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HAIR WAVING COMPOSITION

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This invention relates to a novel composition for use in permanent hair waving.

The lotions in present day use for the cold waving of human hair normally contain the ammonium salt of thioglycolic acid, some free ammonia, wetting agents and other auxiliary ingredients. Other cationic materials than ammonia, particularly sodium and potassium, have been employed, but by far the bulk of the products produced in this country are of the ammonia formula. Ammonia as the alkaline reagent of the cold waving lotion produces two undesirable effects:

(1) Its volatility increases the odor level of the thioglycolate salt and this, in addition to the normal potent odor of the ammonia itself, is very offensive both to the operator and to the patron.

(2) Free alkali in the form of ammonia is being constantly lost by evaporation throughout the process.

This second characteristic of ammonia is responsible for a certain degree of non-uniformity in the waves, since in the wrapped curl the most exposed part of the curl which is made up of the scalp part of the hair rapidly loses its free alkali, essential to the waving process, even though this part of the curl tends to contain the most resistant hair. Thus very little wave is produced by commercial lotions in the exposed part of the curl, or the lotions are normally made more concentrated in free alkali than would otherwise be necessary. The higher alkalinity causes the lotion to attack the inside of the curl made up of the ends of the hair, the least resistant (the most porous) part of the hair, more rapidly and thus causes over-development and frizziness in this region.

Monoethanolamine lotions recently suggested produce two undesirable effects on the hair. The first effect has to do with the feel and appearance of the hair after treatment with this lotion. The hair assumes a characteristic appearance and feel which is best described as "mushiness." The fibers appear to be extremely soft and plastic, a condition that the beautician has learned to associate with hair that has been severely over-processed and is in imminent danger of becoming so brittle as to break off during the course of further manipulation. Actually, the fibers are not damaged, as nearly as can be ascertained by physical tests, to any greater degree than would be effected by the corresponding ammonia lotion. This behavior of monoethanolamine lotions, however, nonetheless tends to rule out the adoption of monoethanolamine in a commercial formula.

The second difficulty with monoethanolamine lotions is that the curls produced by such lotions may be said to be "buckly." This is a term used by the beautician to describe a wave which refuses to conform to a two dimensional pattern, the desirable pattern, but instead becomes three dimensional. This effect prevents the beautician from properly interpreting a test curl. (Test curls are used to determine when the waving process is complete.) Further, it results in a final curl, upon completion of the cold waving process, which retains the same characteristic and as such interferes in the pin curling operation, the operation that the operator performs on the hair to give it its final style.

It has been found that by the addition of two agents to monoethanolamine thioglycolate lotions, these objectionable features of the lotion can be minimized or completely overcome. These two agents are a non-thio salt

of monoethanolamine and a polyhydric alcohol. It was found that when lotions based on monoethanolamine thioglycolate were so modified they produced a test curl and a final wave which resembled very closely those produced with ammonia lotions at all stages of the process. It was further found that a more uniform and a more natural curl was formed.

As non-thio salts of monoethanolamine we may use the hydrochloride, sulfate, nitrate, citrate, and the like.

As polyhydric alcohols we may use ethylene glycol, glycerol, mannitol, sorbitol, glucose and the like.

The following is a general formula of a hair waving lotion according to the present invention.

Materials:	Quantities
Polyhydric alcohols	1–10 g./100 cc.
Non-thio monoethanolamine salt	0.1–0.6 N
Free monoethanolamine	0.2–0.6 N
Monoethanolamine thioglycolate	0.4–1.2 N

Lotions compound in these proportion ranges have a pH of from 9 to 10.

To this formula are added the usual wetting agents, thickeners, opacifiers, perfumes and color as is conventional in the art.

Typical compositions which were found to produce these beneficial effects are listed in the examples given below.

(1) 0.8 N monoethanolamine thioglycolate; 0.37 N free monoethanolamine; 0.4 N monoethanolamine hydrochloride; 4 grams sorbitol per 100 ml. of solution; 0.47% polyoxyethylene stearate; 0.23% alkyl phenoxypolyethoxyethanol; 0.09% perfume; dye to desired color.

(2) 1.01 N monoethanolamine thioglycolate; 0.41 N free monoethanolamine; 0.2 N monoethanolamine hydrochloride; 2 grams sorbitol per 100 ml. of solution; 0.047% nonylphenoxypolyethoxyethanol; 0.343% octylphenoxypoly(10)ethoxyethanol; 0.143% polyoxyethylene abietate; 0.145% methyl abietate; 0.125% perfume; dye to suitable color.

(3) 0.6 N monoethanolamine thioglycolate; 0.35 N free monoethanolamine; 6 grams glycerol per 100 ml. of solution; 0.3 N monoethanolamine hydrochloride; 0.2% alkyl phenoxypoly(10)ethoxyethanol; 0.4% alkyl phenoxypoly(30)ethoxyethanol; 0.05% perfume; dye to desired color.

(4) 0.5 N monoethanolamine thioglycolate; 0.3 N free monoethanolamine; 4 grams sorbitol per 100 ml. of solution; 0.2 N monoethanolamine sulfate; 0.2% alkyl phenoxypoly(10)ethoxyethanol.

(5) Same as (4) except 0.4 N monoethanolamine nitrate in place of 0.2 N monoethanolamine sulfate.

(6) Same as (4) except 0.5 N monoethanolamine citrate in place of the 0.2 N monoethanolamine sulfate.

(7) 0.85 N monoethanolamine thioglycolate; 0.50 N free monoethanolamine; 8 grams of glucose per 100 ml. of solution; 0.4 N monoethanolamine hydrochloride; 0.25% alkyl phenoxypoly(10)ethoxyethanol.

(8) Same as (7) except 4 grams mannitol per 100 ml. of solution in place of the glucose.

(9) 0.99 N monoethanolamine thioglycolate; 0.42 N free monoethanolamine; 0.4 N monoethanolamine hydrochloride; 4 grams of sorbitol per 100 ml. of solution; 0.47% polyoxyethylene stearate; 0.23% alkyl phenoxypolyethoxyethanol; 0.09% perfume; dye to desired color.

The composition given in the solution of Example 1 was compared in a half-head test with a solution of identical composition but containing no MEA hydrochloride and no sorbitol, as the control, by the conventional cold waving procedure. A head having hair for which these lotions are suitable was processed on one side with the experimental lotion (solution 1) and on the other side with the control, using as nearly as possible the same pro-

cedure with the same number of rods and the same blockings, etc.

After the curls had been wound and the final application of the lotions made to the hair, test curls from each side were examined as a means to determine the extent of the processing. The test curl on the side that had been processed with solution 1 appeared entirely normal in that the curl readily fell into a plane paralleling that of the head and the individual fibers followed the curl pattern without tendency to deviate. The test curl on the control side produced a markedly different result; the curl, instead of falling in a plane, split into several bundles of fibers with various planes of configuration. Because of this it was very difficult for the observer to determine the wave length and amplitude of the curl on the control side, the characteristics of the curl pattern that one uses to judge the degree of curling that has been attained.

After the curl had fully developed, the whole head was rinsed, towel blotted, treated with a sodium bromate solution of conventional strength, and again rinsed. On the final evaluation, the curls produced by solution 1 showed excellent manageability and the curls fell into the normally expected two dimensional pattern. The curls on the control side, on the other hand, split into individual fractional curls falling into several different planes, a condition which would be considered by the beautician to be highly undesirable, and which would make it difficult for her to style the hair satisfactorily.

The same contrasting behavior of the hair on the two sides of the head was apparent throughout the subsequent manipulation of the hair and remained obvious after the hair had been styled and dried. (These subsequent manipulations usually consist of pin curling the hair, according to the style desired and imparting a temporary set thereto by drying while wound in pin curls.)

Comparisons of the effect of the other solutions given in the examples above with that of corresponding solutions containing no monoethanolamine salt or the polyhydric alcohol led to the same results.

In addition to the faulty test curl pattern and the unmanageability of the hair, all the monoethanolamine lotions containing no salt and no polyhydric alcohol produced the mushy appearance of the hair referred to earlier.

The solution given in Example 2 was compared in a half-head experiment to an ammonium thioglycolate solution containing 0.86 N ammonium thioglycolate and 0.7 free ammonia with the usual wetting agents and opacifiers. The ammonium thioglycolate solution is one in very common commercial use. This particular strength was made for resistant hair as was the solution described in Example 2.

The two sides of the head were wetted with the solutions in the conventional manner, wound up on equal size curlers using the same number of curls on each side of the head. On completion of winding, both sides were remoistened with lotion, essentially simultaneously, and then processed to the desired test curl using the ammonium thioglycolate side as the control for stopping the processing. Both sides were then water rinsed to remove the excess waving lotion, towel blotted and neutralized using a conventional 8 N sodium bromate solution.

The resulting curl differences were as follows: The scalp curl was stronger on the monoethanolamine thioglycolate side even though the test curls had indicated that the ammonium thioglycolate side was equivalent. The end curl was typically stronger on the ammonium thioglycolate side. In other words, the curl was more uniform from scalp through the ends on the monoethanolamine thioglycolate side. The reasons for these results are believed to be the following: The free alkali in the ammonium thioglycolate wave volatilizes off of the outside or scalp portion of the tress during the processing, thus in effect, reducing the strength of the waving lotion in contact with the scalp portion of the hair. In contrast, the non-volatile alkali in the monoethanolamine thioglycolate lotion remained on the hair and the hair continued to process uniformly throughout the processing time. At the ends of the hair, on the other hand, the ammonia could not volatilize so rapidly and thus the higher concentration of alkali was maintained throughout the processing period. Since the initial concentration of alkali in the ammonium thioglycolate wave is considerably higher than in the monoethanolamine thioglycolate wave, there was more processing on the ends where the alkali could not be lost through volatilization due to the covering by the scalp layers of the hair in the tress.

It is our theory that the subject constituents produce the observed effects by controlling the rate and the degree of swelling of the hair fiber during the reduction cycle. We found that monoethanolamine hydrochloride and sorbitol act in conjunction to control swelling. It is true that a certain amount of swelling is very essential to the success of a waving process, but too much swelling appears to result in a mushy appearance of the fibers and a too faithful retention of the configuration imposed by the contour of the rod. The latter effect produces such a strong temporary set of the fibers that the fibers tend to curl up in the same configuration that they had in the croquignole wind, the axis of which is perpendicular to the desired axis of curvature in the test curl. When one tries to force them into the new configuration the various fibers tend to separate and assume varying orientations. This effect is alleviated by a reduction in the degree of swelling.

The characteristics of the final curl, obtained after the rinse following neutralization, is again affected adversely by the high degree of swelling that is a feature of the unmodified monoethanolamine lotions. Another phenomenon that occurs during the processing with the unmodified lotions is the sudden ballooning of the reduced fiber when the hair is rinsed following the reduction cycle. The reduced and swollen fiber, containing free monoethanolamine, on contact with the rinse water experiences a sudden further swelling which tightens the curl on the rod and is believed to be in part responsible for the buckly pattern that is subsequently observed. Ammonia lotions cause similar behavior but not nearly to the same extent. If the fiber is weak or if it has been too tightly wound, breakage may occur at this point. Or if the rod clamp impinges on the fibers, the fibers will retain a sudden sharp bend in them in the final curl, a condition which is characterized by the beautician as marking of the curl and which detracts from the appearance of the curl.

The pronounced swelling of the fiber that is produced on contact with rinse water is apparently caused by a phenomenon known as imbibition. This phenomenon has been observed with certain natural and synthetic fibers, particularly cellulosic fibers, when the fibers after treatment with certain salts and other agents are immersed in water. It is believed to be the result of unequal diffusion rates of water and the water soluble materials in the fiber across the phase barrier at the water interface. Thus, it appears that the molecules of water diffuse into the fibers much more rapidly than the molecules contained inside the fibers can diffuse outward with a resulting rapid increase in osmotic pressure within the fiber. Depending on the relative rates or diffusion of water as compared with that of the substance in the fiber, the fiber undergoes a temporary but rapid expansion. On further contact with water, equilibrium is established by the concentrations within and without the fiber becoming thermodynamically equivalent, and the fiber subsides to the normal dimensions associated with the resulting solution.

It might occur to one experienced in the cold waving field that a simple solution to the problem associated with the use of these monoethanolamine lotions might be through the expediency of reducing the free monoethanolamine. It is very true that the degree of swelling can be easily controlled by regulating the free alkali content of

the lotion, but there is another function of the free alkali which would suffer if the free alkali content were reduced. This other function of free alkali in a waving lotion is one of promoting the rate of reduction by the thioglycolic acid salts. It is well known that for acceptable rates of reduction the free alkali has to be sufficient to yield a pH in the range of 9 to 10. It has been found that an attempt to control swelling and imbibition by this route leads to an impractical processing time, i.e., the time required for the reduction (waving) cycle to be completed.

As to how polyhydric alcohols in conjunction with monoethanolamine salts control the swelling and imbibition we have no good explanation. Further, we are not even sure that the effect of these reagents on swelling is the sole reason for their observed beneficial influence on the waving process. Some study has suggested that these reagents influence the process in other directions.

We claim:

1. An aqueous hair waving lotion comprising a plurality of different monoethanol amine salts, one of which is the salt of thioglycolic acid, said lotion being adjusted to the pH range of about 9 to 10 with free monoethanol amine and a small quantity of a lower aliphatic polyhydric alcohol dissolved in the lotion.

2. An aqueous hair waving lotion comprising a plurality of different monoethanol amine salts, one of which is the salt of thioglycolic acid, said lotion being adjusted to the pH range of about 9 to 10 with free monoethanol amine, a small quantity of a lower aliphatic polyhydric alcohol dissolved in the lotion, and a wetting agent.

3. An aqueous hair waving lotion comprising a plurality of different monoethanol amine salts, one of the salts being the salt of thioglycolic acid in concentration of from 0.4 to 1.2 normal and the other monoethanol amine salt being in concentration of from 0.1 to 0.6 normal,

from 0.2 to 0.6 normal free monoethanol amine, and from 1 to 10 grams of a lower aliphatic polyhydric alcohol per 100 ml. of solution.

4. A lotion as defined in claim 3 in which the said other monoethanolamine salt is the salt of an acid selected from the group consisting of hydrochloric, sulfuric, nitric, and citric, and the polyhydric alcohol is selected from the group consisting of ethylene glycol, glycerol, mannitol, sorbitol, and glucose.

5. A lotion as defined in claim 3 in which the said other monoethanolamine salt is monoethanolamine hydrochloride and the said polyhydric alcohol is sorbitol.

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