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TREATMENT OF TEXTILE FABRICS

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The present invention relates to a continuous method of treating fibers of vegetable origin to produce goods of any degree of white direct from the gray state.

Suggestions have been made heretofore of bleaching processes suitable for production of bleaching goods in short periods of time as contrasted with the normal batch procedure employing hot bleach liquors in a kier. In this category may be mentioned the bleaching process of Clark and Smolens described in Patent No. 2,029,985 of February 4, 1936, wherein goods impregnated with a bleaching solution are subjected to the action of steam having a high temperature. However, where the production of full white was desired, this procedure was not truly a continuous one due to the fact that preliminary treatment of the goods had to be carried out in batch processes, as, for instance, subjecting gray goods of certain types amenable to such treatments, to the action of hot circulating caustic solutions.

It is an object of the present invention to provide a continuous bleaching method wherein full whites, or any desired degree of white, may be obtained directly from the gray goods in an efficient and continuous manner with the production of goods that are not damaged and in which the tensile strength is substantially the same as the strength of the gray goods.

It is a further object of the present invention to provide a continuous bleaching method carried out at elevated temperatures and temperatures readily adapted for plant operation.

It is a further object of the invention to not only decrease the time consumed in the production of white goods from gray goods but also to decrease the quantity of active bleaching agent consumed in effecting this transformation.

Other objects and advantages will become apparent hereinafter and will be pointed out with particularity in the claims.

In the within description of the invention the processing step will be described as including (a) a treatment preliminary to bleaching, and (b) a bleaching treatment per se.

In accordance with the present invention the goods to be treated, which may be in the raw state, spun, woven or knitted, are impregnated with an aqueous solution having a pH below 7 and subjected to an elevated temperature for a relatively short period of time.

This preliminary acid treatment differs from the usual "sour" in that the goods are not alkaline nor have they been treated with an alkali, and differs from an acid desizing operation in that

little size or starch is removed. In the latter procedure the goods are opened up by a caustic boil after starch removal and prior to bleaching.

The quantity of aqueous solution used to impregnate the goods is in general an amount sufficient to make the goods damp. This quantity, based on dry weight of goods, may be from about 50% to about 200% of the weight of the goods. In general, the goods may be impregnated with the acidulous aqueous solution by any convenient method, as, for instance, by spraying the desired quantity of the solution on to the goods, by padding rolls, or preferably by immersing the goods in the solution and eliminating the excess thereof by the use of squeezer rolls or by hydroextraction.

The solution used to impregnate the goods may be acidulated by substantially any acid medium not reacting adversely upon the goods. In general, inorganic acids, such as hydrochloric acid, sulfuric acid, phosphoric acid, and the like, may be employed to advantage, although water soluble organic acids, as, for instance, acetic acid, have been found suitable for the purposes of the invention. It may also be noted that salts possessing an acid reaction, as, for instance, sodium acid sulfate, or even normal salts reacting acid in solution, such as aluminum sulfate, may at times be suitably employed.

The quantity of acidulous material in the solution is generally relatively small and so little as 0.01% to 1% sulfuric acid has been found suitable for the purpose of the invention. The pH of the solution should be below 7 and it has been found that excellent results are obtained by employing solutions having a pH of about 1.0 to about 5.0, although with goods unusually resistant to acids, a higher hydrogen ion concentration than that specified, may be used.

The quantity of acid should not be too great since it is well known that acidic materials generally react adversely upon fibers of vegetable origin with the production of hydrocellulose. However, with an acidity not higher than about 1% sulfuric acid, the goods will not be damaged.

In accordance with the present invention, therefore, after the goods have been impregnated with from 50% to 200% of the acidulated solution, the goods are subjected to a temperature of about 150° F. for several seconds to 15 to 20 minutes. In general, the greater the quantity of acid in the acidulated solution and the higher the temperature, the shorter will be the time of treatment required. In the preferred method of operation the impregnated goods are subjected to the action of steam for 2 to 3 minutes, more or

less. The goods are then washed and rinsed and are found prepared for subsequent treatment. In accordance with the present invention the fibers of the goods are loosened up, conditioned, and made more adaptable for subsequent processing and operations making them suitable for use. Thus, goods treated in accordance with the present invention may be bleached with a considerable saving in bleaching time and in bleaching ingredient, such saving in bleaching ingredient being anywhere from 25% to 75% of active bleaching agent required to produce the same degree of white where goods are not treated by the preliminary treatment described in the instant invention.

Although any suitable form of apparatus may be employed in carrying out the method of the invention, it has been found that the gray goods may be passed directly into the solution of acid material, then through squeezer rolls where excess of solution is eliminated to about 50% to 200% of the weight of the goods. In case of woven or knitted goods, the goods may be in rope form or in open width; goods in other physical forms (raw stock, skeins, warps, etc.) may be handled in the conventional manner. Depending upon the type of piece goods, whether heavy, subject to creasing and the like, open width may at times be preferred to rope form. The goods are then heated, preferably by passage through a steam atmosphere. The temperature of the goods is thereby raised, and in general will be above about 150° F. and may be close to 212° F. From the steamers the goods are passed into a suitable container of a length and capacity so that the goods remain in the heated condition for the desired period of time, normally about 2 to 3 minutes. In practical operation it has been found that with movement of goods at about 100 yards per minute, a small size box has sufficient capacity.

In an alternative form of the invention the acid solution is heated, for instance to the neighborhood of the boiling point of the solution, the goods saturated with the hot solution, for instance by padding or passage through the solution with elimination of excess, and then maintained hot for several seconds to a few minutes. This may be done by steaming or by passage to an insulated container or box.

After the acid treatment the goods are passed through washing equipment and squeezed out; from there they are immediately passed to the bleaching equipment proper.

The goods have not been bleached by this preliminary acid treatment, still contain size but are more readily adaptable for bleaching. Goods of vegetable origin contain foreign bodies generally acting catalytically upon hydrogen peroxide, and it is believed that this acid treatment either removes these bodies or changes them to a condition where they do not decompose hydrogen peroxide and other active oxygen bleaching agents.

The second step of the improved continuous bleaching operation comprises bleaching the goods at elevated temperatures of above about 150° F., by the employment of a bleaching solution containing hydrogen peroxide or a hydrogen peroxide generating material, all classed herein as peroxides, for instance, alkali metal peroxides, alkaline earth metal peroxides, other metal peroxides, as well as the perborates, percarbonates, persulfates, and the like. The amount of peroxide present in the bath will be entirely depend-

ent upon the degree of white desired, a greater quantity of peroxide being necessary for a full white than for the production of a partial white. In general the bath will be from about one volume to four volume in strength, with a preferred strength of about 2 volume.

In addition to the peroxide the bath may and generally will contain a stabilizing agent for the peroxide. The stabilizing agent may preferably be sodium silicate, although other stabilizers are eminently suitable, as, for instance, magnesium salts, pyrophosphates, and other substances conventional in the bleaching art. The bleaching solution is alkaline in reaction and the alkali employed may be any of the well known alkalies, as, for instance, the caustic alkalies, phosphates, soda ash, silicates, ammonia, and the like. When strongly alkaline conditions are desired the preferred alkali will be caustic soda. The amount of alkali present, expressed as NaOH, will be from about 5 to about 40 grams per liter. When employing soluble silicate alone as the alkali, 10 to 60 grams of sodium silicate, based on a silicate having a specific gravity of 1.4, is found satisfactory. When alkalies other than silicate of soda are employed, the quantity used will be equivalent to the suggested range. When high absorbency is desired in the goods, surface tension reducing agents may be incorporated in the bleach bath.

After being treated in the acid condition and rinsed, the goods are impregnated with the alkaline bleaching solution of the above composition. A practical way is passage of the goods through the bath, the goods taking up and absorbing the bleaching solution. Excess bleaching solution is eliminated from the goods by passage through squeezer rolls where all but 50% to about 150% of the solution is eliminated, producing dampened goods. It will be understood that any other suitable method of impregnating the goods may be employed. From the squeezer rolls the dampened goods are then passed to a heater and heated to above about 150° F. In the preferred mode of operation the goods pass to a steamer where they are subjected to steam and heated to a temperature of at least about 150° F. Depending upon the type of goods and the type of equipment employed, the temperature may be higher than 150° F. and may reach 190° F. to 212° F. or higher. After passing through the steamer, or being heated to the desired temperature in any other fashion, the goods are then allowed to remain hot and bleach to the desired degree of white, then pass into washing, rinsing, or scouring equipment.

The length of time the goods remain hot will depend upon the degree of white desired and upon the quantity of hydrogen peroxide in the bleaching solution. Normally the passage through the steamer will require but a few seconds, the temperature of the goods and the solution contained therein being raised to about 190° F. to 200° F. in the usual operation. The time required for the bleaching, and therefore the period in which the goods remain hot, may be from about 15 minutes to about 1½ hours, although for usual operating procedures, full whites are obtained in about one hour at about 190° F., or thereabouts.

The acid treatment described herein is extremely effective as a preliminary treatment immediately preceding a bleach as it is rapid, opens up the goods, eliminates in large part the cata-

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lytic effect of goods on peroxide, and eliminates dangers associated with alkali treatments.

From the foregoing it will be seen that a rapid and efficient continuous bleaching procedure is afforded wherein the rate of movement of goods is high, the consumption of energy small and the action of the bleaching agent very efficient. It will be understood that variations of time of heating or treating, of temperature and of composition of bath can be made over a relatively wide range without departing from the invention.

The terms "damp," "dampened goods," and the like, as used in the specification and claims, designate a condition of impregnation of goods with a solution insufficient in amount to drip from the goods and define a range of about 50% to 150% of absorbed solution based on the dry weight of the goods.

What is claimed is:

1. The continuous method of processing gray goods composed of fibers of vegetable origin which comprises impregnating the gray goods with sufficient of an acid aqueous solution to dampen the same, heating the dampened impregnated goods with steam, then impregnating the goods with sufficient of an alkaline peroxide solution to dampen the same, steaming the so impregnated goods to heat the same and permitting them to bleach in the heated condition.

2. The continuous method of processing gray goods composed of fibers of vegetable origin which comprises impregnating the gray goods with sufficient of an acid aqueous solution to

dampen the same, maintaining the goods and impregnated solution at an elevated temperature for a short period of time to condition the goods, then impregnating the goods with an alkaline peroxide solution, maintaining the goods and impregnated peroxide solution at an elevated temperature by means of direct steam whereby the goods are permitted to bleach in the damp condition.

3. The continuous method of processing gray goods composed of fibers of vegetable origin which comprises impregnating the gray goods with an acid aqueous solution and heating the goods to an elevated temperature, impregnating the goods with sufficient of an alkaline peroxide solution to dampen the same, subjecting the goods to an atmosphere of steam whereby the goods are heated and permitting the dampened goods to bleach in the heated condition.

4. The steps in the continuous method of processing gray goods composed of fibers of vegetable origin which comprise incorporating in the gray unbleached goods 50% to about 200% of an aqueous solution containing an acid and having a pH below about 6, heating the goods while in the dampened condition to a temperature of at least about 150° F. with direct steam, then incorporating in the goods 50% to about 150% of an alkaline peroxide solution and thereafter heating the goods with steam to a temperature of at least about 150° F. and permitting the goods to bleach in the heated dampened condition.

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