

[54] **TEXTILE TREATMENT PROCESS**

[75] Inventors: Clifford Marshall, Davenham;
Stanislaw Kalinowski, Manchester,
both of England

[73] Assignee: Imperial Chemical Industries Limited,
London, England

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[56]

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Primary Examiner—Mayer Weinblatt

Attorney—Cushman, Darby & Cushman

[57]

ABSTRACT

A process for the treatment of textile materials which comprises applying to the textile material an emulsion or suspension of one or more bleaching agents in a hydrocarbon or halogenated hydrocarbon solvent, substantially removing the solvent from the textile material, and subsequently washing the textile material, and an emulsion or suspension of a bleaching agent for use therein.

11 Claims, No Drawings

TEXTILE TREATMENT PROCESS

This invention relates to a textile treatment process and particularly to a process for the treatment of textile materials to at least partially bleach them.

It is usual practice in the Textile Industry to treat textile materials with chemicals to bleach them. Chemicals known for this purpose include hydrogen peroxide, sodium chlorite and peracetic acid and these are commonly employed in the form of aqueous solutions. Usually the textile material, for example loomstate woven fabric, is treated prior to the bleaching operation to remove grease, fats and waxes by scouring, and also in many cases to remove sizing agents. Scouring and desizing are often carried out as separate operations so that a typical treatment of loomstate fabric is to scour them, then desize them and finally bleach them in separate operations.

Hitherto the majority of scouring processes, desizing processes and bleaching processes have employed aqueous solutions of suitable chemicals, although in recent times scouring processes employing organic solvents, notably trichloroethylene, have become increasingly popular. The major disadvantage of these aqueous preparation processes has been that each operation is lengthy so that a preparation process comprising scour, desize and finally bleach requires a period of several hours, say 6 hours in order to achieve a full white finish. A further disadvantage is that the textile material must be thoroughly washed between each treatment. Even when desizing and bleaching are combined in a single operation a period of, say, 4 hours or more is required; by employing solvent-scouring instead of aqueous alkali scouring this period can be considerably reduced but is still of the order of, say, 2 hours.

The conventional aqueous bleaching processes require a long period of time and comprise impregnating the textile material with the aqueous solution of the bleaching agent, steaming the impregnated material for the desired period of time, and then washing the material. In more recent developments, the impregnated material is passed continuously through steam under pressure and this enables the time required before washing to be reduced considerably. Even with this high pressure bleaching, however, the textile material is scoured and usually also desized in previous operations so that the overall time from loomstate to a full white finish is often still several hours.

We have now devised a process wherein bleaching is carried out very rapidly, for example in about 60 to 120 seconds (including washing), and which moreover, because concurrent dewaxing, desizing and bleaching may be effected, can be employed for treating loomstate, singed or heat-set materials to render them suitable directly for many finishing operations. Additionally, the apparatus required for carrying out the process is compact compared with that required for the three-stage aqueous preparation processes employed hitherto.

According to the present invention we provide a process for the treatment of textile materials which comprises applying to the textile material an emulsion or suspension of a bleaching agent in a hydrocarbon or halogenated hydrocarbon solvent, causing the solvent substantially to be removed from the textile material, and subsequently washing the textile material. It is to

be understood that the subsequent washing step, while essential, need not follow directly the step of removing the solvent, and also that removal of the solvent need not follow directly the step of applying the emulsion. Thus for example a further bleaching step may be incorporated between the steps of solvent removal and washing off, and a further application step, for example for applying alkaline solution to adjust the pH of the emulsion, may be incorporated between the steps of applying the emulsion and removing the solvent.

The emulsion or suspension will normally contain an emulsifying agent and advantageously this may also be a surface active agent to facilitate washing of the textile material subsequent to removal of the solvent. In the case where the emulsifying agent is not itself a surface active (or wetting) agent, then a surface active agent will usually be incorporated in addition to the emulsifying agent.

Textile materials made of either natural or synthetic fibers are in general readily wetted by hydrocarbon and halogenated hydrocarbon solvents and consequently application of the treatment agent is a rapid and simple matter. For example the emulsion or suspension of the bleaching agent can be applied by immersion of the fabric therein, or by spraying, padding or licking. The temperature of the emulsion or suspension during application to the textile material conveniently may be room temperature so that solvent losses during the application are minimized.

Impregnation of the textile material with the emulsion or suspension of the bleaching agent will usually be under conditions such that any wax content (fats, oils, waxes and other dirt) of the fibers remains in association with the impregnated material and does not produce serious contamination of the impregnating bath. If the emulsion or suspension is applied by immersing the textile material therein, the immersion time is advantageously very low.

If it is desired to incorporate the process in a conventional solvent scouring process then the emulsion or suspension of the bleaching agent can be applied to the wet textile material as it leaves the solvent scouring vessel.

After impregnating the textile material with the emulsion or suspension of the bleaching agent, the hydrocarbon or halogenated hydrocarbon solvent is removed. Any method of removing the solvent can be used, for example air-drying, especially using hot air, but we prefer that the removal be rapid, for example by causing rapid vaporization (or flash-off) of the solvent. The resulting solvent vapors may be condensed to recover the solvent for re-use. We especially prefer to pass the impregnated material directly into steam in known manner to flash-off the solvent. Advantageously the steam is caused to flow essentially counter to the direction of movement of the textile material.

The time for which the textile material is maintained in contact with steam or hot air should be sufficient to remove substantially the whole of the solvent from the material and also to promote the chemical reaction involved in bleaching the material. In general times of 20 seconds to 120 seconds are sufficient for these purposes although if desired shorter or longer periods, for example 10 seconds to several minutes, may be sufficient in some cases. After removal of the solvent and

bleaching, the textile material can be immediately washed, for example with an alkaline aqueous solution. However it is not essentially that the textile material be washed immediately after steaming, and if desired a further treatment, for example a further bleach using aqueous sodium chlorite solution, may be effected between the steps of steaming and washing.

Any bleaching agent may be employed which is stable at least while in the emulsion or suspension and which is chemically substantially inert towards the hydrocarbon or halogenated hydrocarbon solvent and any emulsifying/surface active agent present. Examples of suitable bleaching agents are peroxides, sodium chlorite, sodium hypochlorite and peracetic acid. Each of these is preferably employed in the form of its aqueous solution emulsified in the solvent. We prefer to employ aqueous solutions of hydrogen peroxide, a typical solution being a 35 percent solution which is the usual commercially available solution.

As stated hereinbefore the emulsion or suspension will usually contain an emulsifying agent which advantageously is also a surface active agent (or wetting agent) or alternatively both an emulsifying agent and a surface active agent will usually be present. Anionic, cationic or non-ionic surface active agents may be employed as mixtures thereof, and examples of suitable compounds are condensates of alkyl phenols for example nonyl phenol with ethylene oxide; salts of alkyl aryl sulphonic acids for example amine salts of dodecyl benzene sulphonic acid, coconut oil diethanolamide, salts of the monosulphonic acid derivative of a diester of a succinic acid, for example sodium di(methyl amyl) sulphosuccinate, and fatty alkyl sulphates. Also suitable are agents which increase the viscosity of the solvent, for example polyvinyl alcohol.

Any hydrocarbon or halogenated hydrocarbon (particularly halogenated aliphatic hydrocarbon) may be employed for example white spirit, trichloroethylene, perchloroethylene, 1,1,2-trichloro-1,2,2-trifluoroethane and 1,1,1-trichloroethane. Mixtures of solvents may be employed, if desired.

The emulsions and suspensions used in the process are novel compositions and therefore as a further feature of the present invention we provide an emulsion or suspension comprising a hydrocarbon or halogenated hydrocarbon solvent, an emulsifying agent and a bleaching agent. Normally the bleaching agent will be present in the form of its aqueous solution.

The concentration of the bleaching agent in the emulsion or suspension may vary within wide limits but will usually be at least 0.5 percent by weight based on the total weight of the emulsion or suspension and may be conveniently the same as is used in conventional aqueous processes. For most practical bleaching operations there is no advantage in employing a concentration of greater than 10 percent by weight of the emulsion or suspension although higher concentrations may be employed, if desired. In general the larger the concentration of the bleaching agent, which will usually be in the form of its aqueous solution, the greater will be the amount of emulsifying agent required to form the emulsion. We have found that increasing the concentration of the emulsifying agent results in a thickening of the emulsion and we prefer to employ a thin emulsion.

The bleaching agent is usually in the form of its aqueous solution, for example 35 percent aqueous hydrogen peroxide and the amount of the solution employed is selected so as to produce the desired concentration of the bleaching agent in the emulsion. Thus, for example, the concentration of 35 percent aqueous hydrogen peroxide is preferably from 1.5 to 10 percent by weight of the emulsion so that the concentration of the hydrogen peroxide is from about 0.5 to 3.5 percent.

The concentration of the emulsifying agent, which as explained hereinbefore is advantageously also a wetting agent for the textile material, need not be significantly greater than that required just to emulsify the bleaching agent or solution of bleaching agent. The concentration of the emulsifying agent will usually be from 0.25 to 5 percent by weight of the emulsion, preferably about 1 to 2 percent by weight of the emulsion. In the case where there is present both an emulsifying agent and a separate surface active agent, the amount of each agent may be from 0.25 to 5 percent by weight of the emulsion or suspension.

The temperature at which the emulsion is applied to the textile material conveniently can be room temperature although higher temperatures may be employed if desired. The use of temperatures above room temperature may be preferred for example, if the textile material to be treated enters the application zone in a heated condition, as for example if the application zone follows directly a solvent scouring operation using a boiling solvent such as trichloroethylene. Where hydrogen peroxide is employed as the bleaching agent, room temperature is preferred in the application zone since hydrogen peroxide becomes increasingly unstable as its temperature increases.

The process of the invention is particularly suitable for carrying out as a continuous process wherein the textile material is passed continuously through an application zone in which the emulsion is applied to it, directly into a solvent removal zone in which substantially all of the solvent is removed from the material by heating, for example by means of hot air or preferably steam, and then either directly into a wash zone or alternatively into another zone where a further treatment may be effected such as a further bleaching treatment and then into a wash zone. The first wash after solvent removal will usually but not necessarily be in a dilute alkaline solution for example a dilute aqueous solution of sodium carbonate. Subsequent washes, of which there may be a number, may be hot or cold and may be in dilute alkali, soap solution or clear water.

The machine in which the process is carried out preferably incorporates means for recovery of the solvent, especially from the solvent removal chamber. The whole machine should preferably be closed to prevent escape of solvent vapor to the atmosphere. Recovery of solvent vapors from the solvent removal zone (and other zones if desired) can be by conventional means, for example condensation and, if desired, adsorption. A water separator is normally provided for separation of condensed solvent from liquid water. Recovered solvent can then be returned to the stock tank, after cooling if necessary, where it can be formulated for re-use.

The continuous process outlined above is very rapid. We have found that the time for which the textile material is steamed or treated with hot air at about 100°

C should preferably be at least 20 seconds and especially should be about 30 seconds. Therefore even allowing for washing off, loomstate or grey textile materials can be prepared in a period of only 60 to 120 seconds to a degree where they are suitable for many finishing operations.

The process effects at least a partial bleach of the textile material and may be used for the treatment of materials in a variety of forms for example woven or knitted fabrics, felts and other sheet materials, or loose fibers carried on a suitable transport system such as an endless belt. Textile materials made of natural or man-made fibers may be treated, as may blends of natural fibers and man-made fibers. The process is particularly suitable for the treatment of fabrics made of blends of polyester fibers with cotton fibers or regenerated cellulosic fibers, although fabrics made exclusively of cotton or wool, for example, may be treated. Woven or knitted fabrics are preferably treated in open width. Loomstate or desized fabrics may be treated, as also may fabrics which have been signed and/or heat-set prior to treatment.

The process is especially useful for treating loomstate woven fabric or grey knitted fabric since in this case in addition to at least a partial bleach there is achieved at least a partial dewax and at least a partial desize. Thus, dewaxing, desizing and bleaching may be carried out simultaneously to yield in a very short treatment (60 to 120 seconds including washing) a material having high and extremely uniform absorbency properties which is suitable directly for dyeing to medium or dark shades and for other finishing operations for example resin-finishing. In cases where a full white finish is essential the process of the invention may be supplemented by one or more further bleaching processes. By way of example of the degree of bleaching obtained by the process of the invention, loomstate cotton fabric has been bleached such that its blue reflectance as measured on an E.E.L. Reflectometer was improved from 64 to about 75 percent and a 67:33 polyester/cotton fabric has been bleached such that its blue reflectance was improved from 74 to about 80 percent. We have found that the bleach which we obtain has a high degree of permanency.

The invention is illustrated but in no way limited by the following Examples, wherein the following procedures were employed for analysis:

The wax content (wax + fats and grease) of the fabrics was determined by Soxhlet extraction. In Example 4 (100 percent cotton fabric) the extraction solvent was chloroform; in all other Examples the solvent was a petrol ether fraction of boiling range 60°–80° C.

The starch equivalent value of the fabrics was determined in the usual way according to the method recommended by the Cotton, Silk and Man-Made Fibers Research Association of the Shirley Institute in their Test Leaflet No. Chem. 5:

"The material is digested with dilute sulphuric acid under such conditions that the starch is dissolved completely with the minimum degradation of the fiber consistent with this. The solution is then filtered, a suitable aliquot portion of the filtrate is digested with standard potassium dichromate and sulphuric acid, and the quantity of dichromate consumed is determined by titration with a standard solution of ferrous ammonium sulphate using phenyl anthranilic acid as indicator."

Water solubles were determined in Example 7 by Soxhlet extraction using a 1 percent solution of a nonyl phenol/ethylene oxide condensate (Lissapol NX) on a sample of fabric previously extracted in a Soxhlet with a petrol ether fraction of boiling range 60°–80° C.

The blue reflectance of the fabric was determined using a Zeiss Elrepho Reflectometer and recording four readings of which two were recorded for each side of the fabric, one along the warp and the other along the weft. The figure recorded is the mean value of the four readings.

Where not stated H₂O₂ was 35 percent aqueous H₂O₂ solution.

EXAMPLE 1

An emulsion was prepared at room temperature to the formulation

	parts by weight
20 trichloroethylene	95
hydrogen peroxide (35% aq. soln.)	2.5
coconut oil diethanolamide	2.15 (Empilan CDE).
isopropylamine dodecyl benzene sulphionate	0.35 (Nansa YS 94).

25 by adding the mixture of emulsifying agents to stirred trichloroethylene and then stirring in the aqueous solution of hydrogen peroxide.

The emulsion was applied by immersion from the application bath of a small scale pilot machine to a 67:33 polyester/cotton fabric in open width to a pick-up of 160 to 200 percent. The impregnated fabric was progressed by means of no-nip roller through a vessel of inverted U-section containing steam to remove the trichloroethylene. The residence time in the steaming vessel was about 30 seconds. The fabric was then progressed directly into a wash box containing aqueous caustic soda of strength 2.5 g/l.

It will be appreciated that many variations, such as might readily occur to one skilled in the art, may be made to the process outlined above without departing from the scope of the present invention. Thus, for example, the fabric may be impregnated with the emulsion by spraying instead of immersion, and the steaming vessel may be supplemented by a J-box containing live steam. In the latter manner the residence time of the fabric in the steaming vessel can be reduced so that the cloth run and the number of rollers in this vessel can be reduced. Moreover, the bleaching effect can be augmented by an additional bleach in the J-box by providing an aqueous solution of a bleaching agent for example hydrogen peroxide in the base of the J-box.

EXAMPLES 2 TO 7

Example 2

An emulsion was prepared to the formulation

	Parts by weight
55 Trichloroethylene	96
Hydrogen peroxide (35% soln. in water)	3
60 Surface active agent mixture	1

65 The surface active agent mixture was a mixture of a nonyl phenol/ethylene oxide condensate available under the trade name Lissapol NX, isopropylamine dodecyl benzene sulphionate and coconut oil diethanolamine containing 50 percent by weight of the nonyl phenol/ethylene oxide condensate.

The emulsion was applied by impregnation in open width to a loomstate 67:33 polyester/cotton fabric of width 38 inches and dry weight 3.8 ounces per sq. yard, to a pick-up of from 160 to 200 percent (not determined precisely), and the impregnated fabric was passed directly into a steam chamber of inverted U section wherein it was contacted with steam at 95° to 100° C for a period of 30 seconds. The fabric, now essentially freed of trichloroethylene was then passed directly into a wash box containing aqueous caustic soda (5 g/l) at 90° C wherein it remained for approximately 30 seconds. On emerging from the wash-box the fabric was sprayed with cold water. The above treatment was carried out continuously in a pilot machine.

A small sample of the resulting wet fabric was then washed in the laboratory, firstly in a beaker containing aqueous caustic soda (5g/l) at 90° C for about 60 seconds, then in a beaker of hot water at 90° C for about 60 seconds, and finally in a beaker of cold water for few minutes. The fabric was then allowed to air-dry.

The wax content, starch equivalent value or residual water soluble size and blue reflectance value of the fabric were determined and the results are shown in Table 2 below wherein the corresponding values for the untreated fabrics are also quoted for comparison.

EXAMPLES 3-7

The above procedure was then repeated five times using the fabrics, emulsion and wash-box caustic soda solutions shown in Table 1.

Table 1

Ex. No.	* Fabric	Tri-	Emulsion % H ₂ O ₂ (35%)	Wash Box Surface Active Agent	Aq. NaOH (g/l)
3	67:33 polyester/cotton 3.7 oz/sq.yd	97	2	1	3 g/l at 70°C
4	100% cotton 4 oz/sq.yd	97	2	1	3 g/l at 70°C
5	100 wool 5 oz/sq.yd	96	3	1	H ₂ O at 100°C
6	67:33 polyester/cotton-heat set-6.7 oz/sq.yd	97	2	1	H ₂ O at 80°C
7	polyester/viscose (AVRIL) 3.2 oz/sq.yd	97	2	1	3.5 g/l at 85°C

* Each of the fabrics was sized, as follows:

Example	Size
2 to 5	loomstate fabric - size unknown
6	a polyacrylate/starch mixture
7	polyvinylalcohol

The surface active agent in each example was the mixture described in Example 2.

In Example 7, the washes in the laboratory were replaced by a conventional post-bleaching wash and dry sequence in a Textile Mill.

Table 2

Ex. No.	Fabric State	Wax Content (%)	Starch Blue Equiv-Reflect alent ance (%)	Absorbency
2	before	0.70	9.58 64.8	Poor

3	after	0.08	0.59 70.1	Good
	before	0.97	11.4 59.6	Poor
4	after	0.11	0.50 68.8	Good
	before	1.35	10.9 46.6	Poor
5	after	0.40	1.57 56.7	Good
	before	4.4	43.0	
6	after	0.18	57.4	
	before	0.88	6.32 61.8	Poor
	after	0.28	1.49 70.9	Good
			% water solubles	
7	before	0.26	3.8 76.8	Poor
10	after	0.03	0.2 86.6	Good

EXAMPLE 8

An emulsion was prepared to the formulation

	Parts by weight
Trichloroethylene	95
Hydrogen peroxide (35% Aq. soln.)	4
Surface active agent (as in Ex.2)	1

A small sample of a loomstate 67:33 polyester/cotton fabric of weight 5.6 oz/sq.yd was immersed in the emulsion to impregnate the fabric. The pick-up was 170 percent on the dry weight of the fabric.

The impregnated fabric sample was held in steam at 100° C for 30 seconds after which it was washed in a beaker containing either aqueous caustic soda or Na₂CO₃ (2g/l) at 90°C for approx. 60 seconds, and then in hot water at 90° C for approx. 60 seconds and finally in cold water for a few minutes, and then was air-dried.

The results are shown below:

	Wax Content (%)	Starch Equivalent	Blue Reflect-ance (%)	Absorbency
before	0.83	3.43	68.5	Poor
after	0.39	0.56	75.7	Good

EXAMPLES 9 TO 11

These Examples demonstrate the effect of varying the concentration of hydrogen peroxide in the emulsion, and of varying the surface active agent. In each example a 35 percent aqueous solution of hydrogen peroxide was emulsified.

TABLE 3

Ex. No.	Fabric	Emulsion	Parts by weight	Treat-ment
9	67:33 polyester/cotton, desized with enzymes, 5.6 oz./sq. yd. (grey).	Trichloroethylene..... H ₂ O ₂	94-91 1-4	A
		Sodium di(methyl- amyl)sulphosuc- cinate (Manoxol MA).	5	
10	67:33 polyester/cotton, desized with enzymes, 5.6 oz./sq. yd. (grey).	Trichloroethylene..... H ₂ O ₂	98-95	A
		Nonyl phenol/ethyl- ene oxide conden- sate (Lissapol NX).	1	
11	67:33 polyester/cotton, loomstate, 4 oz./sq. yd.	Trichloroethylene..... H ₂ O ₂ Nonyl phenyl/ethyl- ene oxide conden- sate. Isopropylamine do- decyl benzene sul- phonate plus coconut oil di- ethanolamide.	95, 5-97 2-3.5 1/2 2 1/2	B

¹ See below.

² Available under the trade name Nansa 1146.

A. Laboratory Test As described in Example 8. - pick-up 170 percent

B. Machine Test As described in Example 2 - pick-up 170 percent - alkali concentration in wash-box = 3g/l, 0 70° C fabric dried by ironing (to simulate heated-can drying)

The blue reflectance of the treated fabrics was deter-

TABLE 4

Ex. No.	Blue Reflectance, percent				
	Before	1% H ₂ O ₂	2% H ₂ O ₂	3% H ₂ O ₂	4% H ₂ O ₂
9	72.0	79.0	80.0	79.0	79.7
10	72.0	79.0	79.0	79.0	79.0
11	63.6		70.1	70.8	

EXAMPLES 12-14

These examples demonstrate the effect of varying the surface active agent upon the removal of wax and sizes from fabrics.

Samples of a loomstate 67:33 polyester/cotton fabric of weight 5.6 oz./sq.yd. were treated by the laboratory test procedure described in Example 8 with an emulsion containing 96 parts by weight trichloroethylene, 3 parts hydrogen peroxide solution and 1 part of a surface active agent mixture. The pick-up in each example was 170 percent. The wax content and starch equivalent of the fabric were determined before and after the treatment.

TABLE 5

Ex. No.	Surface active agent	Wax content, (percent)	Starch equivalent	
12	Nonyl phenol/ethylene oxide condensate (Lissapol NX) isopropylamine dodecyl benzene sulphonate, (Nansa YS 94)	1.62	4.46	Before.
13	Lissapol NX, a sulphonated ester	0.41	0.58	After.
	(Lankropol KO)	1.62	4.46	Before.
	Lissapol NX	0.43	0.58	After.
14	Isopropylamine dodecyl benzene sulphonate, coconut oil diethanolamide Nana 1146).	1.62	4.46	Before.
		0.42	0.55	After.

EXAMPLES 15-20

These examples demonstrate the use of a variety of hydrocarbon and halogenated hydrocarbon solvents.

An emulsion was applied to the fabric which was then steamed and finally washed by the laboratory test procedure outlined in Example 8. The emulsions are defined in Table 6 below and the wash box contained 3g/l of caustic soda instead of 2g/l as described in Example 8. The fabric in each case was sized. In Examples 19 and 20 the fabric was ironed dry and not air-dried.

TABLE 6

Ex. No.	Fabric	Emulsion	Parts by wt.	Pick-up, percent	Blue reflectance, percent
15	67:33 polyester/cotton, 5.6 oz./sq. yd.	Trichloroethylene.	96	150-170	{ 65.0 Before. 73.0 After.
		H ₂ O ₂ (35% aq. soln.)	2		
		Surfactant A	2		
16	do	Perchloroethylene.	96	150-170	{ 65.0 Before. 76.0 After.
		H ₂ O ₂	2		
		Surfactant A	2		
17	do	Methylene chloride.	96	150-170	{ 65.0 Before. 76.9 After.
		H ₂ O ₂	2		
		Surfactant A	2		
18	do	1,1,1-trichloroethane.	96	150-170	{ 65.0 Before. 76.9 After.
		H ₂ O ₂	2		
		Surfactant A	2		

19	67:33 polyester/cotton, 4 oz./sq. yd.	1,1,2-trichloro-1,2,2-trifluoroethane.	96	180	{ 64.5 Before. 71.4 After.
		H ₂ O ₂	2		
		Surfactant B	2		
20	do	White spirit	96	130	{ 64.5 Before. 68.5 After.
		H ₂ O ₂	2		
		Surfactant B	2		

Surfactant A (isopropylamine dodecyl benzene sulphonate (coconut oil diethanolamide.

Surfactant B isopropylamine dodecyl benzene sulphonate.

EXAMPLES 21 AND 22

These examples demonstrate the effect of removing the solvent by means of hot air instead of steam.

(a) The fabric was treated in a laboratory scale pad/steaming unit designed for strips of fabric of width about 6 inches. The emulsion was applied by padding to the fabric (130 percent pick-up) which was then passed directly into steam at 90° to 100° C where it remained for about 30 seconds. A small sample of the resulting fabric was washed as described in Example 8 and then ironed dry.

(b) The above procedure (a) was repeated except that air at 90-100° C was employed instead of steam.

TABLE 7

Ex. No.	Fabric	Emulsion	Parts by wt.	Blue reflectance, percent
21	67:33 polyester/cotton, 4 oz./sq. yd., (loomstate).	Trichloroethylene.	97	64.5 Before.
		H ₂ O ₂	2	70.0 After (a).
		Surfactant i (pick-up 130%).	1	69.8 After (b).
22	100% cotton, 4 oz./sq. yd., (loomstate).	Trichloroethylene.	97	36.9 Before.
		H ₂ O ₂	2	45.2 After (a).
		Surfactant i (pick-up 130%).	1	43.8 After (b).

ⁱ The mixture described in Example 2.

EXAMPLES 23 AND 24

The examples demonstrate the effect of varying the period for which the impregnated fabric is contacted with steam.

The laboratory test procedure outlined in Example 8 was employed to treat the fabrics shown in Table 8 below. The emulsion employed was

	Parts by weight
trichloroethylene	97
H ₂ O ₂	2
Surfactant Mixture of Ex. 2	1

and the first wash was in 3g/l aqueous caustic soda solution at 90° C. The treated fabrics were ironed dry.

TABLE 8

Ex. No.	Fabric	Blue reflectance, percent					
		Before	10 secs.	20 secs.	30 secs.	40 secs.	120 secs.
23	67:33 polyester/cotton, 4 oz./sq. yd., loomstate (pick-up 120%).	63.9	72.2	73.6	73.0	73.6	73.4
24	100% cotton, 4 oz./sq. yd., loomstate (pick-up 200%).	54.8	65.5	65.6	64.9	65.7	66.5

EXAMPLES 25 AND 26

These examples demonstrate the use of alternative bleaching agents to hydrogen peroxide. The procedure was that outlined in Example 8 but using 3g/l caustic

soda at 90° C for the first wash; and the material was ironed dry and not air-dried.

The emulsions used were

Parts by weight

	A	B	C
Trichloroethylene	97	95	96
Bleaching agent	2 (H ₂ O ₂)	4 (CH ₃ CO ₂ H)	1 (H ₂ O ₂) +2 (CH ₃ CO ₂ H)
Surfactant mixture of Ex. 2	1	1	1

TABLE 9

Ex. No.	Fabric	Blue reflectance, percent			
		Before	A	B	C
25	67:33 polyester/cotton, 4 oz./sq. yd., loomstate (pick-up 120%)	68.8	76.5	74.5	76.9
26	100% cotton, 4 oz./sq. yd., loomstate (pick-up 200%)	36.4	44.0	46.7	44.8

EXAMPLES 27-29

The laboratory test procedure of Example 8 (but drying by ironing instead of air-drying) was employed to treat the loomstate fabrics shown in Table 10 with an emulsion of the formulation:

	Parts by Weight
trichloroethylene	97
H ₂ O ₂	2
Surfactant mixture of Ex. 2	1

The first wash was in 3g/l caustic soda solution instead of 2g/l caustic soda solution.

TABLE 10

Ex. No.	Fabric	Pick-up, percent	Blue reflectance, percent	
			Before	After
27	100% nylon (knitted), 6.8 oz./sq. yd.	230	75.6	78.9
28	Nylon/cotton, 6.8 oz./sq. yd.	150	66.2	72.0
29	Filament polyester (woven), 2.2 oz./sq. yd.	100	74.8	80.2

EXAMPLE 30

This example demonstrates the permanency of the bleach obtained by the process of the invention.

A loomstate 67:33 polyester/cotton fabric of weight 5.6 oz./sq.yd. was treated by the procedure of Example 2 (including steaming and wash-off) but in this case in 3g/l caustic soda solution at 50° C in the wash box with the following emulsion (pick-up 160-200 percent).

	Parts by Weight
trichloroethylene	97
H ₂ O ₂	2
Surfactant of Ex. 2	1

A sample of the fabric was then kept at 100° C in air in an oven and its reflectance was determined periodically.

Blue reflectance, percent

Initial	1 hour	2 hours	3 hours	5 hours
78.3	77.8	77.7	77.0	76.1

EXAMPLES 31 AND 32

These examples demonstrate the incorporation of a second bleaching operation intermediate the steaming operation and the first wash in caustic soda. The procedure was that outlined in Example 8. The emulsion employed was that described in Example 2.

The fabric after steaming for 30 seconds was immersed in a beaker containing 3 percent by weight of

sodium chlorite (80 percent chlorite) and 3 ml/l of 40 percent formaldehyde in water at room temperature. The pick-up was 100 percent on the fabric weight. The impregnated fabric was allowed to stand overnight prior to washing off, and ironed dry.

TABLE 11

Ex. No.	Fabric	Emulsion	Chlorite	Wax content	Starch equiv.	Blue ref.
31	67:33 polyester/cotton, 5.6 oz./sq. yd., loomstate.	170	100	{Before.. 0.83 After... 0.20	3.43 0.66	68.5 76.1
32	100% cotton, 4 oz./sq. yd., loomstate.	120	100	{Before.. 2.23 After... 0.85	9.15 2.65	36.9 62.2

These results show that the intermediate bleach with chlorite does not adversely affect the process.

What we claim is:

1. A process for the treatment of textile materials which comprises impregnating a textile material with a dispersion of one or more bleaching agents selected from the group consisting of hydrogen peroxide, sodium chlorite, sodium hypochlorite, peracetic acid and aqueous solutions thereof, in a solvent selected from the group consisting of paraffinic hydrocarbons and chloro or chloro-fluoro halogenated hydrocarbons or mixtures thereof, and wherein the said bleaching agent is substantially chemically inert toward the said solvent, said impregnation in said dispersion being for such a length of time that any wax content of the fibers remains in association with the impregnated textile material, substantially removing the solvent from the textile material, and subsequently washing the textile material.

2. A process as claimed in claim 1 wherein the said solvent is selected from the group consisting of white spirit, trichloroethylene, perchloroethylene, 1,1,2-trichloro-1,2,2-trifluoroethane, 1,1,1-trichloroethane and mixtures thereof.

3. A process as claimed in claim 1 wherein the solvent is vaporized rapidly to remove it from the textile material.

4. A process as claimed in claim 1 wherein the textile material is washed in an alkaline aqueous solution after removal of the solvent.

5. A process as claimed in claim 1 where the dispersion is an emulsion of a solution of the said bleaching agents.

6. A process as claimed in claim 1 wherein the solvent is the said halogenated hydrocarbon solvent.

7. A process as claimed in claim 1 wherein an emulsifying agent is incorporated in the dispersion, and said emulsifying agent is stable in the presence of said bleaching agent.

8. A process as claimed in claim 3 wherein the solvent is vaporized by contacting the textile material with steam.

9. A process as claimed in claim 7 wherein the emulsifying agent is also a surface active agent.

10. A process as claimed in claim 7 wherein the dispersion incorporates a surface active agent in addition to an emulsifying agent, and said surface active agent is stable in the presence of said bleaching agent.

11. A process as claimed in claim 8 wherein the textile material is contacted with steam for a period of from 20 seconds to 120 seconds.

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