PEROXYDIPHOSPHATE NEUTRALIZER FOR HAIR WAVING

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Int. Cl. A61K 7/10

U.S. Cl. 424—71

6 Claims

3,555,147

AbSTRACT OF THE DISCLOSURE

Ammonium and alkali metal peroxyporphates have been found effective in treating hair as the second stage “neutralizer” or “oxidizer” during cold permanent waving of human hair. This waving process is carried out by treating the hair while in a curled condition in a first stage with reducing agents which are known to relax keratin-containing fibers, especially thioicolic acid and salts thereof; in the second stage the treated hair is contacted with ammonium or alkali metal peroxyporphosphate which restores the hair to its original condition and imparts a long-lasting curl.

BACKGROUND OF THE INVENTION

(A) Field of the invention.

The invention covers an improvement in the process for cold permanent waving of human hair.

(B) Description of the prior art.

In permanent waving of human hair, the process known as “cold permanent waving” has become extremely popular because it can be carried out at home, without the need for specialized equipment, and without the services of a professional beautician. In this waving process, the hair is fixed in a curled or styled position, and allowed to react with a reducing agent which has the property of relax keratin-containing fibers. Many reducing agents are known which relax keratin-containing fibers, including formamidin sulfonic acid, thioicolic acid, sodium sulfide, sodium hydrosulfide, cysteine hydrochloride, sodium hyposulfite, sodium thiosulfate, sodium hydrosulfite, sodium dithionate, thioclastic acid, thioglycolic, thiocaptoananol and others. The mercaptan-type reducing agents, and specifically thioglycolic acid and salts thereof, have been found especially effective. While the complete effect of the reducing agent is not entirely understood, the most probable reaction that occurs is the cleavage of disulfide groups in accordance with the following equation:

\[ \text{Cys-Cys} \rightarrow \text{Cys-SH} + \text{SH-Cys} \]

Subsequently, the above conditioned hair is then treated in a “neutralization” step with an oxidizing agent to restore the hair to its normal condition prior to treatment with the reducing agent. In this “neutralization” stage the disulfide linkages of the hair are re-bond while the hair is still in a fixed, curled position and any excess reducing agent is neutralized; thereafter, the hair retains the curl or wave style originally imparted to it.

Many oxidizing agents (termed “neutralizers”) have been suggested for use in the “neutralization” stage of the cold permanent waving process. The most popular are \( \text{H}_2\text{O}_2 \) and alkali metal bromates, particularly potassium bromate, or compounds which convert to hydrogen peroxide on being dissolved in water, e.g., sodium perborate. Other oxidizing agents such as ammonium peroxysulfate and various alkali metal salts of peroxymonosulfates have also been suggested as “neutralizers.”

The use of these oxidizing agents as “neutralizers” presents serious difficulties. For example, the alkali metal bromates have very high oral toxicity and their use and maintenance in the home, away from professional beatucians, presents a hazard to young children in a household.

Because of this, the use of alkali metal bromates in home kits has been restricted. Other oxidizing agents such as hydrogen peroxide or compounds that produce hydrogen peroxide in solution, e.g., sodium perborate, are extremely active oxidizing agents and tend to damage or to bleach the hair if not carefully monitored. Other suggested oxidizing agents such as alkali metal peroxymonosulfates or peroxysulfates have the serious drawback of tending to degrade the hair in use. Further, the concentration of the peroxymono- or peroxysulfates, and the length of time it is in contact with hair must be critical regulated to prevent noticeable degradation of the hair structure. Peroxysulfates also have a drawback in that they cannot be stored in aqueous solutions and further form extremely acid solutions having pH’s on the order of 2 or 3 when dissolved in water. As a result there is a need for an oxidizing agent which avoids the above drawbacks of present oxidizing systems used in cold permanent waving processes.

OBJECTS OF THE INVENTION

It is an object of the present invention to describe a “neutralizer” for use in treating human hair after the hair has been reacted with a reducing agent in a set position, wherein said “neutralizer” restores the hair to its original condition without degrading or bleaching it.

It is a further object of the present invention to describe a “neutralizer” that can form a substantially neutral, clear, aqueous solution which is stable, free of any disagreeable odors and which is not highly toxic.

These and other objects of the present invention will be obvious from the following disclosure.

SUMMARY OF THE INVENTION

It has now been found that an aqueous solution of either ammonium peroxyporphophate or an alkali metal peroxyporphosphate (preferably having a concentration of from 2 to 10%) is an effective “neutralizer” in the cold permanent waving of human hair after the hair has been reacted with a reducing agent (preferably ammonium thiglcyolate) while fixed in a set position; the peroxyporphosphate “neutralizer” is effective without any tendency to bleach or degrade the hair.

DESCRIPTION OF THE INVENTION AND THE PREFERRED EMBODIMENTS

In carrying out the present invention, human hair is treated in an initial stage with a reducing agent, preferably a mercaptaan solution, which reduces part of the keratin of the hair. The most common mercaptan used as a reducing agent is an aqueous solution of ammonium thiglcyolate. The hair is first fixed in a set position, commonly by wrapping the hair around mandrels and fixing them in position about these mandrels. In this position the hair is treated with the aqueous mercaptan solution, and the hair is permitted to react with the mercaptan. The ammonium thiglcyolate at a pH of about 9 is applied at ambient room temperatures and left in contact with the hair for periods of about 5 to about 15 minutes. During this time the most likely reaction is the conversion of the disulfide linkages of the hair into sulphydryl groups with the concomitant conversion of the ammonium thiglcyolate to ammonium thiglcyolate.

The above description of the first stage of the cold permanent waving process does not form a part of the
present invention; our invention is confined only to the improved “neutralizer” which forms the second stage of the cold waving process. After the hair has been fixed in position and reacted with the mercaptan solution, it must then be treated with an oxidizing agent (“neutralizer”) during the subsequent “neutralization” stage. In the present process the “neutralizer” is a 2–10% aqueous solution of either ammonium peroxydisulfate or an alkali metal peroxydisulfate. Of this latter class sodium peroxydisulfate and potassium peroxydisulfate are the most convenient to prepare and use.

The temperature at which the present “neutralizer” is applied to the hair is not critical. Any temperature which can be utilized in the first stage waving process is generally satisfactory. However, temperatures within the range of about 50–100° F, are normally considered desirable for ease of application and for the comfort of scalp in contact with these solutions.

The present peroxydisulfate “neutralizer” can be used under either alkaline, neutral or acid pH conditions. A 2–10% aqueous solution of the present peroxydisulfate compounds normally has a pH ranging from about 5 to 10, respectively, in an unbuffered state. If a solution of different pH is desired, suitable buffers can be added to the present “neutralizer” solution to operate within the desired pH ranges. The most desirable pH range for treating hair with the present aqueous peroxydisulfate “neutralizer” is from about 6 to about 9.

The amount of peroxydisulfate “neutralizer” which is applied to the hair following the first stage mercaptan treatment should be sufficient to reestablish the disulfide linkages of the hair and also to react with excess portions of the mercaptan treating solution used in the first stage of the cold permanent waving process. For example, when using a 5% thioglycolic solution as the first stage treatment, a 10% peroxydisulfate solution can be used in a 1:1 weight ratio with the thioglycolic solution with good effect. In some instances it is desirable to wash the hair after the mercaptan solution has been applied, but prior to the addition of the “neutralizer,” in order to remove excess mercaptan from the hair and scalp. This intermediate washing is necessary with some “neutralizers” that cannot be used under alkaline conditions because it reduces the pH of the retained liquid in the hair; the initial mercaptan solution has a pH of about 9. In this respect, the present “neutralizer” is advantageous in that the hair can be treated directly after being contacted with the mercaptan solution, since the present “neutralizer” is effective at pH’s of from 6 to about 9. This mode of operation is possible because the instant “neutralizer,” unlike peroxide “neutralizer,” is operative under the same alkaline conditions used in the first step of the cold permanent waving process without bleaching or otherwise damaging the hair.

The maximum pH at which the present “neutralizer” solution should be used is about 9.2. At higher pH values, “neutralizers,” and in fact all hair treating solutions, tend to attack the protein matter of the hair and degrade or otherwise damage the hair structure.

The present peroxydisulfate “neutralizer” is effective in returning hair to its normal, untreated state after contacting the hair for a period of about 2 to 3 minutes. Longer periods of contact between the present “neutralizer” and the hair can be carried out, e.g., periods up to 15 minutes, since the present “neutralizer” does not attack the hair. A preferred time of treatment is from about 2 to about 5 minutes.

The present “neutralizer” which normally is a 2–10% aqueous solution of either an ammonium peroxydisulfate or an alkali metal peroxydisulfate can be mixed with other conventional additives to facilitate use of the “neutralizer.” Typical additives include buffer systems to maintain the pH at a desired level, such as citric acid and potassium dihydrogen phosphate; wetting agents to facilitate penetration of the hair, such as sodium lauryl sulfate, sodium octyl naphthalene sulfonate; and thickening agents which give the “neutralizer” solution more body to facilitate application, such as agar, and hydroxy alkyl celluloses having alkyl groups of 1–6 carbon atoms, e.g., hydroxy ethyl cellulose. Also, medicinal agents, e.g., antifungal agents such as cetrimethyl ammonium sulfate can be included.

While the potassium peroxydisulfate compound is preferred as the sole active agent in the “neutralizer,” it is possible to mix this compound with other known oxidizing agents commonly used as “neutralizers.” For example, the potassium peroxydisulfate can be mixed with hydrogen peroxide, sodium perborate, or sodium bromate, to minimize any adverse oxidizing effect which these common oxidizing agents exert on the hair, by reducing the proportion of these common agents in the “neutralizer” solution.

The following examples are given to illustrate the invention and are not deemed to be limiting thereof.

EXAMPLE 1

A lock of human hair was wrapped on a plastic curler, and was then saturated with a 5% by weight aqueous solution of ammonium thioglyolate which had a pH of 9.1. The hair was allowed to remain in this state for 15 minutes. The hair sample was then rinsed with warm water for two minutes and permitted to remain on the curler for an additional 30 minutes. It was then saturated with a 10% by weight aqueous solution of potassium peroxydisulfate; the solution was adjusted to a pH of 7.0 by adding HCl. The potassium peroxydisulfate solution was maintained on the hair sample for 2 to 3 minutes and the hair was then washed with warm water for 2 minutes and allowed to air dry. The hair was found to be well curled and showed no appreciable relaxation or change after several days even when wetted with water.

EXAMPLE 2

The process of Example 1 was repeated in separate tests with ammonium peroxydisulfate and sodium peroxydisulfate respectively, in place of potassium peroxydisulfate. The results were identical to that obtained with potassium peroxydisulfate.

EXAMPLE 3

The process of Example 1 was repeated using a 5% solution of potassium peroxydisulfate employing a citric acid buffer. This buffer maintained the solution at a pH of 7. The hair sample was found to be well curled and showed no appreciable relaxation or change after several days when wetted with water.

EXAMPLE 4

The process of Example 1 was repeated using a 2% solution of potassium peroxydisulfate admixed with a 2% solution of ammonium peroxydisulfate. The solution was buffered by means of a citric acid buffer and had a pH of 6. The same results were obtained as in Example 1.

EXAMPLE 5

The process of Example 1 was repeated except that a wetting agent in the amount of 0.1% of Triton X-100 was added to the aqueous solution of potassium peroxydisulfate. Triton X-100 is a trade name for a solution of octyl phenoxo polyethoxy ethanol (Rohm and Haas Company). The results were the same as those obtained in Example 1.

EXAMPLE 6

The procedure of Example 1 was repeated using 0.2% hydroxy ethyl cellulose in the aqueous potassium peroxydisulfate solution as a thickening agent. The same results were obtained as set forth in Example 1.
EXAMPLE 7

In this example a mixture of potassium peroxydiphosphate was used in conjunction with a sodium perborate monohydrate solution. The “neutralizer” was made up from 2% sodium perborate monohydrate and 3% potassium peroxydiphosphate dissolved in an aqueous solution. This was buffered with citric acid to a pH of 9.0. When the same procedure as Example 1 was repeated using the above mixed “neutralizer” solution, it resulted in a well-curl hair sample which showed no appreciable relaxation and in which no apparent damage to the hair could be found.

EXAMPLE 8

A mixed “neutralizer” was made up containing 1% sodium bromate and 2% potassium peroxydiphosphate. This was used as set forth in Example 7 with the same results.

Pursuant to the requirements of the patent statutes, the principle of this invention has been explained and exemplified in a manner so that it can be readily practiced by those skilled in the art, such exemplification including what is considered to represent the best embodiment of the invention.

What is claimed is:

1. In the process for treating hair to impart a permanent set thereto wherein said hair is treated with a reducing agent for keratin and said hair is then treated with a neutralizer solution, the improvement which comprises using as the neutralizer an aqueous solution of 2 to 10% by weight of a peroxydiphosphate compound selected from the group consisting of ammonium peroxydiphosphate, sodium peroxydiphosphate and potassium peroxydiphosphate.

2. Process of claim 1 wherein said peroxydiphosphate compound is potassium peroxydiphosphate.

3. Process of claim 1 wherein said reducing agent is an aqueous solution of a water-soluble salt of thioglycolic acid and said neutralizer solution is a 2 to 10% aqueous solution of potassium peroxydiphosphate.

4. Process of claim 1 wherein said neutralizer is an aqueous solution which contains as essential ingredients an aqueous mixture of sodium perborate monohydrate and potassium peroxydiphosphate.

5. Process of claim 1 wherein said neutralizer is an aqueous solution which contains as essential ingredients as aqueous mixture of sodium bromate and potassium peroxydiphosphate.

6. Process of claim 1 wherein said peroxydiphosphate compound is sodium peroxydiphosphate.

References Cited

UNITED STATES PATENTS

2,751,327 6/1956 Deadman 424—72
2,809,150 10/1957 McDonough 424—71
3,256,154 6/1966 Jenkins et al. 424—72
3,266,994 8/1966 Reiss 424—71

FOREIGN PATENTS

995,141 6/1961 Great Britain 23—106
675,374 12/1963 Canada 23—106

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U.S. Cl. X.R.

424—72