ABSTRACT

Materials consisting of textile fibers are simultaneously scoured and bleached in a non-aqueous medium by the method wherein at least one peroxide bleaching agent and at least one organic carbonate selected from the group consisting of alkylene carbonates and hydroxalkylene carbonates in the ratio by weight from 10:1 to 1:5, are dissolved, emulsified or dispersed in a halogenated hydrocarbon to prepare a non-aqueous scouring and bleaching liquid, and the material is treated with the non-aqueous liquid.
METHOD FOR SIMULTANEOUSLY SCOURING AND BLEACHING MATERIALS CONSISTING OF TEXTILE FIBERS

The present invention relates to a method for scouring and bleaching materials consisting of textile fibers, more particularly, relates to a method for simultaneously scouring bleaching material consisting of textile fibers in a nonaqueous medium.

The term "textile fiber material" used hereinafter refers to materials consisting of textile fibers, including loose fibers, spun fiber yarns, filament tow, filament yarns, slivers, woven fabrics, knitted fabrics, nonwoven fabrics, threads, strands, ropes, cords and nets. The textile fiber material may consist of either a simple kind of the textile fibers or two or more kinds of the textile fibers.

That is, the textile material may consist of cotton, viscose rayon fibers, cuprammonium rayon fibers, polyethylene terephthalate fibers, acrylic fibers, polypropylene fibers or a blend of two or more of the above-mentioned fibers.

In the conventional textile industry, it is well-known method to scour and bleach the textile fiber material in an aqueous medium. However, such type of scouring and bleaching has the following disadvantages.

1. It is impossible to simultaneously carry out the scouring and the bleaching of the textile fiber materials.
2. A long time is necessary to complete each scouring and bleaching.
3. The textile fiber materials are sometimes damaged during the scouring and bleaching processes because of the length of time and the high temperature of treatments.
4. Heat consumption is very great due to the length of time and the high temperature of treatments.
5. A large amount of water is consumed because the scoured material and the bleached material must be separately washed with water to completely remove the scouring agent and the bleaching agent.
6. The waste water from the scouring and bleaching processes should be cleaned to avoid pollution.
7. A large space is necessary for equipment necessary for the scouring and bleaching processes because the two should be carried out separately.

Recently, in order to eliminate the above-mentioned disadvantages, various new methods were developed. Especially, the nonaqueous scouring method in which an organic solvent is used, was developed for practical work.

The method wherein the textile fiber material is scoured with an organic solvent, has the following advantages.

1. The scouring and bleaching can be completed within a short period. This is because the organic solvent, for example, halogenated hydrocarbons, has a low surface tension and can dissolve a large amount of waxy substances existing in the textile fiber material. The low surface tension of the solvent results in quick penetration of the solution into the material and the large dissolving property of the solvent causes quick and large removal of the waxy substance from the material.
2. No deterioration of the fibers during processing occurs because no chemical reaction is carried out in the scouring.
3. The consumption of heat during the processing is relatively small. This is because the organic solvent has a lower boiling point and a smaller specific heat and latent heat of gasification than those of water.
4. The organic solvent can be recovered and utilized again.
5. In the recovery of the organic solvent, the waste from the textile fiber material is concentrated and separated from the organic solvent. The separated waste is treated without pollution.

However, the above-mentioned scouring method wherein the organic solvent is used, cannot completely remove foreign matter in the textile fiber material, for example, leaves and seeds, because there is no chemical decomposition of the foreign matter during scouring. Further, even if a water-soluble bleaching agent which is usually used in the conventional aqueous bleaching process, for example, peroxide bleaching agents, is used in the form of an emulsion wherein the bleaching agent is emulsified into the organic solvent by a surface active agent, the complete removal of the foreign matters is difficult. This difficulty results in a relatively low whiteness and wetting properties of the bleached material.

In order to enhance the bleaching activity of the bleaching agent, an alkali or amine compound, for example sodium hydroxide, sodium carbonate, magnesium sulfate, sodium pyrophosphate, sodium tripolyphosphate, sodium hexametaphosphate, sodium silicate, ammonia aqueous solution and watersoluble organic amines, may be added into the bleaching emulsion. However, the addition of the alkali or amine compound causes a low stability of emulsion. Further, the alkali or amine compound sometimes causes decomposition of the organic solvent, especially, halogenated hydrocarbon. After the bleaching is finished, the water-soluble bleaching agent and the alkali or amine should be removed by washing with water or hot water. This type of washing frequently causes pollution. That is, the waste water pollutes the surrounding waterways.

In order to eliminate the above-mentioned disadvantages, various studies have been developed. However, a satisfactory solution for these problems has not yet been obtained.

The object of the present invention is to provide a method for simultaneously scouring and bleaching materials consisting of textile fibers in a nonaqueous medium, which can be effected in a simple operation with a high scouring and bleaching efficiency.

The above-mentioned object is accomplished by the method of the present invention. According to the present invention, the method for simultaneously scouring and bleaching materials consisting of textile fibers in a nonaqueous medium, comprises the steps of preparing a nonaqueous scouring and bleaching liquid by adding at least one peroxide bleaching agent and at least one organic carbonate selected from a group consisting of alkylene carbonate and hydroxyalkylenecarbonate in a ratio by weight of 10:1 to 1:5 into a halogenated hydrocarbon solvent, and treating a material consisting of textile fibers with the above-prepared nonaqueous scouring and bleaching liquid.

In the method of the present invention, the treatment of the textile fiber material with the nonaqueous scouring and bleaching liquid is carried out in a process wherein the textile fiber material is impregnated with a predetermined amount of the liquid at a temperature lower than 40°C, usually, room temperature, the im-
pregnated material is heated with steam at a temperature of 70° to 150°C, preferably, 75° to 130°C, for 30 to 60 minutes, preferably, 5 to 30 minutes. Thereafter, the material is washed with a washing solvent consisting of a halogenated hydrocarbon, hydrocarbon, alcohol, ketone, ether or a mixture of two or more of the above-mentioned compounds. The washing solvent is removed from the material by blowing steam through the material, and, then, if necessary, the material is washed with a small amount of hot water, and dried.

By the present invention method the textile fiber material can be converted to a scoured and bleached material having excellent whiteness and water-wetting properties with no distribution of foreign matter on the surface thereof. Further, it should be noted that the conversion is carried out with a relatively small decrease of tear or tensile strength of the material. Such special effects of the process of the present invention are derived from the addition of the organic carbonate into the scouring and bleaching liquid composed of a peroxide bleaching agent dissolved, emulsified or dispersed into a halogenated hydrocarbon solvent. The action mechanism of the organic carbonate has not yet been made clear. However, the organic carbonate may act as a special activating agent and simultaneously as an appropriate buffering agent for the peroxide bleaching agent in the halogenated hydrocarbon solvent. Accordingly, the method of the present invention has an excellent scouring and bleaching effect which has never been obtained by the conventional method using the emulsion wherein the water-soluble bleaching agent is emulsified in the non-aqueous solvent. Moreover, the scouring and bleaching liquid of the present invention can be easily removed from the textile fiber material by washing with an organic solvent, for example, hydrocarbons and halogenated hydrocarbons, alcohols or ethers.

In the method of the present invention, it is unnecessary to use the alkali or amine compound mentioned hereinbefore as the activator for the peroxide bleaching agent. Such uselessness of the basic activator results in a high stability of the scouring and bleaching solution of the present invention over a long period of time. That is, even if the scouring and bleaching solution of the present invention is stored at room temperature for a length of time, the bleaching activity of the peroxide bleaching agent remains constant.

The organic carbonate usable for the method of the present invention is easily dissolved in an organic solvent, for example, alcohol solvent, ether solvent, hydrocarbon solvent or halogenated hydrocarbon solvent alone or a mixture of two or more of the above solvents. Accordingly, after the scouring and bleaching process is completed, the residue of the scouring and bleaching solution on the textile fiber material is easily removed by washing with the above-mentioned solvent. Thereafter, the textile fiber material may be further washed with either cold or hot water. The solvent washing can be completed within a short time, for example, 20 seconds to 2 minutes. Compared to this, the conventional aqueous method needs a long time, for example, 5 minutes to 10 minutes, of aqueous washing.

By the solvent washing, the waste substances which have been produced during the scouring and bleaching process, the organic carbonate and a surface active agent which may be used if necessary, are dissolved into the washing solvent. These wastes are separated in the form of a solid from the washing solvent when the washing solvent is recovered from the washing waste. From the separated solid waste, the organic carbonate and the surface active agent can be cleansed and used again for the scouring and bleaching process. That is, during the scouring and bleaching process, the organic carbonate and the surface active agent are not decomposed. The recovery of the washing solvent on the textile fiber material is carried out by blowing steam through the material.

As stated above, the textile fiber material which has been washed with the washing solvent and blown with steam, may be further washed with a small amount of hot water. However, since the amount of hot water used is very small and the textile fiber material to be washed with hot water holds substantially no or very small amounts of the scouring and bleaching wastes, the waste washing water does not require cleansing by a waste water cleaning process.

The peroxide bleaching agents usable for the process of the present invention may be selected from the conventional peroxide bleaching agents, for example, hydrogen peroxide, persulfate, persulphate, ammonium persulfate, sodium persulfate and a mixture of two or more of the above-mentioned peroxides. Especially, hydrogen peroxide and persulfate are pertinent compounds for methods in the present invention. The peroxide bleaching agents may be dissolved, emulsified or dispersed into the halogenated hydrocarbon.

The organic carbonates usable for the method of the present invention are selected from the group consisting of alkylene carbonates, preferably, alkylene carbonates wherein the alkylene group has 2 - 4 carbon atoms, and hydroxyalkylene carbonates, preferably, alkylene carbonates wherein the hydroxy-alkylene group has 2 - 4 carbon atoms. The alkylene carbonate may be ethylene carbonate, propylene carbonate or butylene carbonate. The hydroxyalkylene carbonate may be either hydroxypropylene carbonate or hydroxybutylene carbonate.

The scouring and bleaching liquid for the method of the present invention may contain a surface active agent for emulsifying or dispersing the peroxide bleaching agent. For the surface active agent conventional types of the surface active agents may be selected, such as, various types of anionic, cationic, non-ionic and amphoteric surface active agents, for example, polyethylene glycol alkylphenyl ethers, polyethylene glycol alkyl ethers, polyethylene glycol-fatty acid esters, sorbitan monoalkylates, polyethylene glycol alkylamine ethers, alkylbenzene sulfonates, dialkylsulfosuccinates, polyalkylene glycol alkylphosphates and mixtures of two or more of the above-mentioned surface active agents. Particularly, the alkyleneglycol alkyl-phosphates or its salts can be beneficially used for the method of the present invention. They can be used alone or as a mixture thereof with one or more types of the surface active agents.

The polyalkylene glycol alkylphosphates are of the formula:

\[
\text{RO(OOR')}_n\text{PO(OA')}_m (1)
\]

or

\[
\text{ROOCR'()}_n\text{PO(OA')}_m (2)
\]
wherein R represents a hydrocarbon group, R' represents ethylene or propylene group, n represents an integer from 1 to 200 and A and A' represent hydrogen, lithium, potassium or sodium atom or an ammonium (NH₄), alkylamine or hydroxalkylamine group. Such a type as the polyalkylene glycol alkylphosphate may be selected from the class consisting of mono- and di-(polyoxyethylene lauryl ether) phosphates, mono- and di-(polyoxyethylene stearyl ether) phosphates, mono- and di-(polyoxyethylene-p-nonylphenol ether) phosphates, mono- and di-(polyoxypropylene oleylether) phosphates, mono- and di-(polyoxypropylene cetylether) phosphates, mono- and di-(polyoxypropylene p-nonyl ether) phosphates, and lithium, potassium, sodium, ammonium, alkylamine and hydroxalkylamine salts of the above-mentioned mono- and di-phosphates.

If the peroxide bleaching agent soluble in the halogenated hydrocarbon solvent, for example, peracetic acid, is used, no surface active agent may be mixed with the scouring and bleaching liquid.

The halogenated hydrocarbon usable for the method of the present invention may be selected from halogenated aliphatic hydrocarbons, for example, trichloroethylene, tetrachloroethylene, trichloromethane, 1,1,1-trichloroethane, tetrachloromethane, 1,2-dichloroethane, 1,1-dichloroethane, 1,1,2-trichloroethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2-dichloroethylene, 1,2,3-trichloropropene, 1,2-dichloropropene, n-butyl chloride, n-amyl chloride, di-chloropentane, n-hexyl chloride, 2-ethylhexyl chloride, 1,1,2-trichloro-1,2,2-trifluoroethane and 1,2-difluoro-1,1,2,2-tetrachloroethane, and halogenated aromatic hydrocarbons, for example, mono-chlorobenzene, O-chloro-benzene, 1,2,4-trichlorobenzene, O-chlorotoluene, bromobenzene, p-chlorotoluene, a-chloronaphthalene, and chlorinated naphthalene, and mixtures of two or more of the above-mentioned halogenated hydrocarbons.

The halogenated hydrocarbon is selected considering the type of the peroxide bleaching agent used and the type of the textile fibers to be treated, and treating temperature. Particularly, the halogenated hydrocarbons having a boiling point of 45° to 140°C, preferably, 80° to 130°C, for example, trichloroethylene, tetrachloroethylene, 1,1,1-trichloroethane, 1,2-difluoro-1,1,2,2-tetrachloroethane, are pertinent for the method of the present invention, because some of the halogenated hydrocarbons evaporate from the textile fiber material during treatment at a temperature of 70° to 100°C.

In the preparation of the non-aqueous scouring and bleaching liquid of the present invention the peroxide bleaching agent, the organic carbide and, if necessary, the surface active agent are successively or simultaneously added into the halogenated hydrocarbon, the organic carbonate may be added into the halogenated hydrocarbon at any step. Preferably, the organic carbonate is dissolved into a portion of the halogenated hydrocarbon and, then, the solution is mixed with the liquid containing the peroxide bleaching agent dissolved, emulsified or dispersed in the halogenated hydrocarbon. This manner of the preparation is simple and rapid in operation.

The non-aqueous scouring and bleaching liquid contains the peroxide bleaching agent in such an amount that the textile fiber material is impregnated with 0.5 to 10% of the peroxide bleaching agent (active ingredient) based on the weight of the textile fiber material. That is, the concentration of the peroxide bleaching agent in the non-aqueous liquid is determined in response to the amount of the non-aqueous liquid to be impregnated by the textile fiber material, the type of the peroxide bleaching agent and, if necessary, the concentration of the active ingredient in the peroxide bleaching agent. If the peroxide bleaching agent is applied in the amount smaller than 0.5% based on the weight of the textile fiber material, the scoured and bleached textile fiber material has low whiteness and wetting properties and a large distribution of the foreign matter is retained on the surface thereof. If the amount of the peroxide bleaching agent applied onto the textile fiber material is larger than 10% based on the weight of the textile fiber material, the scoured and bleached textile fiber material has an undesirably low tensile and tear strength.

The ratio by weight of the peroxide bleaching agent to the organic carbonate in the non-aqueous liquid is in a range from 10 : 1 to 1 : 5. If the ratio is larger than 10 : 1, the peroxide bleaching agent is insufficiently activated and buffered by the organic carbonate. Even if the ratio is smaller than 1 : 5, the bleaching effect of the non-aqueous liquid does not increase or sometimes, tends to decrease the whiteness and tensile or tear strength, and the cost of the non-aqueous liquid increases. Preferably, the ratio is in a range from 5 : 1 to 1 : 3.

The non-aqueous scouring and bleaching liquid of the present invention may contain the surface active agent in an amount of 0.1 to 7%, preferably, 0.2 to 4% by weight.

The non-aqueous scouring and bleaching liquid of the present invention is applied onto the textile fiber material by conventional methods. For example, the material is immersed into the liquid and squeezed by way of mangle or centrifuge so that the peroxide bleaching agent is held in an amount of 0.5 to 10% based on the weight of the material, in the material. Otherwise, the liquid may be applied onto the material by way of spraying, brushing, or roller coating. The impregnated material is charged into a closed chamber or vessel and heated with steam at a temperature of 70° to 150°C, preferably, 95° to 130°C, for 3 to 60 minutes, preferably, 5 to 30 minutes. During the heating period, the material is sufficiently scoured and bleached, the peroxide bleaching agent is decomposed and the decomposition products, for example, water or acetic acid, and the halogenated hydrocarbon are evaporated. The evaporated halogenated hydrocarbon is collected, purified and recovered. The scoured and bleached material is charged into a closed chamber or vessel and washed with a washing solvent consisting of a halogenated hydrocarbon, hydrocarbon, alcohol, ketone or ether or a mixture of two or more of the above-mentioned solvents, at room temperature. During the washing step, the scouring and bleaching products formed in the material are dissolved into the washing solvent. The halogenated hydrocarbon washing solvents may be the same as the halogenated hydrocarbon usable as solvent for the scouring and bleaching liquid of the present invention. The hydrocarbon washing solvent may be selected from the group consisting of n-hexane, isohe-
The alcohol washing solvent may be methanol, ethanol, n-propanol, isopropanol, n-butanol, isobutanol, sec-butanol, tert-butanol, n-amyil alcohol, isooamyil alcohol, n-hexanol or methyl amyl alcohol. The ketone washing solvent may be acetone, methyl ethyl ketone, methyl-n-propyl ketone, methyl-n-butyl ketone, methylisobutyl ketone, diethyl ketone, acetone oils, mesityl oxide, or cyclohexanone. The ether washing solvent may be sym-dichloroether, isopropyl ether, n-butyl ether, methylphenyl ether, 1,4-dioxane, trioxane, furan or turfurol.

The washed material is charged into a closed chamber or vessel, and steam is blown onto the material at a temperature from 80° to 110°C to evaporate the washing solvent. During the steam blowing period, the washing solvent is removed from the material. Thereafter, the material is dried and the washing solvent is collected and recovered. After the steam blowing is finished, the material is charged into a closed chamber or vessel and further washed with a small amount of hot water to remove the scouring and bleaching products and the washing solvent from the material, if necessary.

As stated above, the heating step, the solvent washing step, the steam blowing step and the hot water washing step are respectively carried out within a closed chamber or vessel. This is effective for avoiding pollution of the atmosphere and recovering the solvents. The waste washing solvent is collected and distilled to separate the solvent from the solid mixture of the organic carbonate, the surface active agent and the scouring and bleaching product. The distilled solvent is recovered. The organic carbonate and the surface active agent are respectively separated from the distillation residue, cleaned up and recovered. The scouring and bleaching product are collected as a solid waste from the distillation residue.

The method of the present invention has the following advantages.

1. The resultant scoured and bleached textile fiber material has excellent whiteness and wetting properties and no distribution of foreign matter on the material surface.
2. In spite of the excellent bleaching effect, the decrease of tensile or tear strength of the material is very small.
3. The non-aqueous scouring and bleaching liquid has a high stability for scouring and bleaching.
4. The scouring and bleaching processes are completed simultaneously within a short time.
5. No pollution.

The following examples are intended to illustrate the application of the present invention but are not intended to limit the scope thereof. In the examples, the "percentages" and "parts" are by weight unless otherwise stated, and the properties of the fabric were determined by the methods detailed below unless otherwise stated.

1. Whiteness of fabric

The whiteness of the simultaneously scoured and bleached fabric was determined by the method where 10 pieces of specimens were prepared by cutting the fabric subjected to measurement for their reflectivity at a wave length of 450 μm using a spectrophotometer. The whiteness of the fabric was indicated by an average of the ratios in percent of the measured reflectivities for the specimens to that of a standard plate consisting of magnesium oxide.

2. Thoroughness of simultaneous scouring and bleaching

The thoroughness (completeness) of the simultaneous scouring and bleaching for cotton fabric was evaluated by human observation concerning distribution of foreign matter such as leaves or other refuse, located on the cotton fabric surface, and classified as "remarkable", "less remarkable" and "not remarkable" in distribution of the foreign matter.

3. Wetting property of fabric

The wetting property of the simultaneously scoured and bleached fabric was evaluated by a method wherein 10 pieces of specimens having a 2 cm width and a 20 cm length were prepared from the simultaneously scoured and bleached fabric, one end of each of the specimens was dipped in a length of 2.5 cm from the end thereof into an aqueous solution containing 0.5% of Patent Pure Blue V (C. I. Acid Blue No. 1, C. I. No. 42045) for 10 minutes so as to allow penetration of the dye solution upward into the specimen. The wetting property of the fabric was indicated by an average value of the length of the upward penetration of the dye solution.

4. Tear strength of fabric

The tear strength of the simultaneously scoured and bleached fabric was determined in accordance with ASTM D 1424-63 using a Falling Pendulum (Elemdorf) tear tester, and indicated by an average value of results for 10 pieces of specimens.

EXAMPLES 1 THROUGH 7

In Example 1, a cotton broad cloth composed of 120 warps and 65 wefts per inch, both the warp and weft consisting of a cotton single yarn of a cotton count of 40s, was scoured and desized by an ordinary method. A non-aqueous scouring and bleaching solution was prepared by dissolving 0.5 parts of ethylene carbonate and 5 parts of a surface active agent consisting of a salt of di-polyoxymethylene-γ-onylphenylether phosphate wherein the polyoxyethylene group consists of 15 oxyethylene units, with β-aminoethanol 81.95 parts of trichloroethylene and, then, adding 5 parts of peracetic acid into the solution while stirring. The above-desized cotton fabric was dipped into the non-aqueous scouring and bleaching solution at a temperature not higher than 40°C, squeezed by a mangle so that the cloth was impregnated with 120% of the non-aqueous solution based on the weight of the cloth, and, then, treated in trichloroethylene vapor atmosphere at a temperature of 85°C to 92°C for 10 minutes. Thereafter, the treated fabric was washed in a washing vessel containing a mixture solvent of 50% of trichloroethylene and 50% of methyl alcohol, rinsed with a small amount of hot water at a temperature of 90°C and dried at a temperature of 100°C.

The resultant fabric was subjected to the measurements for whiteness of the fabric, thoroughness of the simultaneous scouring and bleaching, and wetting properties and tearing strength of the fabric. The results of the measurement are indicated in Table 1.

In Examples 2 through 7, the same procedures as in Example 1 were repeated except that the non-aqueous scouring and bleaching solutions have the compositions
indicated in Table 1. The results are indicated in Table 1.

In comparison Examples 1 and 2, the same procedures as in Example 1 were carried out using the non-aqueous scouring and bleaching solutions having the compositions indicated in Table 1. In Comparison Example 1, no ethylene carbonate was contained in the non-aqueous solution. In Comparison Example 2, the non-aqueous solution contained ethylene carbonate in an amount of ten times that of peracetic acid. Such amounts of ethylene carbonate is beyond the scope of the present invention method. The results are shown in Table 1.

Table 1 shows that when the fabric was treated with the non-aqueous scouring and bleaching solution having a ratio in weight of peracetic acid to ethylene carbonate larger than 10:1, the fabric has a low tear strength. Further, Table 1 shows that the ratio in weight of peracetic acid to ethylene carbonate smaller than 1:5, results in a low whiteness and wetness in the scoured and bleached fabric and a remarkable distribution of foreign matter on the fabric surface. However, when peracetic acid and ethylene carbonate are used in a ratio in weight of 10:1 to 1:5, the resultant scoured and bleached fabric had a high whiteness, a high tear strength, no distribution of foreign matter and high wetting properties.

### Examples 9 through 14

In Example 8, the same procedures as in Example 1 were repeated using 5 parts of hydrogen peroxide instead of peracetic acid. The results are indicated in Table 2.

In Examples 9 through 14, the same operations as in Example 8 were carried out by using the non-aqueous...
It is obvious from Table 2 that when hydrogen peroxide and ethylene carbonate are used in the ratio of from 10:1 to 1:5, the scoured and bleached fabric had a desirable whiteness and tear strength. However, when the ratio is 1:10, the fabric had a low whiteness and when no ethylene carbonate is used, the fabric had a low tear strength.

**EXAMPLES 15, 16 AND 17**

In Example 15, a spun yarn fabric composed of a warp consisting of a spun single yarn of 44 s cotton count in a density of 120 yarns/in and a weft consisting of a spun single yarn of 44 s cotton count in a density of 59 yarns/in, both the warp and weft yarns consisting of 55% by weight of cotton and 45% by weight of polyethylene terephthalate fibers, was treated in the same operations as in Example 1 using a non-aqueous scouring and bleaching solution consisting of 5 parts of peracetic acid, 3 parts of propylene carbonate and 92 parts of trichloroethylene. The treated fabric was subjected to a measurement of whiteness, tear strength, distribution of foreign matter and wetting properties. The results are indicated in Table 3.

In Examples 16 and 17, the same procedures as in Example 15 were repeated respectively using the non-aqueous scouring bleaching solutions having the compositions as shown in Table 3. As Table 3 indicates, the solution for Examples 16 and 17 contained respectively 2 parts and 4 parts of surface active agent consisting of a sodium salt of mono (polyoxyethylene)nlauryl ether) phosphate wherein the polyoxyethylene group consists of 6 oxyethylene units. The scoured and bleached fabrics of Examples 16 and 17 had properties indicated in Table 3.

**Table 3-continued**

<table>
<thead>
<tr>
<th>Item</th>
<th>Example</th>
<th>Comparative Ex. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiteness (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warp</td>
<td>1441</td>
<td>1536</td>
</tr>
<tr>
<td>Tear Strength (g)</td>
<td></td>
<td>1600</td>
</tr>
<tr>
<td>Sum</td>
<td>103</td>
<td>106</td>
</tr>
<tr>
<td>Foreign Matters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration (mm)</td>
<td>101</td>
<td>105</td>
</tr>
<tr>
<td>Remarkable</td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>Remarkable</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>Remarkable</td>
<td></td>
<td>86</td>
</tr>
</tbody>
</table>

From Table 3, it is obvious that the method of the present invention can completely scour and bleach cotton-polyethylene terephthalate fiber blend spun yarn fabric when peracetic acid is used as the scouring and bleaching agent, even if no surface active agent is used. However, it is also obvious that the addition of the surface active agent results in the enhancement of whiteness and wetting properties of the treated fabric with a small decrease of the tear strength.

**EXAMPLES 18 AND 19**

In Examples 18 and 19, the same procedures as in Examples 3 and 10 were respectively repeated except that the non-aqueous scouring and bleaching solutions were applied to the fabrics 24 hours after the completion of preparation of the solutions. The properties of the scoured and bleached fabrics are indicated in Table 4.

In Comparison Examples 5 and 6, the same procedures as in Comparison Examples 1 and 5 were respectively repeated using the non-aqueous scouring and bleaching solutions which have been kept in storage for 24 hours from the completion of the solution preparation. The properties of the scoured and bleached fabric are found in Table 4.
Comparing the fabrics treated in Examples 18 and 19 with those in Examples 3 and 10, it is clear that the properties of the fabric in the former examples are practically the same as those in the latter examples. This shows that the non-aqueous scouring and bleaching solutions of the present invention which contain an alkyne carbonate, remain stable despite a time lapse.

However, comparing the fabrics treated in Comparative Examples 5 and 6 with those in comparative Examples 1 and 3, it is evident that the properties of the fabrics are different between the former and the latter. That is, the 24 hour storage of the non-aqueous scouring and bleaching solutions in Comparative Examples 5 and 6 which solutions contain no alkyne carbonate, results in a decrease of whiteness and wetting properties of the treated fabric and an increase of the distribution of foreign matter on the treated fabric surface. This shows that the non-aqueous scouring and bleaching solution containing no alkyne carbonate is decomposed with the lapse of time.

**EXAMPLES 20 THROUGH 23**

In Example 20, the same procedures as in Example 15 were carried out except that the same cotton fabric as in Example 1 was used instead of the cotton-polyethylene terephthalate fiber fabric in Example 15.

In Example 21, the same operations as in Examples 20 were repeated except that the non-aqueous scouring and bleaching solution was applied to the cotton fabric 24 hours after completion of the solution preparation.

Example 22, the same procedures as in Example 16 were repeated except that the same cotton fabric as in Example 1 was scoured and bleached.

In Example 23, the same operations as in Example 22 were carried out except that the non-aqueous scouring and bleaching solution was used after being kept in storage for 24 hours from preparation completion. The properties of the treated fabrics are indicated in Table 5.

<table>
<thead>
<tr>
<th>Item</th>
<th>Example 20</th>
<th>Example 21</th>
<th>Example 22</th>
<th>Example 23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiteness (%)</td>
<td>87</td>
<td>86</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>Tear (g)SJ</td>
<td>1024</td>
<td>1024</td>
<td>992</td>
<td>992</td>
</tr>
<tr>
<td>Strength (g)Wf</td>
<td>736</td>
<td>736</td>
<td>736</td>
<td>736</td>
</tr>
<tr>
<td>Distribution of foreign matter</td>
<td>Not Remarkable</td>
<td>Not Remarkable</td>
<td>Not Remarkable</td>
<td>Not Remarkable</td>
</tr>
<tr>
<td>Penetration (mm)</td>
<td>105</td>
<td>100</td>
<td>105</td>
<td>104</td>
</tr>
</tbody>
</table>

It is clear from Table 5 that both the non-aqueous scouring and bleaching solution of Example 20 which contains no surface active agent and that of Example 22 which contains the surface active agent are highly stable for the 24 hour storage. The high stability derives from the alkyne carbonate added to the solution.

What we claim is:

1. A method for simultaneously scouring and bleaching materials consisting of textile fibers in a non-aqueous medium, which comprises the steps of preparing a non-aqueous scouring and bleaching liquid by adding at least one peroxide bleaching agent and at least one organic carbonate selected from the group consisting of alkyne carbonate and hydroxyalkylene carbonate in a ratio by weight of 10:1 to 1:5 into a halogenated hydrocarbon solvent, and treating a material consisting of textile fibers by impregnating the material with said above-prepared non-aqueous scouring and bleaching liquid, heating the impregnated material with steam, and thereafter washing the material with a washing solvent.

2. A method as claimed in claim 1, wherein said treating is carried out by impregnating said material with said non-aqueous scouring and bleaching liquid and heating said impregnated material with steam at a temperature of 70° to 150°C for 3 to 60 minutes.

3. A method as claimed in claim 1, wherein said peroxide bleaching agent is selected from the group consisting of hydrogen peroxide, peroxyacetic acid, perboric acid, potassium persulfate, ammonium persulfate, sodium persulfate and mixtures of two or more of the above-mentioned peroxides.

4. A method as claimed in claim 1, wherein said alkyne carbonate is selected from alkyne carbonates wherein the alkyne group has 2 to 4 carbon atoms.

5. A method as claimed in claim 4, wherein said alkyne carbonate having the alkyne group of 2 to 4 carbon atoms is selected from the group consisting of ethylene carbonate, propylene carbonate and butylene carbonate.

6. A method as claimed in claim 1, wherein said hydroxyalkylene carbonate is selected from hydroxyalkylene carbonate wherein the hydroxyalkylene group has 2 to 4 carbon atoms.

7. A method as claimed in claim 6, wherein said hydroxyalkylene carbonate having the hydroxyalkylene group of 2 to 4 carbon atoms is either hydroxypropylene carbonate or hydroxybutylene carbonate.

8. A method as claimed in claim 1, wherein said ratio by weight of said peroxide bleaching agent to the organic carbonate is in a range from 5:1 to 1:3.

9. A method as claimed in claim 1, wherein said halogenated hydrocarbon solvent is selected from the group consisting of halogenated aliphatic hydrocarbons, halogenated aromatic hydrocarbons and mixtures of two or more of the above-mentioned compounds.

10. A method as claimed in claim 9, wherein said halogenated aliphatic hydrocarbon is selected from the group consisting of trichloroethylene, tetrachloroethylene, trichloromethane, 1,1,1-trichloroethane, tetra-chloromethane, 1,2-dichloroethane, 1,1-dichloroethane, 1,1,2-trichloroethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2-dichloroethylene, 1,2,3-trichloropropane, 1,2-dichloropropane, n-butyl chloride, n-amyl chloride, dichloropentane, n-butyl chloride, 2-ethylhexyl chloride, 1,1,2-trichloro-1,2,2-trifluoroethane and 1,2-difluoro-1,1,2,2-tetrachloroethane.

11. A method as claimed in claim 9, wherein said halogenated aromatic hydrocarbon is selected from the group consisting of monochlorobenzene, O-chlorobenzene, 1,2,4-trichlorobenzene, O-chlorotoluene, bromobenzene, p-chlorotoluene, p-chloronaphthalene, and chlorinated naphthalene.

12. A method as claimed in claim 2, wherein said nonaqueous scouring and bleaching liquid impregnated
within said material contains 0.5 to 10% of said peroxide bleaching agent based on the weight of said material.

13. A method as claimed in claim 1, wherein said nonaqueous scouring and bleaching liquid further contains 0.1 to 7% by weight of a surface active agent.

14. A method as claimed in claim 13, wherein said surface active agent is in an amount of 0.2 to 4% by weight.

15. A method as claimed in claim 13, wherein said surface active agent contains a polyalkyleneglycol alkylphosphate of the formula:

\[
\begin{align*}
\text{(1)} & \quad \text{RO(OR')ₙ} \quad \text{P} \quad \text{OA} \\
\text{(2)} & \quad \text{RO(OR')ₙ} \quad \text{P} \quad \text{OA'}
\end{align*}
\]

wherein R represents a hydrocarbon group, R' represents an ethylene or propylene group, n represents an integer from 1 to 200 and A and A' represents a hydrogen, lithium, potassium or sodium atom or an ammonium, alkylamine or hydroxyalkylamine group.

16. A method as claimed in claim 15, wherein said polyalkyleneglycol alkylphosphate is selected from the group consisting of mono- and di-(polyoxyethylene-laurylether)-phosphates, mono- and di-(polyoxyethylene-stearylether)-phosphates, mono- and di-(polyoxyethylene-p-xylenolether)-phosphates, mono- and di-(polyoxypropylene-cetyl)-phosphates, mono- and di-(polyoxypropylene-p-xyleneether)-phosphates and lithium, potassium, sodium, ammonium, alkylamine and hydroxyalkylamine salts of the above-mentioned mono- and di-phosphates and mixtures of two or more of the above-stated compounds.

17. A method as claimed in claim 2, wherein said heating temperature for said impregnated material is in a range from 75° to 130°C.

18. A method as claimed in claim 2, wherein said heating period of time is 5 to 30 minutes.

19. A method as claimed in claim 2, wherein said heated material is washed with a washing solvent consisting of a hydrocarbon, halogenated hydrocarbon, alcohol, ketone or ether or a mixture of two or more of the above compounds.

20. A method as claimed in claim 19, wherein said washed material is treated with steam blown onto the washed material at a temperature of 80° to 110°C to remove said washing solvent.

21. A method as claimed in claim 20, wherein said steamtreated material is further washed with a small amount of hot water.

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