for the cellulosic fiber component may be applied to the fabric simultaneously with the other dyestuffs or afterward by known conventional methods. The textile to be dyed may be in any convenient form such as fibers, yarns and woven, knitted or nonwoven fabrics.

As stated above, the process of the invention provides a one-pass continuous process for dyeing polyester/cellulosic textiles. The polyester component advantageously includes a dimethyl terephthalate polymer which is dyeable with a disperse dye such as Dacron T-54. Preferably, the blend also includes a modified polyester component which can be dyed with disperse dyes to approximately the same depth and in addition is receptive to a different dyestuff class, e.g., a basic dye. For example, the second polyester component may be a dimethyl terephthalate copolymer such as Dacron T-64. Due to this phenomenon, contrast shades can be developed on the two different polyester fibers, with the modified polyester being dyed darker. This occurs because of the additive effect of the disperse dye and basic dye fixation on the modified polyester. The cellulosic fiber component may be a known fiber such as cotton, viscose rayon, etc., and can be dyed to any desired shade.

The disperse dyestuff employed is any of the well-known commercial disperse dyes used for thermosol dyeing of dimethyl terephthalate polymer fibers. Examples of suitable dyestuffs include Resolin Brilliant Yellow C-6GL (CI Disperse Yellow 77), Esterophile Light Orange 3RLL (CI Disperse Orange 46), Eastman Polyester Brilliant Rubine RLSW (CI Disperse Violet 42), Foron Blue BGL (CI Disperse Blue 73), etc. Basic dyes suitable for the dyeing of the modified polyester fiber component include Astrazon Yellow 7GLL (CI Basic Yellow 71), Maxilon Red GRL (CI Basic Red 46), Maxilon Blue BRL (CI-none), Sevron Brilliant Red 4G (CI Basic Red 14), etc. Preferably, the basic dye is a modified basic dye which is a non-ionic complex to give compatibility with anionic and cationic materials. The dye for the cellulosic fiber component may be a vat, sulfur, fiber reactive, direct, naphthol or similar dye. The use of fiber reactive dyes permits the application of the dye simultaneously with the disperse and basic dyes and the fixation thereof to the cellulosic fibers during the pressure steaming operation. This would involve the use of an alkaline pH bath and the use of disperse and basic dyes which are compatible under such alkaline conditions.

Advantageously the disperse and basic dyestuffs are applied to the textile from a single dye pad bath. If the conventional cationic basic dye is employed, an antiprecipitant is included in the dye bath to prevent the precipitation of the basic dye with any anionic chemical in the bath. Suitable antiprecipitants include the formaldehyde condensate of naphthalene sulfonic acid, e.g., a product sold as "Avolan IS," and similar material. Also, a dimethyl phthalate compound sold under the tradename "Chemocarrier KD5W" may be added to further stabilize the pad bath. This latter additive is believed to increase the color yield, to improve pad bath stability and to maintain the disperse dyeable polyester and cellulosic fibers substantially free of any basic dye stain. The proportions of the dyestuffs may vary considerably and will depend upon the desired shades and the proportions of the respective fibers in the textile being dyed.

Preferably, the temperature of the dye bath is maintained between about room temperature and 140°F. Generally, the bath has an acid pH and preferably between about 5.3 and 6.0, although when fiber reactive dyes are employed, an alkaline pH is used as mentioned above. The exposure time of the textile in the dye pad bath may vary over a wide range and generally is between about ¼ and 1 second. The wet pickup of the dye bath on the textile usually is between about 45 percent and 65 percent by weight.

After the dye liquid has been padded onto the textile, it is subjected to a pressurized steam treatment, advantageously for a period between about 1 and 3 minutes and particularly between 1 ½ and 2 minutes. The steam employed is at a pressure above atmospheric pressure and preferably between 15 and 50 psig.

Subsequent to the steam treatment and the application of the selected cellulosic fiber dyes, the fabric may be rinsed, oxidized, washed, soaped and dried in the usual manner as required in continuous dyeing to fix and/or remove any dyestuff which has not been fixed previously. The textile may be subjected to one or more after-treatments prior to the above steps depending upon the multicolor effect desired. For example, the textile may be subjected to a second pad bath including a reducing agent such as sodium hydrosulfite in a caustic solution for vat dyes and sodium sulfide for sulfur dyes. If desired, this second bath treatment also may include a dyestuff for the cellulosic component such as a direct or naphthol dyestuff.

If a second pad bath is used, the textile thereafter is subjected to a steam treatment. This steam treatment further enhances the color values of the dyestuff employed for the cellulosic fibers. The temperature and time conditions of the steam treatment generally will be with steam at about 212°–215°F. for about ½ to 1 minute.

The process of the present invention is useful for continuously dyeing textiles to provide two colors or more. The essential features of the process are that a dye bath including a combination of a disperse dyestuff and a basic dyestuff is employed followed by a pressurized steam treatment to provide a high degree of fixation of the dyestuffs at this stage. The dye bath also may include a dyestuff for the cellulosic component of the blend, although the latter dyestuff may be applied to the textile at a subsequent stage of the process.

The process of the invention is particularly useful in the continuous dyeing of textiles including a blend of two different types of polyester fibers with a cellulosic fiber. With such textiles, it is possible to produce vivid three color effects with each fiber being dyed a different color. In cases where differential abrasion is a problem, it may be desirable to provide a two color effect in which the cellulosic component is dyed to a similar shade as one of the polyester components. In conventional polyester/cellulosic blends, the polyester may be dyed one shade while the cellulosic component is dyed a different shade. Since the resin treated cellulosic component tends to have low abrasion resistance, the wearing away of the cellulosic component causes a noticeable change in the appearance of the garment with the result that it is prematurely discarded even though the polyester component would provide an extended wear life. In contrast, with the process of the present invention utilizing a three fiber blend of two different polyester fibers and a cellulosic fiber the cellulosic fiber can be dyed the same shade as one of the polyester fibers or the cellulosic fiber can be dyed a shade between the two polyester fibers. The wearing away of the cellulosic fiber will not produce any significant change in the appearance of the garment and, thus, the life of the garment is significantly extended.

The invention will be described in greater detail with reference to the following examples which are intended to illustrate the invention without restricting the scope thereof.

EXAMPLE I

Twenty parts of Sevron Brilliant Red 4G (CI Basic Red 14) are dissolved in hot water and sufficient acetic acid added to adjust the pH to about 6. The resulting solution is added to a hot aqueous solution of 60 parts of Avolan IS, diluted with 180 parts of water. To the resulting solution are added 20 parts of Resolin Brilliant Yellow C–6GL (CI Disperse Yellow 77) and 20 parts of Cibanone Blue GF (CI Vat Blue 6) double paste each of which has been diluted with 80 parts of warm water. Thirty parts of glauber salt calcinated are added to protect the basic dyeable polyester (Type 64 Dacron). Thereafter the solution is diluted further to a total volume of 1,000 cc of pad bath.

A fabric formed from a blend of 32 ½ percent Type 54 Dacron, 32 ½ percent Type 64 Dacron (both polyester fibers sold by Dupont) and 35 percent cotton fibers is passed through the above pad bath maintained at a temperature of about 120°F. The wet pickup is approximately 50 percent. The resulting fabric then is passed into a steam chamber containing steam at about 5 psig and about 260°F. for a period of about 90 seconds. Thereafter, the steamed fabric is dried and passed through a second pad bath containing 40 parts of sodium hydrosulfite and 40 parts of caustic soda flakes per 1,000 parts of water. The bath is maintained at a temperature of about 90°F.

The fabric removed from the bath having a wet pickup of 70 percent is passed through a second steam chamber containing steam at 215°F. for a period of 45 seconds. The resulting fabric is sequentially rinsed with cold water, oxidized with hydrogen peroxide, acetic acid, rinsed again with hot water, soaped, rinsed and dried. The resulting fabric has a three color effect with the Type 54 Dacron being dyed a yellow color, the Type 64 Dacron being dyed a bright red and the cotton fibers blue. The colors of the respective fibers are clear and free of smearing.

EXAMPLE II

The procedure of this example is the same as that of Example I except the Type 64 Dacron is dyed to a black with Astrazon Yellow 7GLL (CI Basic Yellow 71), Sevron Brilliant Red 4G (CI Basic Red) and Maxilon Blue BRL while the cotton is dyed to a similar black shade with Indanthrene Direct Black RB (CI Vat Black 9).

EXAMPLE III

The procedure of this example is the same as that of Example I except that the cotton component of the fabric is dyed by adding 60 parts of Sodyesul Liquid Black 4GCF (CI Sulfur Black 1) to the second pad bath and eliminating the Cibanone Blue GF (CI Vat Blue 6) from the first pad bath. The resulting fabric has a three color effect with the cotton component being dyed black rather than blue as in the fabric of Example I.

EXAMPLE IV

Twenty parts of Resolin Brilliant Yellow C–6GL (CI Disperse Yellow 77) and 20 parts of Astrazon Brilliant Red 4G (CI Basic Red 14) paste are separately diluted with 80 parts lukewarm water and then added to 300 parts of water. Thirty parts of Remazol Brilliant Blue R (CI Reactive Blue 19) are dissolved with hot water and added to the above solution which is maintained at a temperature of 80°F. Thereafter 15 parts of soda ash and 30 parts of glauber salt calcinated dissolved in cold water are added. The resulting pad bath is applied to three fiber blend fabric of Example I. Color fixation on all three fibers is generated simultaneously by passing the dyed fabric into a chamber containing steam at about 40 psig for about 90 seconds. The fabric then is rinsed with hot water, soaped, rinsed again and dried. A three-color effect similar to that of Example I is achieved. Since a fiber reactive dye for the cotton fibers and a modified basic dye are employed, no antiprecipitant is required in the pad bath.

EXAMPLE V – X

The procedure of these examples is the same as that of Example II except that the disperse dyestuff Resolin Brilliant Yellow C–6GL is successfully replaced with the following.

Example V

Forty parts of Esterophile Light Orange 3RLL (CI-Disperse Orange 46) paste

Example VI

Forty parts of Esterophile Light Red RBL (CI-Disperse Red 44) paste

Example VII

Forty parts of Eastman Polyester Brilliant Rubine R-LSW (CI Disperse Violet 42)

Example VIII

Twenty parts of Foron Blue BGL (CI Disperse Blue 73)

Example IX

Twenty parts of Foron Navy Blue 2GL (CI Disperse Blue 79)

Example X

Forty parts of Latyl Brilliant Blue BG (CI Disperse Blue 60) paste

The above description and examples show that the present invention provides a novel process for continuously dyeing polyester/cellulosic textiles in a one-pass process. Furthermore, the process of the invention permits the one-pass continuous dyeing of such blends with a high degree of color utilization.

It will be apparent that various modifications and variations in the above described procedures and materials can be made within the scope of the invention. Therefore, the scope of the invention is intended to be limited only by the following claims.

That which is claimed is:

1. A process for dyeing a polyester/cellulosic blend textile a plurality of colors in a one pass continuous process which comprises applying to the textile a mixture of a basic dyestuff and a disperse dyestuff of a different shade at a temperature between about room temperature and 140°F for between about ¼ and 1 second to provide a wet pickup between about 45 percent and 65 percent by weight, and immediately thereafter subjecting the resulting textile to steam at a pressure between about 15 and 50 psi gauge pressure for a period between about 1 and 3 minutes, applying a dyestuff for the cellulosic component before or after said steam treatment and washing the resulting dyed textile; said textile including two types of polyester fibers, one of which is a dimethyl terephthalate copolymer receptive to both disperse and basic dyestuffs and the other of which is a dimethyl terephthalate polymer receptive to disperse dyestuffs only.

2. The process of claim 1 wherein the dyestuff for the cellulosic component is a fiber reactive dyestuff which is applied to the textile simultaneously with the other dyestuffs.

3. The process of claim 1 wherein the cellulosic component is dyed to substantially the same shade as one type of polyester fiber.

4. A polyester/cellulosic textile dyed according to the process of claim 1.

5. A polyester/cellulosic textile dyed according to the method of claim 3.

6. A polyester/cellulosic textile dyed according to the method of claim 2.

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