METHOD OF DECOLORIZING BLUE JEANS BASED ON CLIENT-DESIRED DESIGN

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ABSTRACT

The present invention provides a method of decolorizing blue jeans based on a client-desired design. Hydrochloric acid (HCl) and sodium chloride solution are provided to an electrolytic tub, and are electrolyzed to generate chlorine gas and hydrogen gas. Hypochlorous acid solution is separated from sodium hydroxide. Tapes are attached to the blue jeans to make a constant form. The tape-attached blue jeans are submerged in the hypochlorous acid to change a colorant of the blue jeans.
METHOD OF DECOLORIZING BLUE JEANS
BASED ON CLIENT-DESIRED DESIGN

RELATED APPLICATION

This application relies for priority upon Korean Patent Application No. 2001-13372, filed on Mar. 15, 2001, the contents of which are herein incorporated by reference in their entirety.

DESCRIPTION

The present invention is a method of decolorizing blue jeans and, more particularly, to a method of decolorizing blue jeans based on the client-desired design.

BACKGROUND OF THE INVENTION

Blue jeans are trousers that are made of fabrics obtained by colorizing closely woven fabric with blue colorant such as indigo blue dye. Therefore, the blue jeans become favorite jeans due to toughness, durability, and practicality. Like other fashion clothes, blue jeans have kept pace with various tastes or liking of users by changing their forms and colors.

Since blue jeans are originally rough as well as tough, a user, maker or merchant often intentionally makes the blue jeans worn out by a sandblasting or stone washing process. The colors of initially colorized blue jeans are generally dark, so that there may be a need for partial decolorization thereof by reacting with a decolorant such as sodium hypochlorite (HOCI) during a drum processing. Furthermore, by attaching tapes to parts of the blue jeans during decolorization thereof, the parts are not decolorized to attain desired patterns or shapes.

However, conventional methods of making patterns on the blue jeans have difficulty in attaining desired patterns and clear colors. In a conventional decolorization process, a chemical solution such as sodium hypochlorite or calcium hypochlorite is put into an amount of water having a temperature between 60°C and 80°C (if necessary, abrading materials are added). Together with the water containing the chemical solution, blue jeans are rotated in a drum for 30 minutes or longer. In a case where tapes are attached to the blue jeans in order to attain a desired pattern, the water or other chemical materials may have an influence on the tapes. In addition, an high processing temperature may soften an adhesive element and turbulence may cause the tapes to thrust out from their original positions. Therefore, it is hard to attain the desired pattern. Further, if the tapes are thrust out from the blue jeans during the decolorization, tape-attached parts are also decolorized to make it hard to attain a clear color and pattern.

Also, the conventional decolorization method demands high costs for raising the temperature of a processing solution and continuously providing sodium hypochlorite and an amount of water. Wastewater is inevitably produced in the conventional decolorization. When the wastewater is discharged to a river, environmental pollution results. Therefore, if the wastewater is treated and discharged, additionally costs are incurred.

SUMMARY OF THE INVENTION

A main purpose of the present invention is to provide a method of decolorizing blue jeans with a clear color and a desired design.

Another purpose of the present invention is to provide an environment-friendly method of decolorizing blue jeans, which is capable of preventing waste, pollution, and waste treating cost.

Still another purpose of the present invention is to provide a method of decolorizing blue jeans, which is capable of cutting down decolorization cost by retrieving a chemical material to be used as a treatment material in waste produced during decolorization.

One aspect of the present invention is a method of decolorizing blue jeans using the steps of: providing hydrochloric acid and sodium chloride solution to an electrolytic tub to generate chlorine gas and hydrogen gas, separating hypochlorous acid (HOCI) solution from sodium hydroxide, attaching tapes to the blue jeans to make a constant form, and submerging the tape-attached blue jeans in the hypochlorous acid to change the color of the blue jeans.

Another aspect of the present invention consists of providing hydrochloric acid (HOCI) and sodium chloride solution to an electrolytic tub to generate chlorine gas and hydrogen gas, separating hypochlorous acid solution from sodium hydroxide, colorizing the blue jeans with an oil-based colorant oxidized by the hypochlorous acid to make a constant form, and submerging the tape-attached blue jeans in the hypochlorous acid to change the color of the blue jeans.

The oil-based colorant is identical to a colorant colorized on the blue jeans. When additionally colorizing the blue jeans, colorization amount is controlled at each part of the blue jeans through a plurality of control steps.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a concept diagram showing the general structure of one example of an apparatus for decolorizing blue jeans according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Although specific terms are used in the following description for the sake of clarity, these terms are intended to refer only to the particular feature of the invention selected for illustration and are not intended to define or limit the scope of the invention.

Referring now to FIG. 1, an apparatus for decolorizing blue jeans includes an electrolytic tub 10. A semi-permeable membrane 7 is placed in the center of the electrolytic tub 10. In the early stage, a small amount of hydrochloric (HCl) solution and sodium chloride (NaCl) solution are provided to the electrolytic tub 10. Preferably, NaCl is 0.1-7% solution by weight.

The electrolytic tub 10 has a cathode 5 and an anode 3. Generally, the cathode 5 is made of one selected from the group consisting of platinum, platinum-plated conductor, a material of high electric conductivity that is not eroded by sodium hydroxide, and the anode 3 is made of stainless steel that is strong for the erosion. If a voltage is applied to the cathode 5 and the anode 3 by supplying a power thereto, sodium ions dissociated from sodium chloride are induced to the cathode 5. As a result, an electron is gained to generate sodium metal.
The sodium metal immediately reacts with water to produce sodium hydroxide. The sodium hydroxide is dissolved in the water to produce sodium hydroxide solution. At this time, hydrogen gas is produced and exhausted. Chlorine ions are induced to the anode 3, so that an electron is lost to produce a chlorine molecule. A part of the chlorine molecule is gasified to be exhausted into the air, and another part reacts with the water to produce hydrogen chloride and hypochlorous acid. The hydrogen chloride and the hypochlorous acid are immediately dissolved in the water to produce hydrochloric acid solution and hypochlorous solution. The hypochlorous acid (HOCl) is an oxidant having a strong oxidizing power. The oxidizing power of the hypochlorous acid (HOCl) is 40-80 times stronger than that of sodium chlorate (NaClO) which is an element of a commercial sterilizing-bleaching agent. Although the membrane 7 isolates a cathode space 8 from an anode space 9, sodium ions, chlorine ions, and hydrogen ions are permeated well.

Therefore, the content of sodium chloride in the electrolytic tub 10 is reduced as time passes. Further, the electrolytic tub 10 has the hydrochloric acid and hypochlorous solutions that are intensively concentrated on the anode and cathode spaces 9 and 8. Since hydrochloric acid is induced to each of the cathode 5 and anode 3 to produce a part of chlorine and hydrogen, it is not intensively concentrated thereon. Generating materials of each of the cathode 5 and anode 3 are represented by chemical formulas 1 and 2 below.

\[ \text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HCl} + \text{HClO} \]  
\[ 2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2 \]

The electrolytic tub 10 is connected, via a processing pipe, to a processing tub 30 in which a process for decolorizing blue jeans is carried out. The processing pipe has an output pipe making a material flow from the processing tub 30 to the electrolytic tub 10, and an input pipe 18 making a material flow from the electrolytic tub 10 to the processing tub 30. A pump and valves for making solution flow are installed at the input pipe 18 and the output pipe. In this case, the input pipe 18 may also serve as the output pipe (i.e., one pipe may serve as input and output pipes) and the pump enables the solution to bi-directionally flow.

If a concentration of the hypochlorous acid reaches a predetermined level in the anode space 9 of the electrolytic tub 10, solution in the anode space 9 flows to the processing tub 30 via the input pipe 18.

A chlorine trap duct 14 and a hydrogen trap duct 12 are installed at the electrolytic tub 10. The chlorine trap duct 14 traps chlorine produced over the anode space 9, and the hydrogen trap duct 14 traps hydrogen produced over the anode space 8. Also, the ducts 12 and 14 are connected to a scrubber 20 for processing a gas via a duct pipe 16 for carrying the gas. On the duct pipe 16, a fan FAN may be installed for helping to carry a gas and easily trapping the gas. A confluence may be formed in a center of the duct pipe 16 to mix trapped gases with one another.

Alternatively, the confluence may serve as a reaction chamber just before scrubbing the trapped gases. In the confluence, hydrogen reacts with chlorine to produce a hydrogen chloride gas that is provided to a processing chamber in the scrubber 20.

A shower facility 22 is installed entirely over the processing chamber in the scrubber 20. A shower pipe 26, which is connected to the cathode 8 of the electrolytic tub 10, is connected to the shower facility 22. A pump and a valve are mounted on the shower pipe 26 to carry a chemical solution (here, sodium hydroxide filling most part of the cathode 8) to the processing chamber in the scrubber 20. In the processing chamber, the sodium hydroxide solution is sprayed through the shower facility 22. Most of the sprayed sodium hydroxide solution reacts with the hydrogen chloride provided to the processing chamber to produce a sodium chloride solution. Most of the sodium chloride solution directly drops to a retrieving tub incorporated with the processing chamber. Scattered minute solution drops are condensed and trapped by a de-mister installed at an upper part of the scrubber 20, and then flows into the retrieving tub.

Thus, contaminants are not discharged to the air while only inoxious gases are exhausted via the scrubber 20. In the confluence of the duct pipe 16 and the scrubber 20, a chemical reaction is represented by chemical formulas 3 and 4 below.

\[ \text{H}_2 + \text{Cl}_2 = 2\text{HCl} \]  
\[ \text{HCl} + \text{NaOH} = \text{NaCl} + \text{H}_2\text{O} \]

A sodium chloride solution is put into a retrieving tub 24 that is located at a lower part of the scrubber 20. The retrieving tub 24 is connected to the electrolytic tub 10 via a retrieving pipe 32 having a valve and a pump. Thus, the sodium chloride solution, which is generated in the scrubber 20 via the retrieving pipe 32, is carried to the electrolytic tub 10. Since elements of the sodium chloride solution are all originated from the electrolytic tub 10, processing elements are to be retrieved.

Decolorization-desired blue jeans 31 are submerged, for a predetermined time, in the processing tub 30 with the hypochlorous acid (partially containing hydrochloric acid or other materials) carried from the cathode and anode spaces 8 and 9. Since tapes protect partial surfaces of the blue jeans 31, a chemical reaction is suppressed at tape-attached parts. On the other hand, in unprotected parts, colorant elements for making a color of the blue jeans 31 react with the hypochlorous acid. This results in considerable oxidation of the unprotected parts. Further, a chlorination reaction may occur partially. Owing to the strong oxidizing power of the hypochlorous acid, the reaction is made at a temperature between 10°C and 30°C, preferably between 18°C and 26°C. While it is appreciated that the submerging time is variable with the processing conditions, two to ten minutes are sufficient. Preferably, the tapes do not damage clothes of the blue jeans although they are removed after the decolorization process, and are treated by an adhesive agent which does not weaken an adhesive power in spite of reaction with water or other decolorization chemicals.

With variation of the colorant elements, the blue jeans are gradually decolorized. A degree of the decolorization is controllable with the submerging time, a concentration of the hypochlorous acid, a processing temperature. Since the hypochlorous acid used to decolorize the blue jeans 31 are changed to hydrogen chloride, the hypochlorous acid solution in the processing tub 30 is changed to a solution mainly containing a diluted hydrochloric acid when the decolorization process is performed therein.
The diluted hydrochloric acid solution is provided to the electrolytic tub 10 via the output pipe of the processing pipe. The diluted hydrochloric acid solution is also made up of materials provided from the electrolytic tub 10. Therefore, a process for providing the diluted hydrochloric acid solution may be called a retrieving process. A chemical reaction in the processing tub 30 is represented by chemical formulas 5 and 6 below.

\[
\begin{align*}
R & = \text{OH} + \text{HCl} & \text{[Chemical Formula 5]} \\
R & = \text{Cl} + \text{H}_2\text{O} & \text{[Chemical Formula 6]}
\end{align*}
\]

[0028] wherein the R group (R→) is an atomic group having any structure, and a conventional colorant element is made up of an organic group.

[0030] Generally, oxidized or chlorinated colorant elements are continuously attached to the blue jeans. For that reason, the oxidized or chlorinated colorant elements are not diffused to the processing tub 30 and the diluted hydrochloric acid can be retrieved. If the changed colorant elements are separated from the blue jeans to contaminate the processing tub 30, they must be eliminated by performing an extra treatment process.

[0031] Although it has been described that all the steps are separately performed in this embodiment, a continuous process may be made in which each pipe continuously puts a material out by controlling a rotation speed based on a content of provided materials and an apparatus and environmental conditions such as temperature and pressure for each processing reaction. Since the continuous process does not require manpower for operating a valve or pump of each pipe, automation and mechanization can easily be realized in the whole process.

[0032] According to the present invention, because hypochlorous acid having a strong oxidizing power is used, it is not necessary to raise a processing temperature. Therefore, tapes are not separated from the blue jeans during a process for decolorizing the blue jeans to obtain a design of client-desired form and cleanliness. Further, all materials are circulated except oxygen or chlorine. If water for supplementing oxygen and a part of exhausted gas or a chlorine gas is supplemented, the process for decolorizing blue jeans can continuously be performed only by supplying electricity. Compared with a conventional process in which all decolorizing elements are provided anew for one time treatment and waste is inevitably created, the decolorizing process according to the invention can be recycled only by supplying electricity and supplementing eliminated elements. Thus, costs for providing material and treating waste can be saved. First of all, the present invention makes it possible to realize an environment-friendly process.

What is claimed is:

1. A method of decolorizing blue jeans, comprising the steps of:
   (a) providing and electrolyzing hydrochloric acid (HOCI) and sodium chloride solution to an electrolytic tub to generate chlorine gas and hydrogen gas, and separating hypochlorous acid solution from sodium hydroxide;
   (b) attaching tapes to the blue jeans to make a constant form; and
   (c) submerging the tape-attached blue jeans in the hypochlorous acid to change a colorant of the blue jeans.

2. The method as recited in claim 1, further comprising a step of reacting hydrogen chloride gas with the sodium hydroxide solution to produce sodium chloride solution, wherein the hydrogen chloride gas is generated by trapping and reacting the chlorine and hydrogen gases with each other.

3. The method as recited in claim 2, wherein in the step (c), the colorant is oxidized and a reaction is made to change the hypochlorous acid to the hydrochloric acid.

4. The method as recited in claim 3, wherein the changing the colorant is made in the electrolytic tub and a processing tub; and
   wherein the producing the sodium chloride solution is made in the electrolytic tub and a scrubber, further comprising a step of recycling the hydrochloric acid in the processing tub and the sodium chloride solution in the scrubber to the electrolytic tub.

5. The method as recited in claim 4, wherein the steps are simultaneously performed and each of the steps is continuously performed.

6. The method as recited in claim 1, wherein the changing the colorant is made at a temperature between 10° C. and 30° C.

7. The method as recited in claim 1, wherein the sodium chloride solution provided to the electrolytic tub contains sodium chloride of 0.1-7% by weight.

8. The method as recited in claim 1, before the step (c), further comprising a step of additionally colorizing the blue jeans with an oil-based colorant oxidized by the hypochlorous acid to make a constant form.

9. A method of decolorizing blue jeans, comprising the steps of:
   (a) providing and electrolyzing hydrochloric acid (HOCI) and sodium chloride solution to an electrolytic tub to generate chlorine gas and hydrogen gas, and separating hypochlorous acid solution from sodium hydroxide;
   (b) additionally colorizing the blue jeans with an oil-based colorant oxidized by the hypochlorous acid to make a constant form; and
   (c) submerging the tape-attached blue jeans in the hypochlorous acid to change a colorant of the blue jeans.

10. The method as recited in claim 9, wherein the oil-based colorant is identical to a colorant colorized on the blue jeans and in the step (b), colorization amount is controlled at each part of the blue jeans through a plurality of control steps.

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