

1

3,208,910

ZIRCONIUM ACETATE HAIR TREATING COMPOSITION AND PROCESS OF USING SAME

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This invention relates to styling fluids and rinses for uses in hair dressing operations.

Almost since the beginning of time women have employed compositions of some sort to make straight hair curly and to hold it in position after doing so. Perhaps the earliest material employed to soften hair was plain water, but hair which has been moistened, curled, and dried in curled condition retains its shape for only a short time. Typical modern wave setting fluids contain a mild alkali to soften the hair and a vegetable mucilage such as gum karaya, Irish moss, or pectin, to hold it in position after it has been shaped to the desired coiffure. Hair which has been styled or arranged may be held in place for somewhat longer periods with "lacquers" formed from natural gums, resins, or synthetic plastics such as polyvinylpyrrolidone. Beer and other malt beverages have also been used to give body to hair and to aid in arranging it, but the objectionable odor of such materials has limited their use.

Conventional wave sets and lacquers are known for their characteristics of making hair stiff, unnatural, sticky, and hard to keep clean. Many of them tend to flake unattractively. Still others, e.g., polyvinylpyrrolidone, absorb moisture from the air and become sticky on damp days and hard and brittle in extremely dry weather. All such materials have little or no resistance to water vapor, and treated hair loses its curl in moist weather. Lacquers, which are generally applied in alcohol solution suffer from the additional problem of high inflammability.

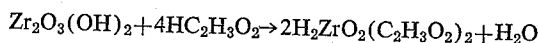
I have now devised a method and a composition for styling hair, which overcomes the objections inherent in the products of the prior art. In the practice of my invention I am able to impart body, luster, and a surprising degree of moisture resistance to human hair. The treated hair is flexible, readily arranged, pleasant smelling, clean, attractive, and glossy, retaining these characteristics for several days, regardless of the relative humidity of the air. The hair may be repeatedly treated without any harmful weakening or embrittling such as is caused by excessive use of basic solutions. Bleached, frizzy, or otherwise weakened and porous hair receives new strength and beauty with my treatment. Compositions used in the practice of my invention are totally noninflammable, and they appear to be amazingly free from responsibility for allergic reactions of any kind.

In accordance with my invention, I treat hair with a dilute solution of a water-soluble zirconium salt, the solution having a pH in the range of about 3 to 6. A highly preferred pH is 5.5, which approximates that of human hair. In direct contrast to the teachings set forth in U.S. Patent 2,707,697, I expressly avoid including any acidic material in the treating solution other than the zirconium salt itself. The hydroxy-carboxy acids disclosed in the said patent serve no useful purpose in the practice of my invention, and they may even prove to be harmful; the

2

hair-softening action imparted by hydroxy-carboxy acids is neither sufficient to permit formation of permanent bonds in the hair nor innocuous enough to keep from interfering with the hair-bodying action taught by my invention. Generally speaking I prefer soluble zirconium carboxylates for use in the practice of my invention, since not only can they be used in somewhat higher concentration than the zirconium salt of mineral acids while still remaining harmless to the skin surfaces, but they also impart more body to the hair.

A particularly preferred zirconium carboxylate for my purposes is the compound known as zirconium acetate. This compound may be obtained by reacting basic zirconyl hydroxide with acetic acid in accordance with the equation:



A commercial source of the zirconium acetate used in the practice of my invention is aqueous "zirconium acetate solution," typically having a chemical analysis of approximately 13% ZrO_2 , .2% CaO , .1% SO_4 , .1% Na , 14% acetic acid, and .01 Fe . The solution, which thus has an effective zirconium acetate concentration of about 27%, has a specific gravity of about 1.17 and a pH of approximately 3.9.

The essence of my invention may be demonstrated by adding from 1 to 10 ounces of the "zirconium acetate solution" described in the preceding paragraph to 1 gallon of distilled water and mixing thoroughly to provide a solution containing from about 0.19-1.9% (preferably 0.2-1.0%) theoretical zirconium acetate, $\text{H}_2\text{ZrO}_2(\text{C}_2\text{H}_3\text{O}_2)_2$, having a pH of from about 3 to 6, and applying the resulting solution to freshly shampooed hair, either before or after curling. After drying the resulting coiffure demonstrates a rich full body, the hair possessing a desirable resistance to combing and a readiness to maintain the configuration imparted to it, and maintains a soft, attractive sheen, remaining clean far longer than hair set in a conventional manner. It is also noted that higher amounts of zirconium acetate greatly increase the moisture resistance of the hair, thus making it far easier to maintain on damp and humid days, although there is a tendency toward increased harshness as additional zirconium acetate is applied. Generally I find that solutions having higher concentrations of zirconium acetate are best suited for use by professional operators, the increased body imparted to the hair manifesting itself by increased difficulty in "combing out." Solutions containing lower concentrations of zirconium salt, although somewhat less effective, result in hair which is easier to comb out and is hence better suited for use by the woman who sets her own hair. The concentration of the zirconium acetate in the treating solution in no event should exceed 2.0% by weight or the treated hair will behave as if it were full of snarls and be extremely difficult for even a professional beauty operator to comb out.

Zirconium acetate solutions may also be applied to hair which has been set and already dried. In such cases it may be desirable to dilute the zirconium acetate still further, e.g., to a .1-1% zirconium acetate concentration. Even hair which has not been washed for several days can be treated in this way, the zirconium acetate restoring beauty, body and luster.

3

A somewhat refined embodiment of my invention may be attained by modifying the zirconium acetate with various other materials. Thus, a preferred composition, having a pH of about 5.5, includes the following ingredients:

13 ounces of "zirconium acetate solution" containing 27% theoretical zirconium acetate by weight
1 pint methyl alcohol
9 ounces polyvinylpyrrolidone
2 ounces insoluble rose perfume
30 drops blue coloring
Sufficient water to make 10 gallons

In the above formulation the alcohol aids in dissolving the polyvinylpyrrolidone, the latter material adding stiffness, sheen, and "snap" to the hair but being present in an amount so small as to have no noticeable effect in the absence of the zirconium acetate. The perfume and coloring material, of course, serve merely to render the product more appealing. Hair which has been shampooed, rinsed, treated with the above solution, set and dried, is appreciably more resistant to combing than is hair treated with conventional setting lotions, and it is readily shaped or arranged, remaining in position while simultaneously presenting an extremely attractive full-bodied appearance. If desired, resistance to combing can be reduced by adding 2 ounces of "Emulphor EL-719" or "Emulphor ON-87" to a gallon of the formulation. (The Emulphors are non-ionic water-soluble polyethylene ethers of fatty acids or alcohols which are stable to salts, acids, and alkalies; these products are useful as dispersing and stabilizing agents and are obtained from the General Dye-stuff Corporation.) Interestingly, I find that the presence of the Emulphors enables me to greatly increase the amount of zirconium acetate which I employ, and hence to impart still greater water resistance to the finished coiffure without causing undue harshness.

Although I do not maintain that I clearly understand the manner in which zirconium acetate functions as I employ it to produce the outstanding results which it does, and I do not wish to be limited by any explanation which I advance, I believe that the following action may take place: zirconium acetate appears to penetrate and swell the clear cuticle layer which surrounds the hair shaft; drying the hair in a curled, stressed position thus causes it to retain its shape. I also believe that the slightly acid pH, corresponding closely to that of hair itself, represents a more "natural" solution with which to treat hair than the highly basic materials employed in most conventional setting or styling lotions.

Where it is desired to obtain a hair treatment having a still greater resistance to moisture, I have found it highly effective to modify my treating procedure slightly. Two techniques have proved effective. In one instance, I shampoo the hair with a soap shampoo, e.g., a coconut oil base product, and, while the soap is still present, apply a solution of zirconium acetate. A highly insoluble zirconium soap is apparently formed in situ on and in the hair shaft, thus imparting a remarkable resistance to water, even heavy rain, although the treated hair is less glossy than hair treated by other methods described herein.

The second procedure which I have found effective in still further enhancing water-repellence involves modifying the zirconium salt solution by adding an emulsifiable petroleum wax such as Socony-Vacuum's "Mobilcer A," which has a melting point of about 125° F., and emulsifying it to as low a particle size as possible, preferably on the order of two microns or less, in a colloid mill or homogenizer. When the resultant emulsion is applied to freshly shampooed and rinsed hair, and the hair thereafter dried—preferably at a temperature sufficient to fuse the wax—a lustrous, water-repellent coiffure results. A treating solution containing about two part by weight of wax per part of (solid) zirconium acetate is particularly effective, treated hair resisting even heavy rain or direct water

4

spray. It is desirable that the wax be one which melts at about 130° F., fuses at the temperature attainable in commercial forced air dryers; heated combs, or locally heated comb-dryers, however, may be used to fuse the wax and thus provide a continuous film. Wax alone, i.e., without the zirconium salt, is unsatisfactory, tending to flake off and make the hair unattractive.

Hair freshly treated with a dilute zirconium salt solution of the type described herein as a "conditioner" may be thereafter subjected to the action of a setting or waving solution, e.g., a permanent waving solution, with superior results. Certain portions of human hair are often more porous than others, a characteristic particularly common in bleached or damaged hair, and it ordinarily requires considerable skill to avoid overtreatment with a waving solution. Pretreatment with zirconium salts, however, imparts a more uniform nature to the hair, making it possible to provide accurately controlled and predictable results from permanent waving.

In addition to the many advantages imparted by aqueous solutions of zirconium salts as I have described their use hereinabove, they can also function as carriers for temporary tinting or rinsing colors, as well as permanent dyes, permitting such materials to penetrate the cuticle of the hair shaft and thereby impart a uniform color which does not show "rub-off" or "fade-out." Hair treated in this fashion looks natural and attractive and is markedly superior to the best previously known procedures; e.g., most professional procedures for imparting temporary colors to hair necessitate the use of a wax emulsion of some type, thereby tending to impart a sticky or greasy characteristic to the hair. Since the hair, after being tinted or dyed, is customarily combed and then set, I find it advantageous to employ zirconium sulfate or oxalate as the salt, such compounds enhancing the luster and dye-receptivity of the hair without increasing resistance to combing. When the hair is thereafter set, however, zirconium acetate solution may be employed as previously indicated.

Based on the teaching set forth in the preceding description, many variations and equivalents will undoubtedly occur to those skilled in the art. For example, it will be apparent that the treatments described herein can be applied to animals, e.g., poodles, or to fur coats, stoles, etc. I wish it clearly understood that such variations are within the scope of my invention, and I do not intend to be limited in any way other than by the scope of the appended claims.

What I claim is:

1. A styling fluid for imparting body, moisture-resistance, and sheen to human hair, consisting essentially of a precipitate-free dilute aqueous solution having a mildly acidic pH and containing as active ingredients from 0.1% to 2% zirconium acetate, and emulsified in said solution a waxy material which is solid at room temperature but which melts below about 130° F., the quantity of said waxy material being approximately twice exceeding the quantity of zirconium acetate.

2. A styling fluid for imparting body, moisture-resistance, and sheen to human hair, comprising a precipitate-free dilute aqueous solution having a mildly acidic pH and containing active ingredients consisting essentially of from 0.1% to 2% zirconium acetate and a small amount of polyvinyl pyrrolidone insufficient to impart any noticeable effect to hair in the absence of said zirconium acetate, said solution further containing a minor amount of alcohol to aid in dissolving said polyvinyl pyrrolidone and emulsified in said solution a waxy material melting at about 130° F., the quantity of said waxy material being approximately twice the quantity of zirconium acetate.

3. A composition particularly adapted for imparting body and natural-appearing color to human hair consisting essentially of a precipitate-free aqueous solution containing a hair coloring material and from about 0.1 to about 2% zirconium acetate by weight.

5

4. A method for imparting body, moisture-resistance and sheen to human hair in a temporary hair-styling treatment, comprising the steps of applying to the hair a dilute precipitate-free aqueous solution having a mildly acidic pH and containing as active ingredients from 0.1% to 2% zirconium acetate, styling the hair, and drying the hair.

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6

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