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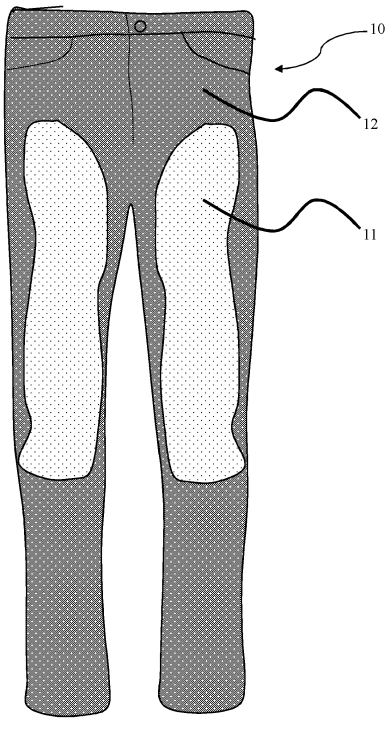
(54) METHOD FOR CHANGING THE COLOUR OF A TEXTILE, FABRIC AND GARMENT

(57) The invention refers to a fabric finishing method suitable for changing the colour of a coloured fabric thereby providing a vintage look to the fabric. The invention refers also to the fabric obtainable by the above method and to a garment comprising such fabric.

Figure 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of textile finishing, in particular textile finishing to change colours in textiles to provide a vintage look.

BACKGROUND OF THE INVENTION

[0002] Finishing processes for textiles are a group of heterogeneous processes that modify the look, the performance and/or the "hand" (feel) of the finished textiles or clothing.

[0003] Common finishing processes that modify the look of textiles, in particular of denim, are those that deliberately remove the dyes in specific areas of the textile (e.g. via mechanical abrasion or chemically) to provide a change in colour, and in particular a colour fading effect known as vintage look (also known as worn-out, washed or faded look). Vintage look provides an "aged" effect to the textile that is particularly sought out in denims for fashion reasons.

[0004] To obtain vintage look, physical and/or chemical processes such as sanding, washing (stone, enzymes, or bleach washing) and laser technology have been used.

[0005] Sanding, or sand blasting, is a mechanical process in which localised abrasion is created. The process involves blasting an abrasive material in powdered form at a very high speed and pressure. Sanding is known to be very hazardous for operating workers, and high health risks have been associated with sanding (e.g. silicosis).

[0006] Washing processes involve a bath with various components, such as stones and/or chemicals, wherein the textile is immersed. Washing processes are wet processes and require great amounts of water and stones/chemicals/enzymes that have to be correctly disposed. For this reasons, washing techniques are often harmful for the environment and are not considered "green". The most common washing techniques for providing vintage look are stone, enzymes, and bleach washing.

[0007] Stone washing provides for stones, such as volcanic pumice stones, to be added as abradants during textile washing. These stones scrape off dye particles from the surface of the yarn of the textile. Colour fading is more apparent and less uniform with respect to other processes. Limitations of stone washing include wear, tear and damage of the textile and eventual metal buttons and rivets thereof and damage of the washing machines. Moreover, environmental harmful grit is produced by the stones. Additionally, areas wherein the dye have to be removed cannot be selected when carrying out stone washing.

[0008] Enzyme washing can be used industrially for replacing or complementing the stone washing process. In particular, enzymes such as laccases can be used in processes related to decolourisation of indigo dyed textiles. Enzymes washing processes have the following limitations: limited operational conditions of the enzymes, requirement of post-treatment of the textile, and limited textile loading size of the washing machine. Bleach washing is carried out with a strong oxidative bleaching agent, such as sodium hypochlorite or potassium permanganate. The bleaching effect and decolouration usually depend on the strength of the bleach liquor, liquor quantity, temperature and treatment time. Parameters above have to be carefully checked in every bleach washing process as fabric degradation can easily occur. This washing technique is the most harmful washing process for operators and for the environment, as large quantities of harmful chemicals (i.e. strong oxidative bleaching agents) are used to prepare the washing bath.

[0009] Laser technology, such as CO_2 laser treatment, can be applied to textile materials as an alternative to or along with conventional treatments such as stone washing, sanding and bleaching for achieving the vintage look. Laser treatments engrave the surface of the textiles, thereby obtaining colour fading to parts of the textile with high precision. The laser treatment is considered a dry treatment and therefore "green". High temperature of laser burns and removes part of the surface of the treated fabric, and thus colour removal is achieved. Textiles can be damaged by the burn and removal of the treated surface, and deformation and loss in strength of the textiles may occur. Deformation of the textile also limits the deep contrast look of a denim textile, i.e. the visual difference in the laser engraved area on denim fabric (blue-white contrast). The operational parameters of the laser treatment that provide colour removal on the textile, e.g. laser energy and treatment time, are the same that may cause damages to the treated textile; for this reason, it may be difficult to obtain a deep and intense vintage look on a textile with laser treatments without damaging it.

[0010] There is the need to provide a process that overcomes the numerous disadvantages of the finishing processes above mentioned to provide a vintage look on textiles.

SUMMARY OF THE INVENTION

[0011] Aim of the present invention is a method for changing the colour of a textile to provide a vintage look that is not harmful to the environment nor to the operating workers, that provides an effective colour fading, is fast, cost-effective, easy to carry out and that limits the eventual damages to the treated textile.

[0012] The above-mentioned aim, as well as others, are reached through the method of claim 1, namely a method for changing the colour of at least a part of a coloured fabric comprising the following steps:

a) providing said coloured fabric with one or more oxidizing agents;
b) heating the fabric obtained according to step a);

and

c) subjecting at least a part of the fabric obtained according to step b) to a laser treatment;

wherein step b) comprises heating the fabric at a temperature comprised in the range of 110 °C to 250 °C.

[0013] The method of the invention provides a change in the colour of a coloured fabric, in particular provides a fading in colour, and therefore vintage look is obtained.

[0014] The method of the invention is advantageous as it provides a vintage look to the fabric while avoiding or limiting the damages that conventionally occur when laser treatment is carried out, e.g. the damages caused by the burn and removal of part of the surface of the fabric stated above. Indeed, according to the method of the invention, the steps carried out before the laser treatment step increases the colour fading effects provided by laser treatment. Therefore, to achieve the same or even better colour fading as in conventional laser treatments, the laser treatment of step c) according to the method of the invention can be carried out e.g. with less power and/or for less time. Accordingly, the laser treatment step c) of the method of the invention provides cost-savings, in terms of less energy and time required to provide colour fading, and at the same time damages less the treated fabric with respect to conventional laser treatments. The method of the invention is also easy and fast to carry out, as it requires conventional equipment and non-expensive chemicals that are commercially available.

[0015] The method of the invention does not harm the environment nor operating workers, as it employs non-harmful chemicals.

[0016] Other objects of the present invention are a fabric obtainable according to the method of the invention and a garment comprising such fabric.

[0017] The invention is now further disclosed more in detail according to embodiments thereof.

[0018] As used herein, "change in colour" or similar terms, unless otherwise specified, refers to the fade of the colour of at least a part of a coloured fabric. This change in colour provides the vintage effect to the fabric well known to the person skilled in the art.

[0019] The heating temperature of step b) has been found to be particularly relevant to provide the change in colour and therefore the vintage look according to the method of the invention. The heating temperature has also been found not to damage the coloured fabric. According to preferred embodiments, the heating temperature is comprised in the range of 110 °C to 220 °C, more preferably of 140 °C to 220 °C, even more preferably of 160 °C to 200 °C, e.g. is 180 °C. According to embodiments, step b) is carried out for a time of at least 20 seconds, preferably in the range of 20 seconds to 15 minutes, more preferably of 30 seconds to 10 minutes, even more preferably of 30 seconds to 1.5 minutes, for example of 45 seconds. This brief time period has been found suitable to provide a change in the colour of the treated fabric when the method of the invention is carried out and does not provide damages to fabric. Step b) aims to activate the oxidizing agents. Activation of the oxidizing agents enhances the effect provided by the laser treatment in step c), i.e. the colour fading effect.

[0020] Without being bound to a specific technical explanation, we believe that the activated oxidizing agents may be able to partially oxidize the dye on the coloured fabric, possibly providing a partial, minor colour fading. Activation of the oxidizing agents is obtained by the heating step b).

[0021] This activation enhances the effects of laser treatment step c) and allows a much better control of the vintage effect with respect to conventional laser methods. For example, when the oxidizing agent is magnesium nitrate hexahydrate and when the fabric is coloured with indigo, the heating step b) provides activation of magnesium nitrate hexahydrate, which is believed to at least partially convert to nitric acid. This activation occurs at about 110 °C or more, preferably at least at 125-130 °C. Indigo may be partially oxidized by nitric acid, which converts to NO and water.

[0022] Preferred oxidizing agents are hydrated nitrates, e.g. Mg dihydrate, Mg hexahydrate ($Mg(NO_3)_2 \cdot 6H_2O$) and Al nonahydrate ($Al(NO_3)_3 \cdot 9H_2O$).

[0023] This first reaction obtained by the step of heating the fabric having on its surfaces hydrate compounds as oxidizing agents at specific temperatures and for reduced time (preferably for 30 seconds to 1.5 minutes) allows a first minor colour fading of at least part of the treated fabric. A major colour fading is obtained in laser treatment step c), and can also involve heating at least part of activated magnesium nitrate hexahydrate to convert it to NO_2, O_2 and MgO.

[0024] Major colour fading obtained in laser treatment step c) as referred herein means a treatment that provides the vintage look to the fabric, i.e. the final, deep colour fading of the selected areas of fabric that are treated with laser, and does not necessarily mean the conversion/reaction of the total amount of oxidizing agents present on the fabric. Step a) provides a coloured fabric to which one or more oxidizing agents are applied to. In embodiments, the oxidizing agent can be one or more of the following: perborate, persulfate, peroxide, permanganate, perchlorate, dichromate, chlorate, chlorite, bromate, nitrite, nitrate ions and/or salts containing the above ions. More preferably, the oxidizing agent is selected from nitrates, nitrate ions and/or hydrated nitrate salts. A preferred nitrate salt is magnesium nitrate. Magnesium nitrate, in particular magnesium nitrate hexahydrate, has been found to be particularly effective to provide the change of the colour to the coloured fabric according to the method of the invention. Magnesium nitrate is a salt that is commercially available and is not harmful to the environment, to the operators and to the fabric itself. Preferred compounds are hydrated nitrates, as for example magnesium nitrate dihydrate ($H_4MgN_2O_8$), magnesium hexahydrate ($Mg(NO_3)_2 \cdot 6H_2O$). In a particularly preferred embodiment, the oxidizing agent is mag-

nesium hexahydrate. Other examples of suitable oxidizing agents can be zinc nitrate, aluminium nitrate, sodium nitrate, silver nitrate, potassium nitrate, strontium nitrate, sodium nitrite.

[0025] Still further oxidizing agents may be selected from at least one of ammonium persulfate, sodium persulfate, sodium perborate, sodium perborate monohydrate, potassium dichromate, sodium dichromate, ammonium dichromate, barium peroxide, hydrogen peroxide solutions, strontium peroxide, zinc peroxide, sodium peroxide, calcium chlorate, potassium chlorate, sodium chlorate, magnesium perchlorate, sodium perchlorate, sodium perchlorate monohydrate, ammonium perchlorate, sodium chlorite, calcium hypochlorite, potassium permanganate, sodium permanganate, ammonium permanganate, and potassium bromate.

[0026] The amount of oxidizing agents per square meter of fabric can depend on the fabric to be treated. Preferably, the amount of oxidizing agents per square meter of fabric is comprised in the range of 0.1 g/m^2 to 100 g/m^2, more preferably of 1 g/m^2 to 50 g/m^2, even more preferably of 10 g/m^2 to 30 g/m^2. It has been found that the amounts of oxidizing agents indicated above provide an effective change in colour in the treated fabric.

[0027] According to embodiments, the fabric with one or more of an oxidizing agent is obtained by applying a composition comprising said one or more oxidizing agents to said fabric.

[0028] In particular, the fabric can be immersed in the composition, and/or the composition can be used to coat the fabric, whereby the oxidizing agents are applied to the fabric. The fabric may be squeezed to provide the required amount of oxidizing agent. According to preferred embodiments, a useful method to apply the composition comprising the oxidizing agents to the coloured fabric is padding. The composition can also comprise other components, such as wetting agents, preferably non-ionic wetting agents.

[0029] The composition is preferably an aqueous composition. For example, said aqueous composition may be advantageously used when the oxidizing agent is magnesium nitrate.

[0030] According to embodiments, the composition comprises an amount of oxidizing agent comprised in the range of 40 g/L to 200 g/L, preferably of 80 g/L to 160 g/L, more preferably is 120 g/L; and/or an amount of wetting agent comprised in the range of 0.5 g/L to 20 g/L, preferably of 1.5 g/L to 6 g/L, more preferably is 3 g/L.

[0031] The composition applied to the fabric according to the method of the invention does not comprise (i.e. it is free from) catalysts, such as acid or basic catalysts. Examples of these acid catalysts can be found in patent application US 2018/0291553 A1 at paragraphs [0031] to [0033].

[0032] Advantageously, the composition does not damage the fabric, as the chemicals present in the said composition are not harmful to the fabric.

[0033] According to embodiments, the method of the invention further comprises a drying step a'), said step a') being carried out after step a) and before step b). The drying step a') is preferably carried out at a temperature lower than the temperature of step b). Part of the oxidizing agents may also be activated during the drying step a'). The drying step a'), as well as the heating step b), can be carried out by any suitable means, such as with an apparatus, e.g. a stenter, or air drying; advantageously, these two steps can be carried out in the same apparatus, e.g. in the same stenter. According to embodiments, the drying step a') is carried out at a temperature comprised in the range of 80 °C to 220 °C, preferably 110 °C to 190 °C, more preferably is 150 °C, the temperature of step a') being lower than the temperature of step b). Advantageously, the drying step can be carried out until the fabric reaches a relative humidity lower than 20%, preferably lower than 15%, more preferably lower than 10%, even more preferably of about 6% or lower.

[0034] Preferably, step a') and/or step b) are carried out by hot air treatment, e.g. in a stenter or in a fan-assisted oven. According to embodiments, the laser treatment of step c) is carried out with a carbon dioxide laser (CO_2 laser).

[0035] According to embodiments, the laser treatment of step c) is carried out with a dpi value comprised in the range of 20 to 50, preferably of 33 to 37.

[0036] According to embodiments, the laser treatment of step c) is carried out with a focal length comprised in the range of 80 to 148 cm, preferably is 148 cm.

[0037] According to embodiments, the laser treatment of step c) is carried out with a laser beam frequency of 5 kHz.

[0038] According to embodiments, the laser treatment of step c) is carried out with a pulsed laser. Preferably, the energy per pulse is comprised in the range of 450 to 650 W, preferably is 450 W.

[0039] According to embodiments, the laser treatment of step c) is carried out with a jump speed is about 5150 μm/s. As used herein, "jump speed" refers to the transition velocity of the laser beam from an engraving point to another.

[0040] According to embodiments, the laser treatment of step c) is carried out with a jump delay comprised in the range of 50 to 300 μs, preferably is about 50 μs. As used herein, "jump delay" refers to the preparation time (i.e. delay time) of the laser before engraving when it reaches an engraving point to another.

[0041] According to embodiments, step c) is carried out using one or more of the laser parameters (i.e. dpi, focal length, laser beam frequency, energy per pulse, jump speed and jump delay) as disclosed above.

[0042] Step c) can be carried out either on the warm fabric, for example immediately after or shortly after step b) has been carried out, or on the cold fabric after the fabric subjected to step b) has cooled down.

[0043] It has been found that laser treatment, for example the laser treatment of step c), provides an improved colour fading when steps a) and b) are carried

out, compared to the colour fading obtained by the same laser treatment without first carrying out steps a) and b). The heating of the fabric provided with nitrate ion and/or nitrate salts and/or suitable oxidizing agents according to the method of the invention has been found to be particularly relevant to provide the above-mentioned increase in colour fading of the laser treatment. For this reason, as it is demonstrated in the Experimental section below, the method of the invention allows obtaining a suitable and effective change to the colour of the fabric by reducing the operational parameters of the laser treatment that may cause damages to the fabric (such as laser treatment time). Laser treatment step c) provides major colour fading, whereby a strong and deep colour fading is obtained. Accordingly, vintage effect is obtained after step c) of the invention on the laser engraved area(s).

[0044] The method of the invention allows a much better control of the vintage look of the fabric compared to conventional methods that provide vintage look, in particular to conventional laser treatments. The better control is achieved by the combination of a first, minor bleaching with heat (step b)) and then a second, major bleaching with laser treatment (step c)). It was advantageously observed that the combination of the drying treatment according to step a') of the method of the invention and the heating treatment according to step b) produces a partial activation of oxidizing agents on the fabric and, thus, a first fading, which is subsequently enhanced by a major fading given by laser treatment.

[0045] It was surprisingly found that the activation of the fabric having oxidizing agents on its surface, for example hydrated nitrates, at temperatures from 110°C to 250°C for a preset period of time consents to avoid the use of an acid or basic catalyst, thereby reducing the amount of resources needed to obtain a fade effect on at least part of the coloured fabric. Another advantage of the method of the invention is the possibility to provide the fabric treated only with the first, minor bleaching (step b)) to the producer of the garments. The producer can then carry out the second, major bleaching, namely the laser treatment, directly to the garment, based on the requirements of the market and when necessary. The garment producer can also treat the fabric according a preferred pattern of fading as required by the final look of the garment.

[0046] The method of the invention also provides energy savings and time savings. The invention method is also suitable to treatment of elastic fabrics, e.g. fabrics comprising elastic yarns, preferably elastomeric yarns, because the lower energy required for the laser beam results in a dramatically less damaged elastic material present in the laser treated elastic yarns. If the fabric to be treated with the method of the invention is an elastic fabric that requires a heat setting treatment, i.e. a treatment to fix the fabric stretchability, the heat setting treatment and the heat treatment of step b) can be carried out simultaneously. In other words, the heat treatment of step b) can also be used as a heat setting treatment to fix the stretchability of the elastic fabric to be treated with the method of the invention.

[0047] As stated above, conventional laser treatments may damage the fabrics, as they result in removal of part of the treated surface, whereas the method of the invention limits such damages. With reference to Figure 1, which represents a pair of pants 10 showing vintage look in determined, selected areas 11, the amount of fabric surface removed by a laser with the method of the invention may be assessed on a washed fabric, i.e. a fabric from which the Mg Nitrate or other oxidizing agent has been removed. For example, the linear density of one or more yarns of the area showing vintage look 11, and the linear density of one or more yarns of the area not showing vintage look 12 may be measured and compared. Such assessment can be made, alternatively or together with the above, by measuring the weight per area of part of the fabric of area 11 and the weight per area of part of the fabric of area 12. In possible embodiments, when the method of the invention is carried out, the measured linear density of a yarn, and/or the measured weight per area of the fabric, of the area 11 may be substantially the same or very similar to the ones measured for the area 12. Accordingly, the area showing vintage look 11 of the garment 10 is not substantially damaged or is only slightly damaged by the method of the invention.

[0048] According to embodiments, the coloured fabric is coloured with at least an indigoid dye. Indigoid dyes are a group of dyes well known in the art, including indigo, that can be reduced to dihydro derivatives (leuco form) and can resemble indigo in their structure. The method of the invention has been found particularly effective when the coloured fabric is dyed with at least an indigoid dye, such as indigo, providing a deep vintage look to the fabric.

[0049] According to embodiments, the coloured fabric is made of cellulose-based fibres and/or blends thereof, preferably is made of cotton fibers and/or blends thereof. The fabric may be elastic. These types of fabrics are used in the denim industry, wherein the vintage look is particularly sought. Moreover, the change in colour provided by the method of the invention has been found particular effective on these types of fabrics.

[0050] According to embodiments, one or more further steps to provide vintage look can be carried out after step c). Preferably, such further step(s) is a stone washing step d) carried out after step c). The stone washing step d) is useful to enhance the colour fading effect provided by the method of the invention. Stone washing carried out after steps a) to c) is less harmful to the environment with respect to when it is carried out alone: the change in colour is already provided by steps a) to c) according to the method of the invention, therefore the stone washing step d) can be carried out for less time and/or with less stones to reduce the harmful grit produced by the stones.

[0051] According to embodiments, the coloured fabric

treated according to the method of the invention is part of a garment or apparel. This allows providing the change in colour to targeted part(s)/area(s) of the garment or apparel so that the final product, i.e. the garment or apparel, has the vintage look in the part(s)/area(s) where it is wanted. The method of the invention allows to control the part(s)/area(s) of the garment where the change in colour has to occur, as the change in colour will occur only in the part(s)/area(s) of the garment wherein steps a) to c) are carried out.

[0052] According to embodiments, steps a), a') (if present) and b) can be carried out on the coloured fabric, and step c) can be carried out on the garment comprising such coloured fabric. This allows the advantage stated above, i.e. the possibility to provide the fabric treated only with the first, minor bleaching (step b)) to the producer of the garments.

[0053] A further object of the present invention is a fabric obtainable according to the method as defined in any one of its embodiments. The fabric of the invention shows a vintage look in its parts wherein the method of the invention has been carried out and is not substantially damaged by the method of the invention, or its damages are reduced compared to conventional laser treatment having the same depth/strength of colour fading. Another object of the invention is a garment comprising the fabric of the invention according to any of its embodiments.

[0054] Fabrics and garments of the invention have been treated with oxidizing agents and may comprise an amount of e.g. nitrate ions and/or of nitrate salts and/or of counter-ion(s) (when nitrate salts have been used as oxidizing agents) after the method of the invention has been carried out on them. According to a preferred embodiment, fabrics and garments of the invention may comprise an amount of e.g. nitrate ions and of counter-ion(s) (when hydrate nitrates have been used as oxidizing agents) after the method of the invention has been carried out on them.

[0055] Accordingly, the amount of oxidizing agents can be evaluated by separating the oxidizing agents, e.g. nitrate ions and/or the nitrate salts and/or the counter-ion(s), from the fabric or garment of the invention with known methods, and by quantifying such an amount with known methods, e.g. complexometric titration or chromatography.

[0056] The amount of fabric surface removed in the fabrics or garments of the invention may be assessed as disclosed above with reference to Figure 1, preferably after the fabrics or garments have been washed such that they are separated from the composition comprising the oxidizing agents, e.g. with the method stated above.

BRIEF DESCRIPTION OF THE FIGURES

[0057]

Figure 1 represents a garment, in particular a pair of pants, showing vintage look in determined areas.

Figure 2a is a picture of a comparative fabric which is subjected to laser treatment only. Figure 2b is a picture of a fabric of the invention.

Figure 3a is a macro picture of a comparative fabric which is subjected to laser treatment only. Figure 3b is a macro picture of a fabric of the invention.

EXPERIMENTAL SECTION AND DETAILED DESCRIPTION OF THE FIGURES

[0058] The invention is further illustrated by means of Figures 2a, 2b, 3a and 3b of examples that are provided for illustrative purposes only and do not aim to limit the scope of the invention.

Example 1

[0059] A composition comprising 120 g/L of magnesium nitrate hexahydrate and 3 g/L of a nonionic wetting agent (Cottoclarin TR (BRP Kimya)) is prepared. An indigo coloured cotton fabric is padded with the so-prepared composition (step a)), thereby providing 22 g of magnesium nitrate hexahydrate per square meter of indigo coloured cotton fabric. Then, the fabric is dried in a stenter machine at 150 °C until it reaches 6% of relative humidity (step a')). Afterward, the fabric is heated in the same stenter at 180 °C for 45 seconds (step b)). Finally, a laser treatment step with a CO_2 laser (VAV r-Series 650 W) is carried out on a predetermined area of the fabric (step c)). Laser parameters are 37 dpi, focal length: 148 cm, frequency: 5 kHz, energy per pulse: 450 W, jump speed: 5149.7 μm/s and jump delay: 50 μs. The colour has faded in the area where laser treatment has been carried out, thereby a vintage look is obtained.

[0060] To further improve the vintage look of the fabric, the fabric has been subjected to stone washing for 30 minutes (step d)). The colour has faded on the whole fabric; the area where laser treatment has been carried out presents a higher colour fading with respect to the other areas.

Example 2

Comparative example of change in colour

[0061] A fabric of the invention is prepared according to steps a), a'), b) and c) as disclosed in Example 1.

[0062] A comparative fabric is prepared by carrying out laser treatment using the same parameters disclosed in Example 1 starting from an identical fabric as the one of Example 1. The comparative fabric has not been subjected to steps a), a') and b) of the method of the invention.

[0063] The change in colour of the fabrics is evaluated by Datacolor 6000 spectrophotometer using the strength adjustment method, which is a conventional method for comparing the strength of colours. Max absorption peak is set at 660 nm. Fix adjustment strength is set to 100%.

The comparative fabric shows a result of 100% strength. The fabric of the invention shows a result of 52% strength.

[0064] According to the above results, the fabric of the invention has less colour strength compared to the comparative fabric, therefore a higher colour fading is obtained with the method of the invention compared to the laser treatment only. The results of this example are also showed in Figures 2a and 2b, which show respectively the comparative fabric and the fabric of the invention, and Figures 3a and 3b, which show respectively macro pictures of the comparative fabric and of the fabric of the invention. As it can be observed by Figures 2 and 3, the change in colour is more apparent in the fabric of the invention (Figures 2b and 3b) with respect to the change in colour in the comparative fabric (Figures 2a and 3a).

[0065] Therefore, it has been demonstrated that carrying out steps a) and b) of the method of the invention before laser treatment improves the colour fading effects of the laser treatment itself.

Example 3

Energy and time saving of the method of the invention

[0066] A comparative fabric and a fabric of the invention have been prepared starting from identical untreated fabrics. The comparative fabric has been prepared carrying out only laser treatment on the untreated fabric.

[0067] It has been observed by the present Example that the laser treatment to manufacture the fabric of the invention provided an energy saving of about 12% to 20% and a time saving of about 12% to 15% per garment, in particular per pair of pants, and an energy saving of about 120 to 130 W and of about 86 seconds per m^2 of treated fabric, with respect to the laser treatment to manufacture the comparative fabric, to provide a comparable vintage look.

[0068] The present Example proves that the laser treatment (step c)) of the method of the invention, compared to laser treatment only, (i) provides cost-savings in terms of energy-savings and time-savings, and (ii) can be carried out with reduced values of the operational parameters that may cause damages to the fabric, such as laser energy and laser treatment time.

Example 4

[0069] The method of the invention is carried out on a fabric. 5 g of such fabric are kept in 200 mL of deionized water for 30 minutes at a temperature of 50 °C. Then, complexometric titration is carried out on the water above using EDTA. It resulted that such water contained 5.8 mg/L of magnesium ion corresponding to about 62 mg/L of magnesium nitrate hexahydrate.

Claims

1. A method for changing the colour of at least a part of a coloured fabric comprising the following steps:

   a) providing said coloured fabric with one or more of an oxidizing agent, preferably selected from: perborate, persulfate, peroxide, permanganate, perchlorate, dichromate, chlorate, chlorite, bromate, nitrite ions, nitrate ions and/or salts containing the above ions;
   b) heating the fabric obtained according to step a); and
   c) subjecting at least a part of the fabric obtained according to step b) to a laser treatment;

   wherein step b) comprises heating said fabric at a temperature comprised in the range of 110 °C to 250 °C.

2. The method according to claim 1, wherein the heating temperature is comprised in the range of 110 °C to 220 °C, preferably of 140 °C to 220 °C.

3. The method according to claim 1 or 2, wherein the heating temperature is comprised in the range of 160 °C to 200 °C, preferably is 180 °C.

4. The method according to any claim 1 to 3, wherein heating step b) is carried out for a time of at least 20 seconds, preferably in the range of 20 seconds to 15 minutes, more preferably of 30 seconds to 10 minutes, even more preferably of 30 seconds to 1.5 minutes.

5. The method according to any claim 1 to 4, wherein said oxidizing agent is selected from nitrate ions and/or nitrate salts, preferably is magnesium nitrate.

6. The method according to any claim 1 to 5, wherein said oxidizing agent is selected from hydrated nitrates, preferably it is at least one of magnesium nitrate dihydrate, magnesium nitrate hexahydrate and aluminum nitrate nonahydrate.

7. The method according to any claim 1 to 6, wherein said fabric with one or more of an oxidizing agent is obtained by applying a composition comprising said one or more oxidizing agents to said fabric.

8. The method according to claim 7, wherein said composition is an aqueous composition comprising an amount of said oxidizing agent in the range of 40 g/L to 200 g/L, preferably of 80 g/L to 160 g/L, more preferably is 120 g/L, and/or an amount of wetting agent comprised in the range of 0.5 g/L to 20 g/L, preferably of 1.5 g/L to 6 g/L, more preferably is 3 g/L.

9. The method according to any claim 1 to 8, further comprising a drying step a'), said step a') being carried out after step a) and before step b) and at a temperature comprised in the range of 80 °C to 220 °C, preferably 110 °C to 190 °C, more preferably is 150 °C, the temperature of step a') being lower than the temperature of step b).

10. The method according to any claim 1 to 9, wherein said laser treatment of step c) is carried out using one or more of the following laser parameters:

- a dpi value comprised in the range of 20 to 50, preferably of 33 to 37;
- a focal length comprised in the range of 80 to 148 cm, preferably is 148 cm;
- a laser beam frequency of 5 kHz;
- an energy per pulse comprised in the range of 450 to 650 W, preferably is 450 W;
- a jump speed is about 5150 μm/s; and
- a jump delay comprised in the range of 50 to 300 μs, preferably is about 50 μs.

11. The method according to any claim 1 to 10, wherein said coloured fabric is coloured with indigo and/or at least an indigoid dye.

12. The method according to any claim 1 to 11, wherein said coloured fabric includes cellulose-based fibres, preferably cotton fibers.

13. The method according to any claim 1 to 12, wherein a stone washing step d) is carried out after step c).

14. The method according to any claim 1 to 13, wherein said coloured fabric is part of a garment or apparel.

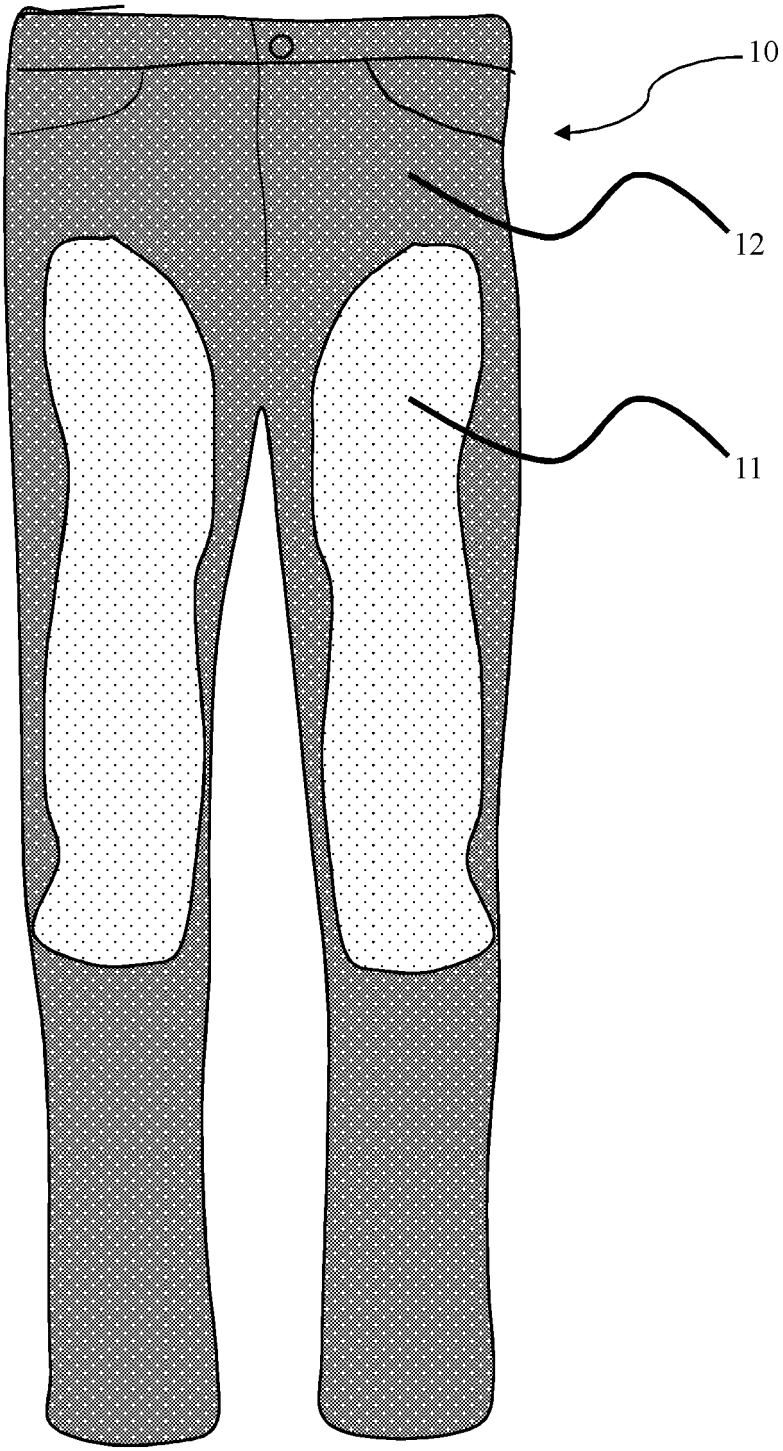
15. A fabric as obtainable according to steps a) and b) as defined in claim 1, said fabric comprising an oxidizing agent, preferably selected from nitrate ions and/or nitrate salts, preferably hydrate nitrate salts.

16. A fabric as obtainable according to the method of any claim 1 to 14, comprising elastic yarns, preferably elastomeric yarns.

17. A garment comprising the fabric according to claim 15 or 16.

18. A method for increasing the colour fading of a laser treatment on coloured fabrics, **characterized in that** steps a) and b) as defined in any one of claims 1 to 14 are carried out before said laser treatment in the absence of acid catalysts.

Figure 1



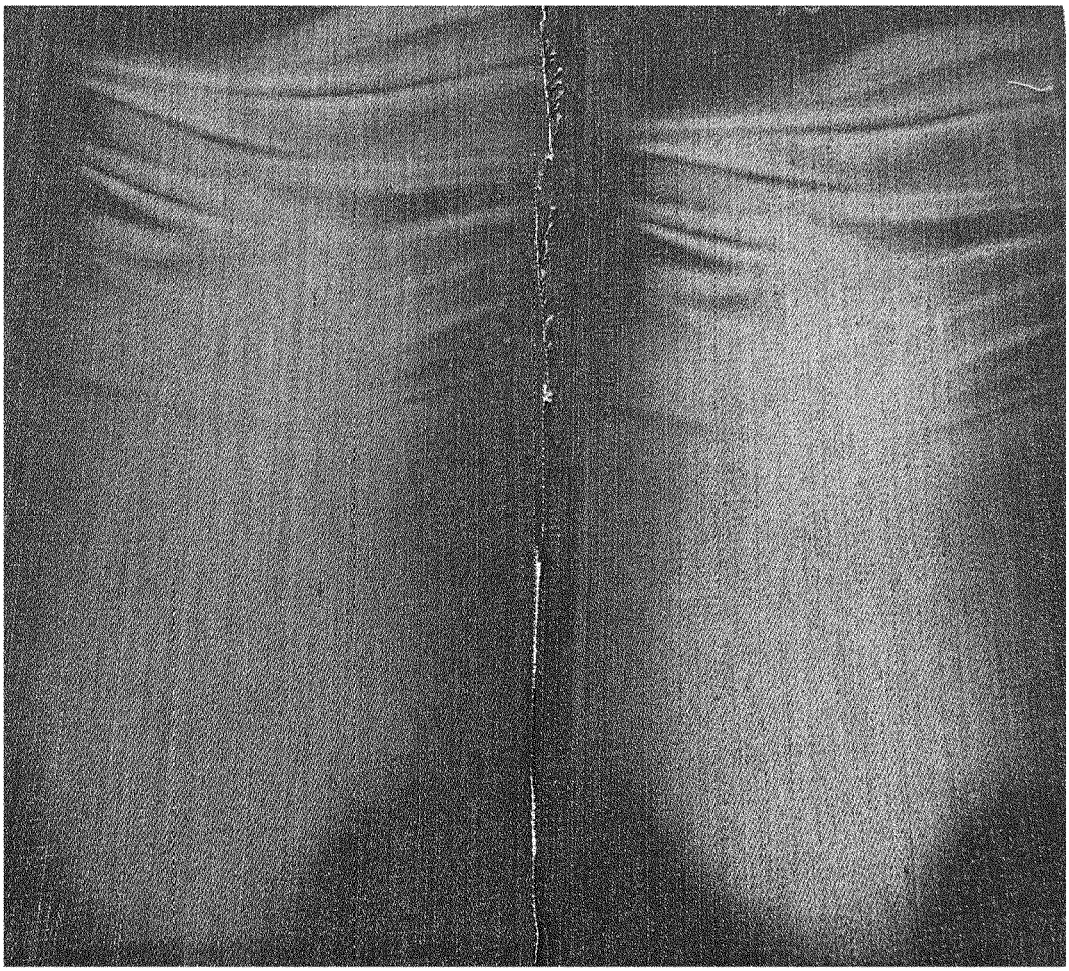


Figure 2a Figure 2b

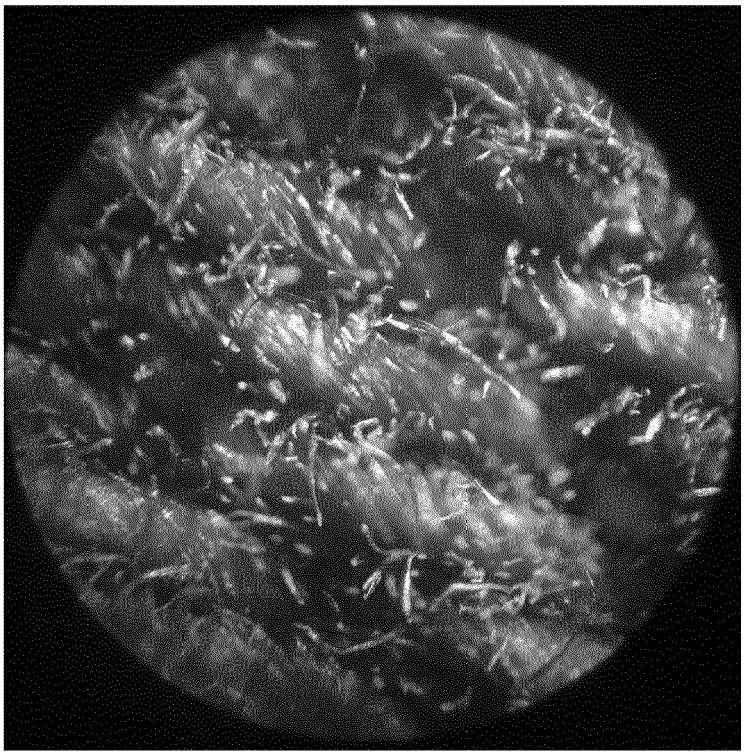


Figure 3a

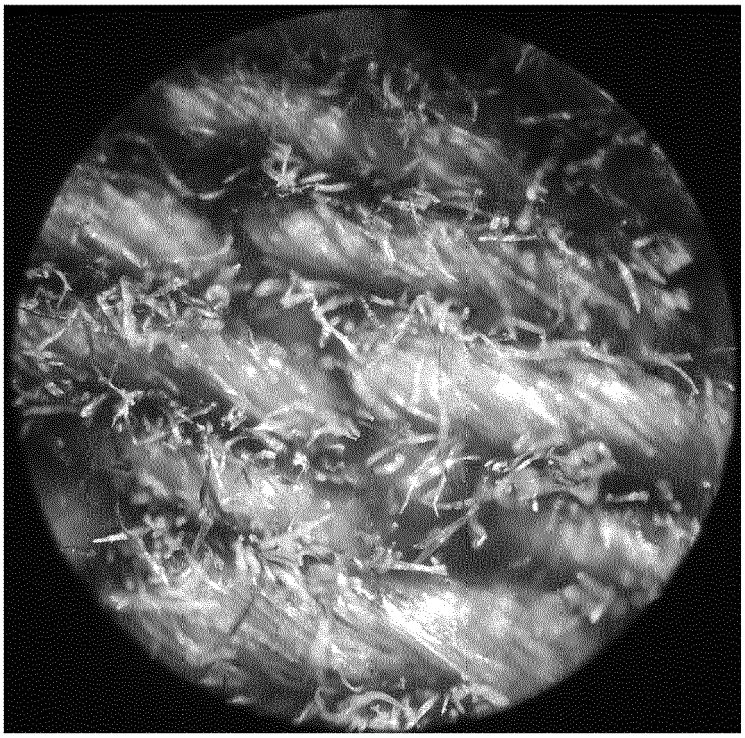


Figure 3b

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 3769

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

D06P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 July 2020	Blas, Valérie

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REFERENCES CITED IN THE DESCRIPTION

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