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BLEACHING TEXTILE FIBRE

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This invention concerns the bleaching of textile fibre and more particularly a continuous bleaching process, this application representing a continuation of Serial No. 712,809, an application filed by the applicant herein under date of February 23rd 1934 under the heading "Continuous Bleaching Process" and of Patent No. 2,110,649, dated March 8th 1938, which has been issued on said patent application.

As a suitable bleaching agent, hydrogen peroxide, comes into question, or such preparations, which rely on the presence of hydrogen peroxide in watery solution for the bleaching action. According to this invention such bleaching agent may include, above all, percarbonate, caro's acids, organic and inorganic sulfomonoperacids, perphosphoric acids and the corresponding salts of these acids,—with exception of perborate and persulfate, which are not particularly suited for the instant objects. Goods or materials suited for bleaching by the instant process are textile fibre, be it of animal, plant, synthetic or mixed origin.

It is a particular object of this invention to carry out the bleaching in a continuous process. Continuous processes are known in other arts e. g. in dyeing, where either the treatment liquor, i. e. the solution serving for treatment, or the material to be treated is continuously moved. In a preferred exercise of the instant invention both methods are used, i. e. the material to be bleached is moved through the moving bleach. The bleaching agent, which has been used, is continuously regenerated or replaced, such replacement being effected at a point of the moving bleach, where no bleaching action takes place. Other ingredients used in the bleach are similarly replenished, when they are used up or are otherwise lost.

In continuous processes of other arts the chemicals may readily be adjusted in conformity with accompanying operations, and the solution finding use in such processes may be made and will remain more or less strong in accordance with the reaction thereby to be effected. By way of contrast the concentration of a bleach, in particular of a bleach of the type herein concerned, cannot be adjusted at random, because it is very little stable, spends itself and is, more particularly, subject to decomposition by reason of being moved or by reason of contact with and friction upon the surface of the material or goods to be bleached. Direct or indirect agitation of the bleach causes the loss of oxygen, i. e. oxygen is liberated from the hydrogen peroxide, and escapes to the atmosphere without having been put to bleaching use.

It is a particular object of this invention to overcome the uncertainty resulting from the changing concentration of a bleach by reducing the oxygen losses.

Such object is obtained, in part, by effecting a full, quick and intensive contact of the material to be bleached with the bleach. If the procedure is thus expedited, it may be carried through at a predetermined concentration of the bleach without the danger of undue and uncertain local fluctuation of such concentration.

The said object is further enhanced by dispensing with the use of carrier means, so far as a transportation through the bleach is concerned. Not only do such carriers agitate and therefore unduly decompose the bleach, but they also interfere with free and even contacting of the bleach with the material to be bleached, and they delay or may even prevent contact of all parts of the material with the bleach.

The instant invention renders the use of such carriers unnecessary because the goods are strung loosely or pieced together in band fashion for instance as a continuous or endless chain. Such a band or chain supports itself, while it depends into and is guided through the bleach. In connection with rayon and the like the squirted filament or bunches thereof may thus be directly run through a bleaching operation. In such a continuous "run" of the material through the bleach a fibre rapidly changes contact with the particles of the bleach at all times, thus assuring a bleaching treatment of like concentration for all parts of the material to be bleached.

An added improvement and acceleration of the bleaching process is further effected by moving the material to be bleached and the bleach contrary to each other, preferably at a 180° angle between the respective directions of movement. This makes it possible, that comparatively small quantities of the bleaching agent and bleach may be used, thus effecting a saving not only in bleaching material, but also in respect to a wear of the fibre of the material to be bleached. The new or newly conditioned bleach enters the bleaching vessel at a point, where the material to be bleached passes from said vessel after having passed therethrough. Thus the fresh bleaching solution is brought into contact with such portions of the material to be bleached, which could not be previously bleached by the exhausted or partly exhausted parts of the bleach. It is of course more effective to put new bleach primarily into use where an exhausted bleach fails.

On the other hand the material enters upon

the bleach, where the bleach has already been used and has been exhausted in part by bleaching activities. There the bleach is called upon to remove from the material to be bleached the more readily removable stains or portions of stains, the bleach being still strong enough for such substantially preliminary activities.

When the course of bleaching procedure is planned and directed in the foregoing manner, a bleaching process may be successfully carried through, although the bleach used is very low in concentration. Under normal circumstances, and as a matter of fact for a plurality of materials to be bleached, a peroxide concentration of 0.5% was found to be fully sufficient, which is indeed a very low concentration. At such a dilute phase a bleach yields very little oxygen to the atmosphere, since weak hydrogen peroxide solutions are known to be much more stable than more concentrated solutions. On the other hand it is also known, that it is much easier to stabilize dilute bleaches of this kind, even to the extent of complete protection.

When a bleach is thus most readily stabilized, its bleaching speed is not appreciably reduced. The contemplated ingredients will be discussed in further detail hereinafter.

Regeneration and reconditioning of the bleach is preferable effected in a return passage outside of the bleaching vessel. If the bleach is circularized by way of a pump, the replacement may be best effected in the vicinity of such a pump. The bleach should be introduced at one end and it should be withdrawn at the other end of the bleaching vessel.

The material to be bleached should now move counter to the flow of the bleach, but its movement should not be impeded in any other manner. However the soaking of the material to be bleached may be expedited and a complete change of the bleach contained in such material may be effected by the use of one or more wringers, e. g. a pair of pressure rollers. Such wringers find use at the end as well as at intermediate points of the bleaching vessel.

The material to be bleached may carry activators or catalizers; however the use of activators containing heavy metal should be avoided, since they have a detrimental effect upon the goods. As suitable alkaline substance soap may be given preference. Soap might for instance be left in the goods from a preceding washing operation.

The bleaching may be carried out in one or in a series of vessels or the material to be bleached may be recycled a number of times through the same vessel. In connection with a number of vessels a relative adjustment of the concentration of the bleaching agent, or of othe other ingredients may be in order; regardless of modifications and concentrations, a regulation of the procedure will also be obtained by a temperature differentiation between the bleach in the different vessels or by passing the material to be bleached at different speeds through the various vessels.

Alkaline stabilizer, as they have been frequently used in the past, cannot be recommended in connection with a continuous bleach of the instant invention, since an agitated bleach decomposes rapidly in spite of such protection. On the other hand ingredients which tend to reduce the pH value were found to be eminently useful; for instance, above all, acids. However there must be discrimination in the choice of the acid. The following stabilizers may be found useful, because they yield colloidal solution:

Albuminous products and decomposition products of albumen, like glue, gelatine, starch, sugar, mannite, cellulose derivatives, silica gel etc.

In addition anti-catalizers may be used to advantage, more particularly substances, which offset the action of traces of iron, since such traces are apt to cause a yellowing or other oxidation of the goods, particularly in connection with bleaches of low pH value: Aliphatic anions, like oxalate, tartrate, lactate, citrate etc. may be useful, or phosphate, pyro- or metaphosphate or borate. Protection by oxalic acid is therefore particularly advantageous.

Suitable other ingredients are wetting compounds which also exhibit a stabilizing effect, as there are, in particular, aliphatic sulphates or sulphonates of higher molecular weight. The following compounds may be suggested: The dodecanol-sulphate of sodium or triethanolamine, sodium- or triethanolamine-octadecenoyloxethaneaminosulphonate, sodium butylmethylcyclohexanol sulphate, sodium-dodecanolphosphate or pyrophosphate, etc.

The bleaching may be started in a bleaching vessel, and it is then completed by way of storage and of drying the goods. The bleaching vessels may be arranged in series or in stagger formation, the goods to be bleached moving always counter to the bleach. The goods may be wrung in and between the various bleaching vessels; after a short rinse, they may be carried away on rollers, which may be heated for drying purposes. If the goods are stored in a moist state, this may be helpful to remove obstinate stains, which are adapted for treatment by bleaches of very low concentration, but where the bleaching requires a longer duration of time.

The following examples are offered as illustrative rather than limitative of the instant invention;

Example 1

Woolen yarn, which has been washed and rinsed and in which substantially 1% (percent) of soap and 0.5% starch remain occluded, is passed—for instance continuously from the rinse—at a speed of 3.6 meters per minute in series through four vessels, or one vessel with four compartments, these containers being preferably made of rust proof material. In the compartments and therebetween may be arranged wringers, each compartment being substantially 80 centimeters long, with a capacity of 100 liters.

The bleach flows counter to the general direction of movement of the band of wool. It contains 0.5% hydrogen peroxide and .01% of oxalic acid. The bleach is circularized by a pump with a capacity of approximately 10 liters per minute. The material to be bleached was passed through each compartment in a zig-zag path, so that it traveled in each compartment for the distance of 2.5 to 3 meters. Near the pump the bleach is regenerated, i. e. replenished in respect to hydrogen peroxide and oxalic acid. The goods pass from the last of the compartments by way of a wringer, and the bleaching may continue during storage, being finally finished by drying.

Example 2

Bundles of rayon filament, or a mixture thereof with wool, pass as a sheet through five successive compartments at a speed of 3 meters per minute, the apparatus being otherwise arranged in the

manner of Example 1, glass being preferably used. The bleach should be used at substantially 30° Celsius containing approximately 0.8, but no more than 1.0% hydrogen peroxide, and 0.1% of sodium dodecanol sulphate. If the vessels are made of stainless steel preference is given to phosphate ion, e. g. meta-, pyro-, ortho-, or isopolyphosphates.

Generally speaking, preference is given to a bleach of a lower pH value in connection with the bleaching of animal or artificial fibre. In connection with the bleaching of vegetable fibre, the pH value should be higher.

Example 3

An unfinished yarn of wool, e. g. untwisted or only partly twisted, is passed ten times through a bleach containing 0.6% of hydrogen peroxide, 0.01% of oxalic acid, 0.06% of sodium octadecenoyloxethane sulphonate, and 0.02% of gelatine, at 40° Celsius. The damp goods are wound onto a reel and are allowed to dry thereon without rinsing, the temperature being about 30° Celsius.

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