S. H. MHATRE

3,544,261

... FOR BLEACHING TEXTILES

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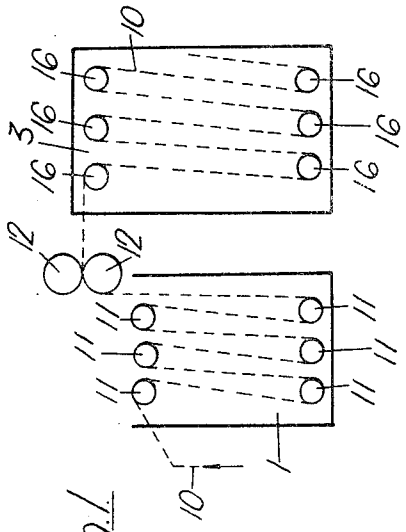

Fig. 1

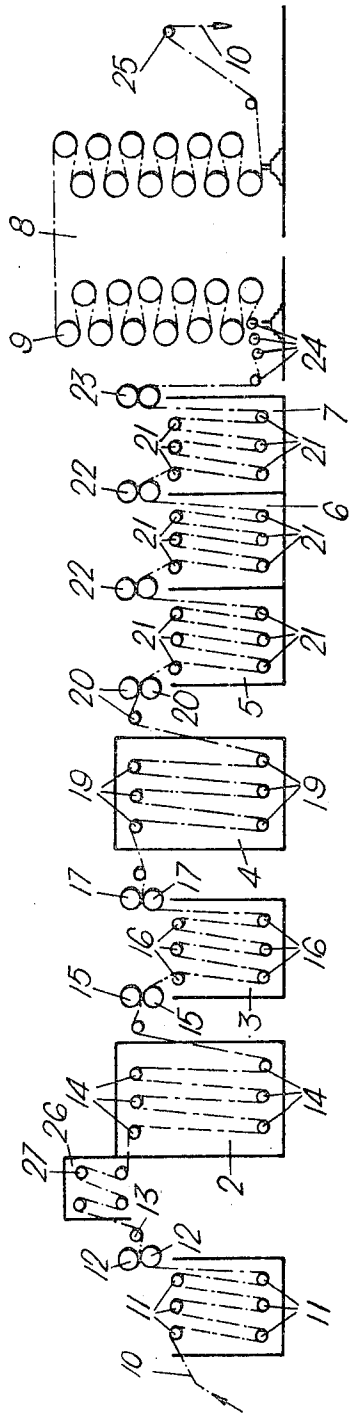

Fig. 2

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# PROCESS FOR BLEACHING TEXTILES

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## ABSTRACT OF THE DISCLOSURE

A process for bleaching textile materials of natural and/or synthetic fibers in the form of yarn, webs, woven and non-woven fabrics, filaments, and the like in which the textile material is impregnated with an aqueous hypochlorite bleaching solution having an active chlorine content of about 0.25–10 grams/liter and a pH of about 7–12. The impregnation is conducted so as to provide on the textile material a concentration of chlorine of about 0.06–1.0% by weight of the textile material. The impregnated textile material is then exposed to an atmosphere of saturated or supersaturated steam at a temperature of about 50–140° C. for a period of about 15–60 seconds. The bleached material is then subjected to washing and drying.

The proposed process is an improvement over the known process of bleaching textiles using sodium or calcium hypochlorite solution alone or in admixture with other substances. The conventional practice of bleaching consists of impregnating textiles in a hypochlorite solution and storing it until bleaching is complete. The same practice is followed while using the hypochlorite in admixture with other substances. This is a time consuming process and involves the use of a J-box or a timing wheel in the rope form or open width where the fabric is subjected to considerable crushing which may lead to shadow creases. This is a serious disadvantage if the fabric or web or any other textile material is to be subsequently dyed. The conventional process is also limited to a narrow range of useful pH, viz 9.5 to 10.5 in that at pH values below 9.5 the risk of degradation of cellulose is a serious factor and at pH values above 10.5 a satisfactory level of whiteness is not produced.

The object of this invention is to improve the conventional process so as to complete the bleaching within a relatively short period. Time for bleaching can in fact be reduced to the order of a few seconds from that of few hours as at present.

It is proposed according to this invention that the treatment of textiles with a hypochlorite or a hypochlorite in admixture with other substances be conducted in an atmosphere of steam. This process which is carried out in open width in the case of fabrics, webs or tapes can also be rendered truly continuous in that further bleaching, washing and drying or any other treatment can be carried out in a composite unit so designed for the purpose.

It is found that very little active chlorine is left behind on the fabric or web or yarn in the proposed process, the advantages resulting thereby being:

(1) avoidance of the risk of after-tendering
(2) elimination of the necessity for anti-chlor treatment.

Broadly speaking the process is carried out as under:

The textile material which is in the grey state, or scoured or desized state, is treated, conveniently at room temperature, with either sodium hypochlorite or calcium hypochlorite solution (aqueous) or both, with or without other additives such as wetting agents or chelating agents



such as ethylenediamine tetraacetic acid and diethylenetriamine pentaacetic acid or sodium chloride or sodium bromite, or other catalyst and/or accelerator for the purpose, proprietary or otherwise, squeezed to give the required pick-up of bleaching agent, and then heated under steam when in a few seconds the bleaching action is completed.

For treating with bleaching solution the textile material, dry or wet, is passed through a pad or mangle containing the bleaching solution maintained at a desired pH, ranging from 7 to 12, and at room temperature. It is subjected to the benefit of one or more nips so adjusted to give the desired resultant pick-up of bleaching agent. Usually the pick-up of 45 to 100% of the bleaching or of 0.05 to 1.0% of active chlorine on the weight of the textile material is desirable. For heating under steam the so treated material is exposed to the action of either saturated or superheated steam in a chamber or a pressure vessel, which is also referred to as "ager." The value of this temperature may range from 50° C. to 140° C. For temperature ranges above 80° C., the textile material (after impregnating with the said bleaching solution, with or without additives), may be preheated in a preheater using steam or infrared or direct heat radiations just prior to steaming in the main chamber.

It is observed that under the aforesaid conditions the bleaching action is completed within 15 to 60 seconds.

Concentration of bleaching solution is preferably from 0.25 to 10.0 gms./l. of active chlorine.

The present invention also proposes a plant for bleaching using the foregoing process.

Basically the plant will comprise of an impregnating chamber for the bleaching solution and a steam chamber or "ager" with means to convey textile material from the former to the latter and means to remove the bleached textile material from the steam chamber.

In a preferred embodiment a pre-heating chamber is included in the plant prior to conveying the impregnated textile material to the steam chamber.

According to a further embodiment the plant comprises an impregnating chamber, a steam pre-heating chamber, a second impregnating chamber and steam chamber for completing bleaching.

Also included in a plant for carrying out the process of this invention may be (i) a washing machine into which textile material is conveyed from the steam chamber, and (ii) drying means. Drying means may be a series of heated cylinders or a hot air chamber.

Means for expressing the textile material after impregnation as well as after washing are also preferably included in the plant according to various embodiments.

A pad or mangle, with or without an auxiliary saturator is used as an impregnation chamber so that material to be treated with bleaching solution can be given the benefit of one or more impregnations and nips to impart requisite pick-up of bleaching agent.

It is found that the degradation of cellulose in the textile material bleached by the process herein described, as determined by the fluidity values in a cuproammonium solution, is lessor comparable to that of the same textile material treated by the conventional process. It is also found that the degree of whiteness as determined by visual inspection of the bleached textile material or the reflectance values as measured by any of the standard instruments for the said purpose for the material bleached by the herein proposed process is equal or superior to that produced by the conventional process and that the tensile strength, both for the warp and weft, of the textile material bleached in accordance with this process is equal or superior to that of the textile material bleached in the conventional manner.

The results of comparative tests done on four sets of cotton material bleached (i) by the herein proposed process and (ii) by the conventional process are given below:

EXAMPLE

Identical samples of textile material, as given in the following Tables I and II, were treated by conventional as well as herein proposed bleaching methods.

For conventional process a sodium hypochlorite solution in water containing 2 grams per litre of available or active chlorine at a pH between 10–10.5 at 30° C. was used. The period for which the material stayed in contact with the bleaching solution was 45 minutes.

For the herein proposed process also sodium hypochlorite solution in water containing 2 grams per litre of available or active chlorine was used. The pH of the bleaching solution was kept at 8.5±0.25. The textile material was drawn through the impregnating chamber at the rate of 55 meters per minute so that total contact time thereof with the bleaching solution was 12 seconds. The bleaching solution was kept at room temperature. Temperature in steam treatment chamber was between 95 and 98° C.

TABLE I

| Quality | Fluidity: Conventional process | Fluidity: New process |
|---|---|---|
| Drill (8.1 ozs./sq. yd.): | | |
| 1 | 3.5 | 2.5 |
| 2 | 3.0 | 3.3 |
| 3 | 3.1 | 3.8 |
| 4 | 2.8 | 2.8 |
| Satin drill (7.8 ozs./sq. yd.): | | |
| 1 | 3.2 | 2.9 |
| 2 | 4.2 | 3.6 |
| 3 | 2.8 | 3.3 |
| 4 | 5.1 | 4.1 |
| Gaberdine (6.7 ozs./sq. yd.): | | |
| 1 | 1.5 | 2.3 |
| 2 | 2.5 | 1.9 |
| 3 | 5.3 | 2.0 |
| 4 | 5.0 | 3.2 |
| Poplin (3.6 ozs./sq. yd.): | | |
| 1 | 3.7 | 2.9 |
| 2 | 3.4 | 4.5 |
| 3 | 2.6 | 3.0 |
| 4 | 5.0 | 3.9 |

TABLE II
[Tensile strengths (lbs.) process]

| Sample No. | Conventional: Warp | Conventional: Weft | Herein proposed: Warp | Herein proposed: Weft |
|---|---|---|---|---|
| 1 | 480 | 167 | 490 | 167 |
| 2 | 467 | 160 | 468 | 163 |
| 3 | 445 | 160 | 447 | 173 |
| 4 | 472 | 177 | 478 | 173 |

Size of test strip was 7" x 4" and machine used was "Goodbrand Machine."

The invention is described below with reference to the accompanying drawings.

In the drawings:

FIG. 1 shows a plant which will be needed to carry out the process in its broadest sense.

FIG. 2 shows more comprehensive plant in accordance with this invention.

Referring to FIG. 1 the impregnating box is marked **1** and has a series of rollers **11** around which the textile material **10** passes and gets impregnated with the bleaching solution contained in the box **1** and gets nipped by the nipping roller **12** to the desired amount of pick-up from where it passes on to steam treatment chamber or ager **3** having a set of rolls **16**. Steam, superheated or saturated, is injected into the chamber **3**. The speed at which rolls **11** and **16** rotate is adjusted to provide time required for proper impregnation and duration of steam treatment.



In FIG. 2 the textile material **10**, from the first impregnating chamber **1** after passing around a set of rollers **11** is nipped at rollers **12** and conveyed by the nipping rollers and roller **13** into preheating chamber **2** where after passing over a set of rollers **14** it is conveyed by rollers **15** into the second impregnating chamber **3**. After passing over sets of rollers **16** in chamber **3**, the textile material is nipped at rollers **17** and conveyed into steaming chamber or ager **4** where the textile material is finally bleached. From chamber **4** after passing over the rollers **19** the bleached material is nipped at rollers **20** and conveyed therefrom to a washing machine having three compartments **5**, **6** and **7** with a series of rollers **21** for passage of the material through the compartments **5**, **6** and **7** of the washing machine, and rollers **22**, **23** for nipping. Nipping rollers **23** and rollers **24** convey the bleached and washed material to drying means **8** comprising a series of heated rollers **9** after passing around which the bleached, washed and dried material **10** is taken off a roller **25**. If desired, a preheater **26** with rollers **27** may be employed in conjunction with steam chamber **2**.

What we claim is:

**1**. In a process of bleaching a continuous strip of textile material with a hypochlorite solution, the improvement which comprises: drawing said material through an aqueous hypochlorite bleaching solution having a chlorine content of about 0.25–10 grams/liter and a pH of about 7–12, the rate of movement of said material through said solution being such as to impregnate said material with about 0.05–1.0% of chlorine by weight of said material; exposing said resultant impregnated material for a period of about 15–60 seconds to an atmosphere of saturated or supersaturated steam at about 50–140° C. and washing and drying said material.

**2**. A process according to claim **1** in which the chlorine content of said hypochlorite solution is about 2.0 grams/liter and the pH about 8.5, and the rate of movement of said material through said hypochlorite solution is such as to expose it to said solution for a contact time of about 12 seconds.

**3**. A process according to claim **2** in which the bleaching solution is at room temperature and the resultant impregnated material is subjected to preheating prior to exposure to an atmosphere of saturated or supersaturated steam.

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