

[54] **ACIDIC PERMANENT WAVING SOLUTION AND PROCESS FOR ITS USE**

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[58] **Field of Search** ..... **132/7; 424/71, 72**

[56] **References Cited**

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[57] **ABSTRACT**

There is provided a two stage acidic waving system of improved properties with respect to reduced irritation and hair destruction.

The two stage solution consists of urea or its derivatives as all or part of a first stage for dissolving in a second stage to provide resulting aqueous solution which is from 1 to 4 molar in urea, 0.8 to 1.4 molar in a water soluble thiol, 0 to 0.6 molar in a bicarbonate compound, 0 to 0.007 molar in borax and a water soluble protein in an amount from about 2 to 5 percent by weight based on the total weight of the solution, the solution having a pH between 6 and 6.8.

Following hair treatment with the waving solution, the hair is neutralized in a conventional manner and styled.

**25 Claims, No Drawings**

# ACIDIC PERMANENT WAVING SOLUTION AND PROCESS FOR ITS USE

## BACKGROUND OF THE INVENTION

Alkaline permanent wave solutions containing urea and a thiol, such as ammonium thioglycolate have been reported in the literature, for instance, in U.S. Pat. Nos. 2,708,940 and 2,717,228. In using these solutions, maximum deformation of the hair is attained with an ammoniacal thiol solution used on unprocessed and bleached human hair at solution pH between 8.0 and 10.

Reduction of the hair with mercaptans is accompanied by substantial swelling of the hair under alkaline conditions.

Swelling is as important as the reduction process itself. Rate of reaction increases with pH and temperature and has been reported to depend on the extent of ionization of the mercaptan group of the thiol acid, such as ammonium thioglycolate.

Reaction between the hair and the ammonium thioglycolate rapidly reaches an equilibrium with the extent of reaction depending upon the amount of thioglycolate applied to the hair.

Solutions heretofore employed have exhibited the problems of an undesirable odor due to ammonia emission and have also been highly irritating to the skin and eyes as well as destructive to the hair.

## SUMMARY OF THE INVENTION

According to the present invention, there is provided a two stage acidic hair waving system for use in commercial hair waving and styling operations and a process for using the solutions.

The first stage at least consists of urea and/or its alkyl inclusion derivatives and is normally dry.

The second stage is a solution containing water, a water soluble thiol, such as ammonium thioglycolate, and a water soluble hair protein.

There may be present in the first and/or second stage a bicarbonate compound and/or borax.

Prior to use, urea or its derivative is dissolved to form an aqueous acidic waving solution. The solution contains urea or its derivatives in a concentration from about 1 to about 4 molar, a water soluble thiol, preferably ammonium thioglycolate, in a concentration from about 0.8 to about 1.4 molar, a bicarbonate compound in a concentration of from 0 to about 0.6 molar, borax in a concentration from 0 to about 0.007 molar, protein in an amount from about 2 to about 5 percent by weight based on the total weight of the solution, the solution having the pH from about 6 to about 6.8.

The use, the reforming solution is applied to the hair which is processed at a temperature from about 110° to 130°F for a period of from about 5 to 30 minutes.

After rinsing the solution from the hair, there is applied a conventional neutralizing or rebonding solution to assure rebonding of the hair ends, then thoroughly rinsed in warm water following which, the hair is styled.

The reforming solutions of this invention are unique as to prior art solutions in that the rate of reaction with hair may be better controlled because the ionization of the mercaptan group of the thiol is dependent solely on heat and not pH.

In addition, ammonia is not evolved as an irritant, and therefore there is less irritation to skin and eyes.

In the combination, urea is used to swell the hair sufficiently to permit penetration of the thiol which acts as the bond breaker for sulfur in the hair.

Further, it has been found that the protein is more stable in the acid medium and will not further hydrolyze as in an alkaline waving solution. Borax when present provides a better curl pattern and also serves as a buffer in conjunction with bicarbonate compound to control pH.

## DESCRIPTION

According to the present invention, there is provided a novel acidic waving solution and process for its use in the styling of hair.

The waving solution is a two stage system, first stage of which comprises urea and its inclusion monoalkyl derivatives, such as methyl urea and ethyl urea preferably in a dry form or, if desired, in an aqueous solution.

The second stage of the solution consists of an aqueous solution of a thiol compound, and a conventional water soluble hair protein.

In the preferred embodiment, a bicarbonate compound and borax is present, either being provided from the first or second stage, preferably from the first stage.

The urea and/or its derivatives and any of the contained additions is mixed to form a resultant aqueous solution to what may be termed a "reforming solution," in which urea and/or its inclusion derivatives concentration is from about 1 to about 4 molar, a thiol, such as ammonium thioglycolate is present in a concentration from about 0.8 to about 1.4 molar, a bicarbonate compound in a concentration from 0 to about 0.6 molar, borax in a concentration from 0 to about 0.007 molar, hair protein in an amount from about 2 to about 5 percent by weight based on the total weight of the solution, the net solution having a pH from about 6 to about 6.8.

Because urea is not stable in the solution over long periods of time, evolving ammonia which causes the pH of the solution to increase, a two stage system is necessary in order to assure that the waving solution will be acidic in nature at the time of use.

For this reason, the urea or its functional derivatives and any additional ingredients present are added at the time of use and dissolved in the aqueous solution containing the remaining constituents to provide the net composition set forth above.

As used herein, the term "thiol" is intended to include a water soluble compound containing a sulfhydryl or mercaptan group as the hair reducing agent. Conventional thiols are those comprising strong polar groups, such as ammonium thioglycolate, sodium thioglycolate, sodium and ammonium salts of mercaptoethylenesulfonic acid and 3-mercapto-2-hydroxypropanesulfonic acid and the like. The preferred thiol is ammonium thioglycolate.

By "urea or its inclusion derivatives" there is meant urea and low molecular weight monoalkyl derivatives of urea, such as methyl and ethyl urea.

By a "hair protein" there is meant, in general, conventional hydrolysis derivatives of collagen which has been reduced in molecular weight to render the protein water soluble.

In the solutions employed in the practice of this invention, the urea or urea inclusion derivatives, the thiol

and the proteins are those conventionally used in hair waving solutions, whether hot or cold.

What is unique with respect to the waving solutions employed in accordance with the practice of this invention is that they are acidic as opposed to alkaline in nature. The reactions of the solutions are specific to the extent that essentially only the sulfur bonds are affected, while peptide linkages are not affected to any extent as in alkaline waving solutions. As a consequence, hair damage is less. There is no emission of irritating ammonia, and the solutions are therefore less irritating to skin and eyes. Further, the protein present has been found to be more stable and not hydrolyzed as in alkaline waving solutions.

In the waving solutions of this invention, urea or its inclusion derivatives, serve as a swelling agent for hair to facilitate reduction of the sulfur bonds by the thiol under hair dryer techniques employed.

Borax, when present, improves curl patterns and also acts as a buffer in conjunction with the bicarbonate compound consisting of ammonium bicarbonate, an alkali metal bicarbonate such as sodium or potassium bicarbonate as well as mixtures thereof which, when present, maintains the solution at the desired pH.

In use, it has been found, because an acidic medium is employed, that the rate of reaction of the reforming solution with hair may be more easily controlled because of the ionization of the mercaptan group of the thiol compound is solely dependent on heat and not pH.

While not bound by theory, the reforming solution, because it is employed at a pH below 7, and hair is subsequently oxidized at a pH of about 6.1, there is continuity of pH with no material shift in hydrogen bonds and salt linkages.

As indicated, the protein reforming solution of this invention is prepared by the addition of urea and/or its derivatives alone or with other constituents, if present, as solid crystals or in solution to provide the activated solution of the nature described above.

The resultant acidic reforming solution may be applied to all types of hair, with normal precautions and where the beauty aid patrons's scalp is void of abrasions and the like.

Care should, of course, be taken, in the usual manner, to prevent eye or skin contact. Should the solution accidentally contact the skin or the scalp, it should be blotted, without wiping, with water soaked cotton, following which is applied a bonding solution hereinafter described which is then blotted with water soaked cotton to remove solution residue.

As the urea and/or its derivatives, and any contained additives is dissolved to form the protein reforming solution, agitation is normally required where the urea and/or its derivatives is provided as a solid. Mere shaking of the mixture is sufficient to achieve solution.

The hair is first shampooed, towel dried and pre-dampened with the reforming solution and conventional styling wrapping procedures followed, using selected proper sized rods for the desired curl configuration.

Following wrapping, a dryer is preheated to a temperature from about 110° to about 130°F, and each desired curl saturated with the protein reforming solution.

A thin plastic cap or similar covering is then applied over the entire head making sure that all applied rods are covered and that the applied cap snugly fits around the hair line.

The patron is then placed under the preheated dryer making sure that the heat provided reaches all areas of the hair including the nape. Care should be taken to test curls approximately every 5 minutes for normal hair and about every 2 to 3 minutes for tinted hair.

When the hair forms the desired pattern which may range over a time period from about 5 to about 30 minutes, the hair is rinsed with warm water for a period of about 3 to about 5 minutes.

Each curl is then thoroughly squeezed with a towel to remove excess moisture to insure thorough bonding and conditioning action of the subsequent applied neutralizing solution.

There is then applied an acidic protein bonding or neutralizing solution (pH about 6.1) which are typically aqueous solutions containing oxidizing agents such as hydrogen peroxide, potassium bromate, alkali metal perborates, such as sodium and potassium perborate, and the like, as well as mixture thereof, which neutralizes the redox effect of the reforming solution. That is to curb reduction of the hair while the reforming solution is oxidized. This also constitutes a rebonding operation to assure rebonding of the hair ends.

As presently preferred, the neutralizing solution is allowed to remain in the hair for at least 5 minutes for complete bonding and conditioning.

The rods are then removed and the neutralizing solution thoroughly worked through the hair to insure rebonding of the hair ends.

The hair is then thoroughly rinsed with tepid water and styled in the usual manner to the desired end result.

The presently preferred reforming solution of this invention have the following composition:

Urea	1 to 4 M
Ammonium thioglycolate	0.8 to 1.4 M
NaHCO <sub>3</sub>	7 to 50 grams/liter
Borax (Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O)	0 to 2.5 grams/liter
Protein	2 to 5 percent by weight
Balance	Water
pH	6.0 to 6.8

While nowise limiting, the following are illustrative examples of the acidic reforming solutions of this invention.

#### EXAMPLES 1 to 6

The following are representative compositions found useful as acidic waving solutions found useful in combination with neutralizing solutions for hair styling. Each component is listed in the typical concentration employed, the balance of the solution being water. The formations are shown in Table I.

TABLE I

Component	Examples					
	1	2	3	4	5	6
Urea (moles/liter)	2.0	2.7	3.0	3.0	2.7	2.0
Ammonium thioglycolate (moles/liter)	1.4	1.2	1.3	1.3	1.2	1.4
Sodium bicarbonate (gms/100 grams of solution)	5.0	0.8	1.0	0	0	0
Borax (gms/100 grams of solution)	0	0	0.25	0.25	0	0
Protein (% by weight of solution)	2.0	2.0	2.0	2.0	2.0	4.0
Solution pH	6.7	6.5	6.5	6.6	6.8	6.8

What is claimed is:

1. A two stage acidic composition for use in waving operations which comprises:

a. a first stage comprising a urea compound selected from the group consisting of urea, methyl urea, ethyl urea and mixtures thereof;

b. a second stage comprising water, a water soluble thiol and a water soluble protein;

the addition of said first stage to said second stage alone or by the addition of water forming a net solution having a pH between about 6.0 and about 6.8, said net solution having a urea compound concentration of from about 1 to about 4 molar; a water soluble thiol concentration of from about 0.8 to about 1.4 molar and a water soluble protein content of from about 2 to 5 percent by weight based on the total weight of the net solution.

2. A two stage acidic composition as claimed in claim 1 in which the water soluble thiol is ammonium thioglycolate.

3. A two stage acidic composition as claimed in claim 1 in which a bicarbonate compound selected from the group consisting of ammonium bicarbonate, an alkali metal bicarbonate and mixtures thereof is present in the net solution in an amount up to about 0.6 molar.

4. A two stage composition as claimed in claim 3 in which the bicarbonate compound is contained in the first stage.

5. A two stage composition as claimed in claim 3 in which the bicarbonate compound is contained in the second stage.

6. A two stage acidic composition as claimed in claim 2 in which a bicarbonate compound selected from the group consisting of ammonium bicarbonate, an alkali metal bicarbonate and mixtures thereof is present in the net solution in an amount up to about 0.6 molar.

7. A two stage acidic composition as claimed in claim 1 in which borax is present in the net solution in an amount up to about 0.007 molar.

8. A two stage composition as claimed in claim 7 in which the borax is contained in the first stage.

9. A two stage acidic composition as claimed in claim 7 in which the borax is contained in the second stage.

10. A two stage acidic composition as claimed in claim 3 in which borax is present in the net solution in an amount up to about 0.007 molar.

11. A two stage acidic composition as claimed in claim 4 in which the borax is contained in the first stage.

12. A two stage acidic composition as claimed in claim 4 in which the borax is contained in the second stage.

13. A two stage acidic composition as claimed in claim 5 in which the borax is contained in the first stage.

14. A two stage acidic composition as claimed in claim 5 in which the borax is contained in the second stage.

15. A two stage acidic composition for use in hair waving operations which comprises:

a. a first comprising a urea compound selected from the group consisting of urea, methyl urea, ethyl urea and mixtures thereof, a bicarbonate compound selected from the group consisting of ammonium bicarbonate, an alkali metal bicarbonate and mixtures thereof and borax;

b. a second stage comprising water, a water soluble thiol, and a water soluble protein;

the addition of said first stage to said second stage alone or with the addition of water forming a net solution having a pH between about 6.0 and about 6.8, said net solution having a urea compound concentration of from about 1 to about 4 molar, a water soluble thiol concentration of from about 0.8 to about 1.4 molar, a bicarbonate compound concentration up to about 0.6 molar, borax in a concentration up to about 0.007 molar and a water soluble protein content of from about 2 to about 5 weight percent by weight based on the total weight of the net solution.

16. A two stage acidic composition as claimed in claim 15 in which the water soluble thiol is ammonium thioglycolate.

17. A two stage acidic composition for use in hair waving operations which comprises:

a. a first stage comprising a urea compound selected from the group consisting of urea, methyl urea, ethyl urea and mixtures thereof;

b. a second stage comprising an aqueous solution of a water soluble thiol, a bicarbonate compound selected from the group consisting of ammonium bicarbonate, an alkali metal bicarbonate and mixtures thereof; borax, and a water soluble protein;

the addition of said first stage to said second stage alone, or by dilution with water forming a net solution having a pH between about 6.0 and about 6.8, said net solution having a urea compound concentration of from about 1 to about 4 molar; a water soluble thiol concentration of from about 0.8 to about 1.4 molar, a bicarbonate compound concentration up to about 0.6 molar, borax concentration up to about 0.007 molar and a water soluble protein content of from about 2 to about 5 percent by weight based on the total weight of the net solution.

18. A two stage acidic composition as claimed in claim 17 in which the water soluble thiol is ammonium thioglycolate.

19. A two stage acidic composition for use in hair waving operations which comprises:

a. a first stage comprising urea;

b. a second stage comprising an aqueous solution of ammonium thioglycolate, ammonium bicarbonate, borax and a water soluble protein;

the addition of said first stage to said second stage alone, or by dilution with water forming a net solution having a pH between about 6.0 and about 6.8, said net solution having a urea concentration of from about 1 to about 4 molar; an ammonium thioglycolate concentration of from about 1 to about 4 molar; an ammonium thioglycolate concentration of from about 0.8 to about 1.4 molar, ammonium bicarbonate in a concentration of from 0 to about 0.6 molar, borax in a concentration of from 0 to about 0.007 molar and a water soluble protein content of from about 2 to about 5 percent by weight based on the total weight of the net solution.

20. A process for conditioning hair for styling which comprises:

a. treating hair strands in an aqueous acidic reforming solution having a pH between about 6.0 and about 6.8, and containing a urea compound selected from the group consisting of urea, methyl urea, ethyl urea and mixtures thereof in a concen-

tration from about 1 to about 4 molar; a water soluble thiol in a concentration in an amount of about 0.8 to about 1.4 molar, sodium bicarbonate in a concentration from 0 to about 0.6 molar, borax in a concentration from 0 to about 0.007 molar and water soluble protein in an amount of from about 2 to about 5 percent by weight based on the total weight of the solution;

b. heating the treated hair strands to a temperature from about 110 to about 130°F for a time sufficient to provide a waving condition;

c. rinsing the hair to remove at least a substantial portion of the reforming solution;

d. applying to the hair a neutralizing solution containing at least one oxidizing agent;

e. rinsing the hair with water and setting the hair.

**21.** A process as claimed in claim **20** in which the urea compound in the aqueous acidic reforming solu-

tion is urea and the thiol is ammonium thioglycolate.

**22.** A process as claimed in claim **20** in which the neutralizing solution contains an oxidizing agent selected from the group consisting of hydrogen peroxide, potassium bromate, an alkali metal perborate and mixtures thereof.

**23.** A process as claimed in claim **21** in which the neutralizing solution contains an oxidizing agent selected from the group consisting of hydrogen peroxide, potassium bromate, alkali metal perborate and mixtures thereof.

**24.** A process as claimed in claim **20** in which the treated hair strands are heated for a period of time from about 5 to about 30 minutes.

**25.** A process as claimed in claim **21** in which the treated hair strands are heated for a period of time from about 5 to about 30 minutes.

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