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PERMANENT HAIR WAVING NEUTRALIZATION BY MONOPERSULFATE

Thomas E. Bell, Wilmington, Del., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

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This invention relates to improvements in the treatment of substances containing keratin, such as hair and wool. It is particularly concerned with improvements in the application of a set to hair during an otherwise substantially conventional permanent waving process.

It is customary to treat a substance which contains keratin, human hair especially, with a chemical agent to relax the individual fibers, then to bend the material physically into a new and desired shape and finally to set it permanently in the new shape by means of a second chemical treatment.

The compound employed in the relaxation treatment is an alkaline reducing agent which converts the disulfide groups in the keratin to sulfhydryl groups and thereby breaks peptide or other chains joined by disulfide linkages. Many reducing agents are known which relax keratin-containing fibers, including formamidine sulfinic acid, thioglycolic acid, sodium sulfide, sodium hydrosulfide, cysteine hydrochloride, sodium hypophosphite, sodium thiosulfate, sodium hydrosulfite, sodium dithionate, thiolactic acid, thioglycerol, β -mercapto-ethanol and others. These compounds of the prior art may be used as heretofore in a first or reducing step of the instant process. Thioglycolic and formamidine sulfinic acids, however, are among the most satisfactory for use in this invention.

It will readily be understood that the intermediate or shaping step also remains unchanged over the prior art. This step may consist of a very simple process such as bending or twisting separate locks of hair into a desired contour.

Heretofore a multiplicity of compounds have been used in the setting or oxidizing step of the waving process. Such compounds should, in general, cause little damage to the hair and should take effect rapidly. Preferably they should, in addition, be acidic in nature to neutralize the alkaline reducing agent. Hydrogen peroxide, alkali metal bromates and sodium perborate are examples of oxidizing agents utilized previously to this end. Ammonium dipersulfate has also been suggested as a suitable agent.

Each of the oxidizing agents named suffers from various defects detracting from its utility. Hydrogen peroxide, for example, must be slightly acidified before use and tends so strongly to damage or bleach the hair that it has found only minor utility in this field and is somewhat restricted to use by the professional beauty stylist. The alkali metal bromates, while otherwise satisfactory, possess such oral toxicity that they are at a commercial disadvantage, especially when used in the home by the amateur beautician. Sodium perborate is at a disadvantage because of its high alkalinity and low solubility. Ammonium dipersulfate is too slow in oxidizing reaction for practicable utility. Several other oxidizing agents which have been suggested at various times possess odors of a distinctly disagreeable character.

A primary object of the present invention is, therefore, provision of a novel oxidizing agent for use in the last

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or setting step of permanent waving. Another object is provision of an oxidizing agent for permanent waving which is adapted for use in the home by an amateur beauty stylist. Another object of the invention is provision of a novel oxidizing agent which is naturally acidic in reaction and which does not damage hair to which it is applied. A further object is provision of an oxidizing agent for permanent waving which reacts rapidly with the sulfhydryl groups of the hair and without leaving any bad odor.

The above-mentioned and still further objectives are achieved in accordance with this invention by a permanent waving process departing from those in customary use only in employing an aqueous solution of an alkali metal monopersulfate in the final or wave-setting step. Thus, hair may first be treated with thioglycolic or formamidine sulfinic acid, shaped as desired, rinsed if necessary and finally set in place by means of the alkali metal monopersulfate.

The preferred monopersulfates of this invention are those of sodium and potassium, NaHSO_5 and KHSO_5 . They may be directly employed at the natural pH of their aqueous solution, i. e., pH 2 or 3, and use of the compounds at their natural pH represents the preferred embodiment of the invention. It is not essential, however, that the monopersulfates be used only at these acidities. Higher pH values are effective although they may accelerate the decomposition of the oxidizing agent. A pH of 6 or 7 or even higher can be obtained readily by adding a buffer compound such as sodium phosphate or silicate to the solution or, in predetermined quantity, to the dry salt.

The solutions utilized may vary in concentration most desirably from about 500 p. p. m. to 2000 p. p. m. of active oxygen but higher concentrations may be used if corresponding care is taken not to damage the hair treated. Lower concentrations may also be used but may require time to accomplish their intended purpose.

The active oxygen of a monopersulfate, as used throughout this specification, is the oxygen in the molecule in excess of that required to form the corresponding bisulfate. For potassium monopersulfate it may be expressed as a percentage from the equation for the decomposition of the compound,



in the following manner:

$$\text{Percent active oxygen} = \frac{\text{Wt. of } [\text{O}]}{\text{Wt. of } \text{KHSO}_5} \times 100$$

The symbol $[\text{O}]$ represents the oxygen produced by the decomposition of the monopersulfate.

The temperature of application is not sharply critical. A temperature between ambient, ca. 20° C., and about 40° C. is preferred. Higher temperatures can be employed if desired but are unnecessary. Lower temperatures can also be used but may be uncomfortable to the human subject being treated.

The time of contact between the hair and the monopersulfate solution also lacks sharp criticality. This time should, however, be kept to a minimum to prevent damage to the hair. A time comparable to that of a quick shampoo or rinse is satisfactory and is preferred. Total contact time should actually not exceed five minutes, with an even shorter period, two or three minutes, being preferred. Contact periods slightly longer than five minutes can be tolerated but damage to the hair increases progressively as the period lengthens.

A preferred embodiment of the invention, according to the principles set forth above, may now be described: Hair is soaked with an aqueous solution of thioglycolic or formamidine sulfinic acid adjusted to pH 8-9 with am-

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monia and is curled on a plastic curler. It is then sequentially rinsed in warm water, allowed to stand for a short time and treated with an aqueous solution containing potassium monopersulfate. The curl is then rinsed rapidly and thoroughly, undone and finally air dried. The result is permanently curled hair which has lost very little of its tensile strength.

The advantages obtained by use of monopersulfates generally parallel the objectives of the invention. Thus, the low pH of these compounds eliminates the necessity for utilizing a two-component system containing both an oxidizing agent and an acid. The monopersulfates are, furthermore, strong oxidizing agents which react rapidly without unduly damaging the hair. In addition, the relative stability, high solubility and non-toxicity of the monopersulfates eliminates difficulties found in agents of the prior art.

There follow some examples which illustrate the practice of the invention in detail. Unless otherwise noted, the temperatures of all applications are ambient.

Example 1

This example illustrates the use of a solution of potassium monopersulfate in the process of the invention.

A lock of hair was saturated with an aqueous solution adjusted to pH 8-9 with ammonia and containing 4.7% thioglycolic acid. The lock was curled on a plastic curler, allowed to stand on the curler for 15 minutes and then rinsed, in position, with hot water for 2 minutes. The curl was maintained on the curler for an additional 30 minutes and was then saturated with a solution containing 1500 p. p. m. of active oxygen as potassium monopersulfate. The curl was unwound, resaturated with the potassium monopersulfate solution, rinsed thoroughly with warm water and finally dried in air. The hair was found to be well curled and to have lost only about 6% in tensile strength.

Example 2

This example illustrates the use of a potassium monopersulfate somewhat less concentrated than that used above.

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As in the first example a lock of hair was saturated with an aqueous solution containing ammonia and 4.7% thioglycolic acid, was allowed to stand curled on a plastic curler for 15 minutes and was then rinsed with hot water for 2 minutes. After standing for 15 more minutes, the curl was saturated with a solution containing 750 p. p. m. of active oxygen as potassium monopersulfate. The curl was unwound, resaturated with the above described neutralizer, rinsed thoroughly with warm water and finally dried in air. Results were the same as in Example 1: the hair was well curled and had lost only about 6% of its tensile strength.

Having described my invention, I claim:

1. The process of restoring disulfide linkages to hair in which the linkages have been disrupted by reduction comprising treating said hair with an aqueous solution containing between about 500 and 2000 p. p. m. of active oxygen bound in the form of the monopersulfate of an alkali metal, said treatment being carried out at a pH of about 2-3 and a temperature of about 20-40° C. for not more than about 5 minutes.

2. The process of claim 1 in which the alkali metal is potassium.

3. The process of claim 1 in which the alkali metal is sodium.

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