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(54) METHOD FOR MANUFACTURING A DYED TEXTILE

(57) A method of producing a dyed textile, which method comprises a step of a) providing a plurality of weft threads and a plurality of warp threads, a step of b) impregnating the warp threads with a solution containing a polymer selected from chitosan or derivatives thereof, a step of c) weaving the weft threads and the warp threads to obtain a textile, a step of d) dyeing the textile with a dye composition and a step of e) drying the dyed textile. The dye composition comprises a predetermined amount of graphite and no intermediate processing steps are provided between said dyeing step d) dyeing and said drying step e).

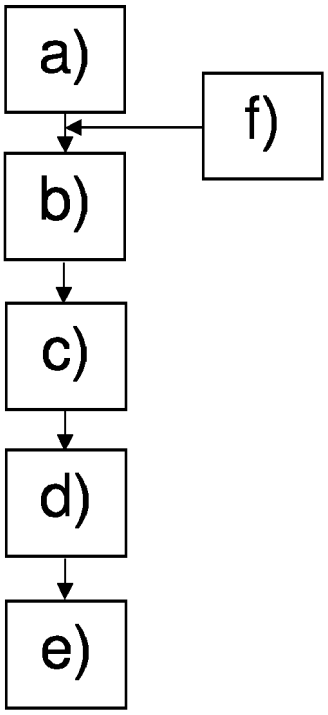

FIG.1

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Description

Field of The Invention

[0001] The present invention generally finds application in the field of textile processing and particularly relates to a method of producing a dyed textile.

Background art

[0002] The use of methods and plants for dyeing textiles with synthetic chemical dyes has been been long known in the textile processing industry.

[0003] A first drawback of these prior art methods is that these dyes are, at least partially, hazardous and polluting, and not easily disposable, and they must be used in large amounts to obtain an appreciable effect on textiles.

[0004] A further drawback is that the yarns of the textile must undergo a number of processes before and after dying. Namely, the yarns must be desized, washed, mercerized and bleached before and after dyeing.

[0005] This extends the overall processing time and at least partially weakens the textile fibers.

[0006] Another drawback is that the use of these chemical dyes requires large amounts of water, which increases the overall processing consumption and costs.

[0007] In an attempt to at least partially obviate these drawbacks, methods of treating and dyeing textiles have been developed which include the application of a reinforcing agent to the yarns of the textile before submitting it to processing steps.

[0008] WO2014/170876 discloses a method of processing and dyeing textiles which includes a step, known as desizing step, in which a predetermined amount of chitosan or derivatives thereof is applied on the yarns of the textile before dyeing.

[0009] Chitosan is a natural product derived, for instance, from the chitin of crustaceans and its application on the yams imparts greater strength and dye absorption capacity thereto.

[0010] After application, chitosan is directly cured on the surface of the yarns, to further improve their mechanical properties before dyeing.

[0011] Nevertheless, the dyes that are used in the later dyeing step are also of chemical-synthetic type and suffer from the aforementioned drawbacks.

[0012] A further drawback of this solution is that yarns must undergo additional processing steps, including curing or partial removal of chitosan, before being dyed.

[0013] Another drawback is that the overall water consumption for the entire process is only partially reduced and have a dramatic impact on the overall processing cost.

[0014] A further drawback is that this method requires plants with dedicated workstations to ensure optimized implementation.

[0015] Yet another drawback is that this solution does not afford the use of waste materials from other processes, possibly occurring in different technical fields.

[0016] WO2016/034997, ITMI2012778, US5501711, and the papers "Chitosan boosts dyeing efficiency" and "Effective utilization of chitosan for dyeing" disclose methods of treating textiles with chitosan to improve affinity with a dye composition.

[0017] US1870408 and FR569763 disclose fabric or yarn dyeing methods which use graphite.

[0018] One drawback of these solution is that a minor or variable increase of the affinity of the fabric or yarn with the dye composition is obtained after treatment.

Technical Problem

[0019] In the light of the prior art, the technical problem addressed by the present invention is to provide a method of producing a dyed textile that is very simple and inexpensive and avoids the use of synthetic chemical dyes, which are highly toxic and not easily disposable.

Disclosure of the invention

[0020] The object of the present invention is to obviate the above drawback, by providing a method of producing a dyed textile that is highly efficient and relatively cost-effective.

[0021] A particular object of the present invention is to provide a method as described hereinbefore that is very simple and inexpensive.

[0022] Another object of the present invention is to provide a method as described hereinbefore that reduces the overall water consumption.

[0023] A further object of the present invention is to provide a method as described hereinbefore that does not use synthetic chemical dyes.

[0024] Another object of the present invention is to provide a method as described hereinbefore that does not weaken the structure of the textile threads.

[0025] A further object of the present invention is to provide a method as described hereinbefore that reduces the overall amount of dyes required for optimal dyeing of the textile.

[0026] Yet another object of the present invention is to provide a method as described hereinbefore that may be used in existing plants of the textile industry.

[0027] A further object of the present invention is to provide a method as described hereinbefore that can use waste materials obtained from different processes.

[0028] These and other objects, as more clearly explained below, are fulfilled by a method of producing a dyed textile as defined in claim 1, which comprises a step of a) providing a plurality of weft threads and a plurality of warp threads, a step of b) impregnating the warp threads with a solution containing a polymer for improving the mechanical properties of the threads, a step of c) weaving the weft threads and the warp threads to obtain a textile, a step of d) dyeing the textile with a dye com-

position and a step of e) drying the dyed textile.

[0029] The dye composition comprises a predetermined amount of graphite and no additional intermediate textile processing steps are provided between said dyeing step d) and said drying step e).

[0030] Advantageous embodiments of the invention are obtained in accordance with the dependent claims.

Brief Description of The Drawings

[0031] Further features and advantages of the invention will be more apparent from the detailed description of a preferred, non-exclusive embodiment of method of producing a dyed textile according to the invention, which is described as a non-limiting example with the help of the annexed drawings, in which:

FIG. 1 is a block diagram of the method of producing a dyed textile according to the invention.

Detailed description of a preferred exemplary embodiment

[0032] Particularly referring to the aforementioned figure, there is shown a method of producing a dyed textile composed of a plurality of warp threads and a plurality of weft threads.

[0033] The warp and weft threads may be cotton threads, cotton and linen threads or cotton and silk threads, and the final textile may be a denim fabric.

[0034] In a preferred embodiment of the invention, the method comprises a step of a) providing a plurality of weft threads and a plurality of warp threads and a step of b) impregnating the warp threads with a solution containing a polymer for improving the mechanical properties of the threads.

[0035] The step b) is typically known as "desizing" and is carried out, as is known per se, using a desizing machine with a respective tank containing the solution with the polymer.

[0036] Conveniently, the polymer may be selected from the group of polycationic biopolymers comprising chitosan and derivatives thereof, which have a plurality of periodically distributed positive charges.

[0037] Chitosan is a polysaccharide composed of D-glucosamine and N-acetyl-D-glucosamine monomers, and is obtained by deacetylation of chitin, a natural polymer that is found in the exoskeleton of crustaceans.

[0038] Furthermore, D-glucosamine monomers comprise respective primary amine groups which can be easily protonated under weakly acidic conditions and are responsible for the positive charges distributed along the polymer chain.

[0039] The impregnating solution may contain an amount of chitosan or derivatives thereof ranging from 1% to 3% by weight.

[0040] Upstream from the impregnation step b), the method may advantageously comprise a step of f) dipping the warp threads in pure water and later squeezing the threads to remove excess water.

[0041] With the dipping step f) the inner side of the warp threads may be completely imbibed, while the outer side is available for later impregnation with the chitosan solution.

[0042] The method comprises a step of c) weaving the chitosan-impregnated weft threads and warp threads to obtain a fabric, and this step may be preferably preceded by a step of stretching and winding the warp threads.

[0043] Furthermore, a step of d) dyeing the textile with a dye composition of dyeing and a step of e) drying the dyed textile are provided.

[0044] The dyeing step d) is carried out by dipping the impregnated textile in a tank containing the dye composition and squeezing the textile with one or more squeezing rolls to facilitate absorption of the composition.

[0045] As is known in the art, the dyeing step d) may be carried out using a padding machine, which comprises the tank for the composition and one or more squeezing rolls.

[0046] In a first embodiment of the invention, the drying step e) is carried out using a tentering machine disposed in line with the tank and the squeezing rolls of the padding machine, such that the dyeing step d) and the drying step e) may be carried out continuously.

[0047] A second embodiment of the invention differs from the first embodiment in that the drying step e) is carried out using a tentering machine disposed in parallel with respect to the tank and the squeezing rolls of the padding machine, such that the dyeing step d) and the drying step e) may be carried out discontinuously.

[0048] In both first and second embodiments, the drying step may be carried out in the tentering machine for 15 seconds at a temperature of 120°C.

[0049] In a peculiar aspect of the invention, the dye composition comprises a predetermined amount of graphite, for imparting a gray color to the textile. Furthermore, the method does not include intermediate textile treatment steps between the dyeing step d) and the drying step e).

[0050] Due to the combination of these features and the use of chitosan, the use of synthetic chemical dyes may be avoided and the overall water and power consumptions of the entire textile washing and dyeing process may be reduced.

[0051] Graphite is electrically conductive, as each of its graphene sheets has a free electron that is not involved in the formation of covalent bonds with other carbon atoms of the sheet.

[0052] The negative charges generated by the free electrons of graphite interact with the positive charges of chitosan, thereby facilitating absorption of the dyeing composition on the threads of the textile.

[0053] Advantageously, the dye composition may comprise a predetermined weight fraction of water and a predetermined weight fraction of a base compound containing powdered graphite.

[0054] For example, the weight fraction of water may

range from 70% to 90% based on the total weight of the dye composition and the weight fraction of the base compound may range from 10% to 30% based on the total weight of the dye composition.

[0055] Of course, these weight fractions are only given by way of example and may be suitably changed according to the desired intensity of the color to be imparted to the textile, without departure from the scope of the present invention.

[0056] Furthermore, powdered graphite may be obtained from waste materials of other processes carried out in other industrial contexts, such as automotive or electronics.

[0057] The dye composition is obtained directly within the dyeing tank of the padding machine, by dilution of the base compound with a predetermined amount of water.

[0058] During the dyeing step, the graphite in the dye composition is almost entirely absorbed by the textile, which will simplify the later dye composition disposal and storage steps.

[0059] Preferably, the base compound may comprise a weight fraction of water that ranges from 35% to 45%, a weight fraction of powdered graphite that ranges from 40% to 50%, and an overall weight fraction of a bactericidal agent, an antifoaming agent, dipropylene glycol, a dispersing agent and a binding agent that ranges from 5% to 25% based on the total weight of the base compound.

[0060] The dispersing agent may be sodium polyacrylate and the binding agent may be selected from the group of the acrylates, whereas the base compound can exhibit a predetermined final viscosity grade.

[0061] The formation of the base compound first includes the step of providing a predetermined amount of powdered graphite having a coarse particle size, e.g. 100 μm, and the step of introducing it into a stirrer with the other above mentioned components.

[0062] The stirring step is carried out for 20 minutes at 90 rpm and results in a pre-dispersion, in which all the above listed components are uniformly distributed.

[0063] Then, the pre-dispersion is treated under pressure in a horizontal mill comprising zirconium balls. The pre-dispersion is treated in the mill until the particle size of the graphite powder is less than 7μm.

[0064] The pre-dispersion is filtered with a self-cleaning filter at 100 mesh to obtain the base compound, which is later packaged in plastic containers having a capacity of 30 kg each.

[0065] It will be appreciated from the foregoing that the method of producing a dyed textile fulfills the intended objects and particularly meets the requirements of avoiding the use of synthetic dyes, using recycled materials and reducing the overall power and water consumptions.

[0066] The method of producing a dyed textile according to the invention is susceptible of a number of changes and variants, within the inventive concept disclosed in the appended claims.

[0067] While the method has been described with particular reference to the accompanying figures, the numerals referred to in the disclosure and claims are only used for the sake of a better intelligibility of the invention and shall not be intended to limit the claimed scope in any manner.

Industrial Applicability

[0068] The present invention may find application in industry, because it can be produced on an industrial scale in textile processing plants.

Claims

1. A method of producing a dyed textile, which method comprises the steps of:

   a) providing a plurality of weft threads and a plurality of warp threads;
   b) impregnating the warp threads with a solution containing a polymer for improving the mechanical properties of the threads;
   c) weaving the weft threads and the warp threads to obtain a textile;
   d) dyeing the textile with a dye composition;
   e) drying the dyed textile;

   characterized in that said dye composition comprises a predetermined amount of graphite, and **in that** that no intermediate processing steps are provided between said dyeing step d) and said drying step e), said polymer being selected from the group comprising chitosan or derivatives thereof, having a plurality of periodically distributed positive charges adapted for interaction with the negative charges of said dye composition.

2. A method as claimed in claim 1, wherein said dyeing step d) is carried out by dipping the impregnated textile in a tank containing said dye composition and squeezing the textile with one or more squeezing rolls to facilitate absorption of the composition.

3. A method as claimed in claim 1, **characterized in that** said dye composition comprises a predetermined weight fraction of water and a predetermined weight fraction of a base compound containing powdered graphite.

4. A method as claimed in claim 3, **characterized in that** the weight fraction of water ranges from 70% to 90% based on the total weight of the dye composition, and said weight fraction of the base compound ranges from 10% to 30% based on the total weight of the dye composition.

5. A method as claimed in claim 3, **characterized in that** said base compound is diluted with water directly in said impregnation tank to form said dye composition.

6. A method as claimed in claim 1, **characterized in that** it comprises, upstream from the impregnation step b), a step of f) dipping the warp threads in pure water and later squeezing the threads to remove excess water.

7. A method as claimed in claim 1, **characterized in that** said drying step e) is carried out using a tentering machine disposed in line with said tank and said squeezing cylinders, said dyeing step d) and said drying step e) being carried out continuously.

8. A method as claimed in claim 1, **characterized in that** said drying step e) is carried out using a tentering machine disposed in parallel with respect to said tank and said squeezing rolls, said dyeing step d) and said drying step e) being carried out discontinuously.

9. A method as claimed in claim 1, **characterized in that** said impregnating solution contains a weight fraction of chitosan or derivatives thereof that ranges from 1% to 3%.

10. A method as claimed in claim 3 wherein the base compound comprises:

a weight fraction of water that ranges from 35% to 45%;
a weight fraction of powdered graphite that ranges from 40% to 50%;
an overall weight fraction of an antifoaming agent, a bactericidal agent, dipropylene glycol, a dispersing agent and a binding agent that ranges from 5% to 25%.

11. A method as claimed in claim 10, wherein said dispersing agent is sodium polyacrylate and said binding agent is selected from the group of the acrylates.

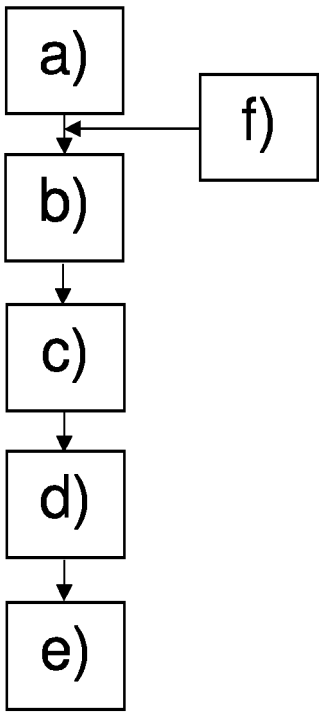

FIG.1

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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 7214

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 August 2018	Fiocco, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 7214

DOCUMENTS CONSIDERED TO BE RELEVANT

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