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PROCESS FOR BLEACHING TEXTILE MATERIALS
PRENATATED WITH SODIUM CHLORITE

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PROCESS FOR BLEACHING TEXTILE MATERIALS PREGNATED WITH SODIUM CHLORITE

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The invention relates to a process for bleaching textile materials, such as fibres, yarns, and knitted or woven fabrics, by means of activated sodium chloride. More particularly, the invention relates to the bleaching of cotton fabrics by means of activated sodium chloride.

It is conventional to bleach textile materials by means of sodium chloride which has been activated for this purpose by adding an acid such as formic or acetic acid. Sodium chloride is a very effective bleaching agent, and has the important advantage that an overdose does not lead to the overbleaching of the treated material. Nevertheless, the sodium chloride bleaching process has not been extensively used up to the present, because the process involves the formation of chlorine dioxide, which has a very strong corrosive action to which practically no materials are resistant. Thus, it was hitherto very difficult, if not impossible, to prevent the apparatus used in sodium chloride processes from being heavily corroded.

Various proposals have been made to restrict the corrosion of the apparatus by the chlorine dioxide. For instance, it has been proposed to limit the formation of the chlorine dioxide by the use of a rather high pH and a relatively low temperature; however, this method leads to excessive bleaching times that are much too long for a continuous process in the order, for example, of six hours.

It has also been proposed to prevent the formation of the chlorine dioxide by using an eter instead of an acid for the activation of the sodium chloride. However, it was found that the amount of eter to be added in order to obtain an effective bleaching action was so large that it caused an excessive acidity which led again to the formation of chlorine dioxide.

It is an object of the invention to provide a process for bleaching textile materials by means of sodium chloride, wherein corrosion of the apparatus is substantially prevented without an undue increase of the required duration of the treatment.

Another object of the invention is to provide a process for bleaching textile materials by means of sodium chloride, wherein the corrosion of the apparatus is effectively prevented by binding the chlorine dioxide formed during the bleaching operation.

Still another object of the invention is to provide a process for bleaching textile materials by means of sodium chloride, which is adapted to be carried out continuously without undue corrosion of the apparatus.

Further objects of the invention, and the exact nature thereof will appear from the following description, given with reference to the accompanying drawing, in which the sole figure schematically represents an apparatus by means of which the process according to the invention may be carried out.

According to the invention, the material is impregnated with sodium chloride and treated in a closed space in which a steam atmosphere prevails, the chlorine dioxide formed during the reaction being bound by injecting a volatile reducing agent into said space.

By the action of the injected reducing agent, the chlorine dioxide formed during the reaction is converted into hydrochloric acid, which is also rather aggressive, but to which various materials are sufficiently resistant. A very suitable reducing agent to be used in the process according to the invention is hydrogen sulphide. At the prevalent relatively high temperatures (140 to 212°F.), hydrogen sulphide is practically insoluble in the sodium chloride solution used for impregnating the textile material. It reacts spontaneously with the chlorine dioxide formed during the reaction, and may be rapidly and easily distributed in the reaction space. The free sulphur formed by the reduction of the chlorine dioxide may be discharged from the reaction space together with the treated material, and may be readily removed from the material by washing. In fact, the amount of sulphur formed during the reaction is small, since only a small amount of chlorine dioxide is formed if the process is properly controlled, so that the amount of hydrogen sulphide added may likewise be small.

Another suitable reducing agent to be used in the process according to the invention is an aqueous solution of formaldehyde. During the reduction, the formaldehyde is converted to formic acid, which may be used for activating the sodium chloride, so that it is not necessary to add a separate activating agent to the solution used for impregnating the material.

Preferably, the reducing agent is supplied to the reaction space together with the steam. As stated hereinbefore, the temperature in the reaction space is generally between 140 and 212°F. In order to provide for an effective control of this temperature, it is preferred to heat the reaction space indirectly by means of steam pipes, in addition to the direct heating by the steam supplied to the reaction space.

The invention will be more fully explained by reference to some examples. These examples relate to the bleaching of a cotton fabric having 70 ends and 55 picks per inch, and a specific weight of .033 lb. per sq. ft.

Example 1

An aqueous sodium chloride solution is prepared by dissolving 20 parts by weight of 50% sodium chloride and 2 parts by weight of sodium pyrophosphate (serving as a buffering agent) in 1000 parts of water. The solution is adjusted to a pH of 4.5 by means of acetic acid. The cloth is impregnated with this solution and pressed to obtain a humidity of 100%. The impregnated cloth is introduced, through a suitable lock, into the reaction space, in which a steam atmosphere with a temperature of 203°F. prevails. Together with the steam, an amount of hydrogen sulphide sufficient to bind the chlorine dioxide formed during the reaction is introduced into the reaction space. The dosage of the hydrogen sulphide is checked during the reaction by introducing a paper strip impregnated with a lead acetate solution into the reaction space through a suitable lock. The cloth remains in the reaction space for 45 minutes; the amount of hydrogen sulphide supplied during this time amounts to about 0.3 parts by weight on 1000 parts of cloth. After the reaction, the cloth is removed from the reaction space through a suitable lock, washed in three successive baths at 203°F., 158°F., and room temperature, respectively, and dried.

Example 2

The cloth is treated as described in Example 1 except that the sodium chloride solution is adjusted to a pH of 7 by means of acetic acid, and that an aqueous 40% solution of formaldehyde is introduced into the reaction space instead of hydrogen sulphide. The amount of formaldehyde solution supplied to the reaction space
during the reaction time of 45 minutes is about 6 parts by weight on 1000 parts of cloth.

It will be understood that the operating conditions, in particular the pH of the sodium chlorite solution (if hydrogen sulfide is used as a reducing agent), the steam temperature in the reaction space, the reaction time, and the amount of reducing agent supplied to the reaction space, are dependent on the nature of the material to be treated. The most suitable conditions may be readily determined in each case by experiments. It has been found, however, that generally the preferred values are from 4 to 5 for the pH of the sodium chlorite solution, from 176° F. to 212° F. for the steam temperature, and from 45 to 90 minutes for the reaction time.

The process according to the invention may be carried out with the aid of existing apparatus, which is well known in the art, so that a detailed description appears to be superfluous. For purposes of illustration, a suitable apparatus has been schematically shown in the accompanying drawings.

The cloth to be treated is supplied from a roll 1 to a bath 2, in which it is impregnated with the sodium chlorite solution, which may or may not be activated with formic or acetic acid, according as hydrogen sulfide or formaldehyde is used as a reducing agent. The cloth is then pressed by means of the rollers 3 and introduced through a lock 4 into the reaction space 5. Two rolls 6 and 7 are arranged in the space 5. The incoming cloth is wound on one of these rolls, for instance on the roll 6, together with a second layer wound off from the other roll 7. The roll 7 also contains a third layer which leaves the reaction space through a lock 8. As soon as the second and the third layer have been completely removed from roll 7, the incoming cloth is transferred to roll 7 by means of suitable gripping members (not shown), and wound on this roll together with one of the layers present on roll 6, while the other layer on roll 6 is removed from the reaction space through lock 8. Thus, if the rolls are suitably proportioned, the cloth may be continuously supplied to and removed from the reaction space, and still remain in the same during the required reaction time. By means of a conduit 9, steam is supplied to the reaction space, together with a suitable amount of a volatile reducing agent, such as hydrogen sulfide or formaldehyde. If formaldehyde is used, the solution in bath 2 need not be activated by means of an acid. The cloth leaving the reaction space through lock 8 is successively led through three washing baths 10, 11 and 12, and to a drying device (not shown). Heating tubes 13, through which steam is led, are provided in the lower part of the reaction space. The condensates formed in the reaction space is removed by conventional means (not shown).

Although the invention has been described hereinbefore with reference to some specific examples, it is to be understood that many modifications are possible within the scope of the invention as set forth in the claims.

I claim:

1. In a bleaching process, wherein a textile material impregnated with a sodium chlorite solution having a pH between 4 and 7 is treated in a closed reaction chamber heated with steam to a temperature of 140 to 212° F., the method of neutralizing the chlorine dioxide vapors developed from the impregnated material comprising the step of introducing a volatile reducing agent selected from the group consisting of hydrogen sulfide and formaldehyde into said reaction chamber.

2. A process for bleaching textile materials comprising the steps of impregnating the material to be treated with an aqueous sodium chlorite solution adjusted to a pH between 4 and 7, removing excess solution from said material, treating the impregnated material in a closed reaction chamber heated with steam to a temperature of 140–212° F. for 45 to 90 minutes, and introducing a volatile reducing agent selected from the group consisting of hydrogen sulfide and formaldehyde into said reaction chamber during said treatment to neutralize the chlorine dioxide vapors developed from the impregnated material.

3. The process as claimed in claim 2, wherein about 0.3 part by weight of hydrogen sulfide to 1000 parts of textile material are supplied to said reaction chamber during said treatment together with the steam.

4. The method as claimed in claim 2, wherein about 6 parts by weight of an aqueous 40% solution of formaldehyde on 1000 parts of textile material are supplied to said reaction chamber together with the steam.

5. The process as claimed in claim 2, wherein the sodium chlorite solution is adjusted to a pH between 4 and 5 by the addition of acetic acid.

6. The process as claimed in claim 2, wherein the sodium chlorite solution is adjusted to a pH of 7 by the addition of acetic acid.

7. The process as claimed in claim 2, further comprising the step of washing the textile material after said steam treatment to remove reaction products of said volatile reducing agent.

References Cited in the file of this patent

UNITED STATES PATENTS

2,358,866 MacMabon ------------ September 26, 1944
2,429,317 Hampel --------------- October 21, 1947
2,513,788 Day et al. ------------ July 4, 1950
2,521,340 Carr --------------- September 5, 1950
2,526,859 Aston -------------- October 24, 1950

FOREIGN PATENTS

118,721 Australia -------------- July 18, 1944
121,074 Australia -------------- February 20, 1946
141,483 Australia -------------- June 13, 1951

OTHER REFERENCES