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PROCESS AND COMPOSITION FOR SETTING HAIR ON THE HUMAN HEAD

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The present invention relates to a process and composition for setting hair on the human head.

In dressing a woman's hair, it is necessary to impart an altered wave shape to the strands so as to maintain some selected style of hair dress in accordance with which the hair has been arranged pursuant to the woman's wishes. There are broadly, two methods for thus altering wave shapes. One of these is a permanent alteration, this being the so-called "permanent" wave; the other is a transient, i. e., temporary, alteration this being known in the art as a hair "set." The present invention specifically is concerned with the second type of alteration, i. e., with hair setting.

Customarily, a woman's hair has a permanent shape, usually a curl, this being either a natural shape or an artificial shape which has been brought about by molecular rearrangement within the hair structure itself, customarily by chemical action. If the only attention given to the hair is combing, the strands are unruly, that is to say, they assume a haphazard relationship which is most unsightly. To secure an attractive appearance and impart any particular coiffure, it is necessary slightly to alter the permanent shape of the strands so that the permanent curled configuration, for example, has its diameter modified, usually by slight enlargement, and also its plane of orientation changed. This alteration, it will be recalled, is of a temporary nature only and the hair subsequently will revert to the original permanent shape. The tendency to lose its temporarily assumed set shape is accelerated by physical disarrangement of the hair, e. g., by tousling or sleeping, or by subjecting the hair to a damp atmosphere or actual wetting.

It is customary, at the present time, to employ gums and other film-forming chemicals, such as lacquers or water-soluble plastic solutions, in liquid form, or as an aerosol spray to hold the hair set for a longer period of time than is obtainable by a simple water set. Nevertheless, when the hair is physically disturbed or subjected to a damp atmosphere, these stiffening agents become soft or crack and tend to allow the hair to assume its original natural or permanent wave, so that the hair has to be reset. Such chemicals, upon drying of the solution, form a thin sheath on the outside of the individual hair fibers which, although creating a result more desirable than a water set, still is fragile and moisture deterioratable.

It is the principal object of the present invention to provide a process and composition of the character described which are not susceptible to the foregoing drawbacks and will impart a more durable and attractive set than is obtained by other conventional present-day hair setting methods and will maintain a set shape from shampoo to shampoo.

It is another object of our invention to provide a process and composition of the character described in which a stiffening agent is present and is deposited within as well as without the individual hair strands.

It is another object of our invention to provide a

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process and composition of the character described which so physically affect the fibers as to permit penetration by a film-forming stiffening agent.

It is another object of our invention to provide a process and composition of the character described which affect the molecular structure of the hair secondarily whereby to permit the foregoing penetration and render the hair soft and pliable without, however, disrupting the bonds that principally maintain the permanency of hair shape.

It is another object of our invention to provide a process and composition of the character described which do not break the disulphide and peptide bonds of hair keratin but do break some of the hydrogen and salt bonds, thus making the hair unusually pliant and easy to arrange in a given shape and prone to maintain its shape under the control of the stiffening agent and at the same time permit penetration of the hair by the stiffening agent.

It is another object of our invention to provide a process and composition of the character described which, in addition to rendering the hair softer than heretofore and thus facilitating arrangement into any desired coiffure, tend to make the hair maintain its set form when dry so that this shape will be retained even if the stiffening agent temporarily is weakened, as by moisture deterioration.

It is an additional object of our invention to provide a process of the character described which is simple and inexpensive to practice and a composition which employs safe, inexpensive and commercially available chemicals.

Other objects of our invention in part will be obvious and in part will be pointed out hereinafter.

Our invention accordingly consists in the compounds and steps which will be exemplified in the chemicals and methods hereinafter described and of which the scope of application will be indicated in the appended claims.

In accordance with our invention we apply to the hair a setting solution which essentially comprises only polyvinyl pyrrolidone, which is a water-dispersible plastic stiffening agent, and triethanolamine and urea which are both water-soluble non-reducing swelling agents, as well as plasticizers for polyvinyl pyrrolidone. The liquid carrier must include water. Preferably, the solution is applied to the hair before it has been manipulated to impart any particular shape thereto, and thereafter, the hair wet with such solution, is arranged in accordance with some particular style, for example, put up in pin curls having a certain arrangement relative to each other. It will be understood that it is within the scope of our invention, first to wet the hair with water and only then to wet it with our solution, after which the hair is manipulated in a well-known manner. It also will be understood that, optionally, the hair first can be arranged by manipulation and thereafter our solution applied thereto before the hair has otherwise been wet, but we do not prefer this method inasmuch as it does not make use to the full of all the advantages of our invention.

We have observed that the swelling agents urea and triethanolamine leave the hair particularly pliant and limp and therefore make the hair very easy to handle by a professional operator or by the woman herself. We have seen, moreover, that the use of these swelling agents, even by themselves, impart a semi-permanence to the set so that if subsequently the polyvinyl pyrrolidone should be somewhat weakened temporarily the hair nevertheless will tend to remain in its set shape until such stiffening agent resumes its full strength. We have noticed that said composition and process are particularly useful in the setting of thin or weak hair strands although they are, of course, applicable to all kinds of types of hair.

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Triethanolamine and urea are known to swell human hair. In addition, they are known to break hydrogen and/or salt bonds in the keratin molecule although they do not affect disulphide bonds and peptide linkages. Moreover, these two swelling agents acting jointly are observed to have a combined effect greater than would be expected so that an enhanced swelling action is produced.

We have ascertained that when a setting solution includes these particular compositions a deposit of polyvinyl pyrrolidone, integrated with its plasticizers, urea and triethanolamine, is formed within the hair strands where it adds body and strength to the strands and superimposes its set shape on the shape of the strands. It will be appreciated that the polyvinyl pyrrolidone deposit by reason of its location within the individual hair strands is comparatively well protected and therefore is less susceptible to physical deterioration and to deterioration by the action of moisture. In addition to this internal deposit a sheath of polyvinyl pyrrolidone is formed externally on the strands, this sheath being intimately bound with and forming an integral extension of the internal deposit so that it is particularly well secured in place on the hair shafts.

It will be noted, moreover, that the polyvinyl pyrrolidone which is internally deposited and also forms a sheath on the hair shafts is in a pliable form, that is to say plasticized, i. e. non-brittle, due to the presence of the plasticizers urea and triethanolamine.

Due to this internal deposit, principally, we have observed that a set is obtained which is much longer lasting than that which is secured with previous film forming compositions or even with compositions employing swelling agents of a non-reducing type and non-penetrating stiffening agents. Where there is penetration of the hair shafts by the stiffening agents a set secured in the foregoing manner and with the use of the aforesaid setting composition lasts as long as one week even if roughly handled and even under humid conditions.

We believe that the physical modification of the surface structure of the hair strands occasioned by the swelling undergone by hair when subjected to the combination of triethanolamine and urea in water solution and by the rupture of the hydrogen bonds and the salt linkages permits the water dispersed polyvinyl pyrrolidone together with its said specific plasticizers which also are in aqueous solution to penetrate the hair shafts so that the aforesaid pliable polyvinyl pyrrolidone deposit is formed within the shafts upon evaporation of the aqueous carrier. It is the said deposit in conjunction with the plastic external sheath which imparts the extra strength and longevity to the set.

We have found that both the external sheath and the internal deposit imparted by solutions embodying our invention will not flake off or be too oily or too hard. The hair, after treatment with said solution, is soft enough to be set due to the swelling action and the ensuing limpness of the hair and will retain this set for a very substantial period of time after drying. The hydrogen bond breaking effect of the urea which, we believe, principally facilitates penetration of the hair fibers by the dispersion of this specific plastic also renders the hair more flexible for setting. The triethanolamine enhances this effect by its breakage of the salt linkages of the keratin molecules. However, these bond breaking effects do not diminish the lasting quality of the set because the primary structural bonds of the hair are not degraded as is the case in permanent waving.

To achieve the desired penetration and satisfactorily to swell and render the hair pliant pursuant to our invention, the concentrations of polyvinyl pyrrolidone, triethanolamine and urea can be varied for broadly different types of hair, for instance, for porous or damaged (bleached, dyed or permanently overwaved) hair, satis-

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factory results are secured with a lower concentration than for normal hair. The reason apparently is that such hair is more easily softened, swelled and penetrated by the said solution.

Although there is no theoretical upper limit to the concentration of polyvinyl pyrrolidone present in the solution, commercial considerations and attractiveness dictate a practical higher limit. Thus, if the concentration is too great, the precipitation of the polyvinyl pyrrolidone (together with its plasticizers) taking place upon drying will create a noticeably dusty and flaking effect which is quite undesirable. Moreover, the use of too great an amount of polyvinyl pyrrolidone represents nothing more than an unnecessary additional expense. Therefore, we consider that for practical considerations the upper limit for the polyvinyl pyrrolidone should be about 3% by weight of solution. The lower commercial practical concentration of polyvinyl pyrrolidone that achieves satisfactory results in the practice of our invention is about 1% by weight. When still lower concentrations are employed there is sufficient plastic material present to impart a satisfactory set inasmuch as only a given volume of liquid can be held in the hair under any particular circumstances.

In order to create a flexible, elastic, non-brittle, non-irritating and sheen giving internal deposit and external sheath, the amount of urea and triethanolamine should each be about 50 to 75% by weight of the weight of polyvinyl pyrrolidone present.

Polyvinyl pyrrolidone is available in different stages of polymerization. A stage we have found to be very satisfactory in the practice of our invention is that at which the molecular weight of the polyvinyl pyrrolidone is about 40,000, this type of polyvinyl pyrrolidone being known commercially as K30. We believe that molecules of such size have no difficulty in penetrating individual hair strands that have been treated with urea and triethanolamine.

The pH of the penetrating solution desirably varies from about 9.0 to 10.5 and is controlled primarily by the concentration of triethanolamine. Within this range, the higher the alkalinity the greater the absorbing capacity of the hair for polyvinyl pyrrolidone.

We have observed that hair treated pursuant to our invention is particularly easy to handle and arrange in any given form, has an unusually long life of set and tends to retain its set even under the most adverse conditions. We believe that the reason for these unusual results, aside from the internal location of the plasticized deposit of polyvinyl pyrrolidone, arises from the breaking and subsequent restoration of hydrogen and salt linkages in the keratin molecule. Such rupture of the hydrogen and/or salt bonds does not affect the main molecular arrangement of hair strands that causes this hair to maintain a permanent shape but such rupture, when water is present, makes the hair very easy to handle because the disruption is of what might be referred to as "secondary" bonds, i. e. bonds which only secondarily affect the shape of the hair strands yet which, in part, contribute to the resiliency thereof. We believe that, after the hair has been dried, the said ruptured linkages automatically reform at least to a considerable extent under ambient conditions. This action tends to maintain the hair strands in the shape in which they have been dried by imposing a new and temporary stress that affects the overall stress-strain equilibrium in the strands whereby even if the internal deposit of polyvinyl pyrrolidone temporarily is weakened the hair will maintain its set shape.

We further believe that the softening, swelling and penetrating effects which we have discussed hereinabove are enhanced during the time that the hair dries with the solution present since, as the concentration of the swelling agents increases, additional bonds will be broken while there is still sufficient water and polyvinyl pyrrol-

idone present to permit penetration of the solution into the shafts.

Our novel composition is applied to water-wetted or dry hair and is spread therethrough by manipulation with the fingers or by combing so that the hair is thoroughly wet with the solution. Alternatively, other methods of application can be utilized such, for instance, as spraying or daubing. After such application, the hair is arranged to give a desired configuration in any manner well known to the art so as to secure some preferred coiffure. For instance, the hair is set in pin curls or on curlers according to some pre-arranged pattern. An operator practicing our invention will find that the hair, because of its unusual pliancy and limpness, is particularly easy to arrange in any given style and will tend to remain relaxed in the shape which has been imparted to it.

Thereafter the hair is dried, e. g., preferentially by the use of a dryer or if that is not available by open-air drying. The temperature used is low, that is to say, not over 160° F. and preferably not over 130° F., so that the drying operation whether done with or without the aid of warm air is considered as a "cold" operation, this being distinguishable from the temperature present during a so-called "hot" waving operation.

Prior to drying, the urea and triethanolamine attack the hydrogen and salt bonds under ambient temperature conditions, rendering the hair pliant and limp as mentioned above and the polyvinyl pyrrolidone enters the individual hair shafts along with triethanolamine and urea. During the evaporation of the aqueous carrier the concentrations of triethanolamine and urea increases to a point where their maximum effectiveness is achieved while there still is sufficient water, triethanolamine and urea present to break additional secondary bonds to a substantial extent so as to increase the softness of the hair and the penetration of the polyvinyl pyrrolidone, triethanolamine and urea. As the drying proceeds to completion, the polyvinyl pyrrolidone is, in addition to being deposited on the interior of the hair shafts as a plasticized solid, also deposited as a thin sheath on the exterior of the shafts so that the two deposits rigidify the hair shafts and hold them in their set shapes.

It is desired to mention that long lasting sets can be obtained by applying our new solution to the hair after it has been arranged in some desired configuration and is either wet or dry. However, such an altered order of steps loses the advantage of the additional pliancy and softness which aids the operator in setting and enables a particularly neat and attractive coiffure to be secured.

A preferred example of the penetrating solution is:

2½ gr. polyvinyl pyrrolidone
1¼ gr. urea
1¼ gr. triethanolamine
95 gr. water

We have found that, apparently due to the physical effect on the hair structure of the type of swelling agent above described, the drying time for hair treated in accordance with our invention is substantially less than for hair set by any present day conventional method.

It thus will be seen that we have provided a composition and process which achieve all the objects of our invention and are well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein described is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim as new and desire to secure by Letters Patent:

1. An alkaline composition for setting hair cold on the human head, said composition essentially comprising an aqueous carrier, polyvinyl pyrrolidone, urea and triethanolamine.

2. An alkaline composition for setting hair cold on the human head, said composition essentially comprising a water solution of polyvinyl pyrrolidone ranging from about 1% to 3% concentration by weight, and urea and triethanolamine in an amount ranging from about 50% to 75% each of the polyvinyl pyrrolidone.

3. An alkaline composition for setting hair cold on the human head, said composition essentially comprising a water solution of polyvinyl pyrrolidone having a molecular weight of about 40,000, and urea and triethanolamine.

4. An alkaline composition as set forth in claim 3 wherein the polyvinyl pyrrolidone does not exceed a concentration of about 3% by weight.

5. An alkaline composition as set forth in claim 3 wherein the polyvinyl pyrrolidone does not exceed a concentration of about 3% by weight, and the urea and triethanolamine are present in an amount of about 50% to 75% by weight of the polyvinyl pyrrolidone.

6. An alkaline composition as set forth in claim 5 having a pH between about 9.0 to 10.5.

7. An alkaline composition for setting hair cold on the human head, said composition essentially comprising an aqueous carrier, polyvinyl pyrrolidone, urea and triethanolamine, the pH of the composition being between about 9.0 and 10.5.

8. A method of setting hair cold on the human head, said method comprising applying to the hair an alkaline composition including an aqueous carrier, polyvinyl pyrrolidone, urea and triethanolamine.

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