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SHAMPOO OF IMPROVED FOAMING AND LATHERING POWER COMPRISING HIGHER FATTY ALCOHOL SULFATE AND SUBSTITUTED IMIDAZOLINE

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ABSTRACT OF THE DISCLOSURE

An aqueous shampoo composition of improved foaming and lathering power includes a major proportion of aqueous solvent medium and minor proportions of higher fatty alcohol sulfate and of a 1-hydroxy-lower alkyl, 2-higher alkyl imidazoline, at a slightly basic pH.

SUBJECT OF THE INVENTION

This invention relates to a shampoo of improved foaming and lathering characteristics, which is also of satisfactory high viscosity and condition the hair well. It comprises an aqueous solution of a salt of higher fatty alcohol sulfuric acid and a substituted imidazoline in an aqueous medium, at a slightly basic pH.

BACKGROUND OF THE INVENTION

In addition to being required to clean well, commercially successful shampoos for human hair, especially those intended to appeal to feminine purchasers, are required to be of excellent foaming and lathering powers, to have a desired high viscosity and to leave the hair conditioned after shampooing. Much research has been done in an effort to improve these characteristics of shampoos.

With respect to detergency, many of the available synthetic organic surface active agents and detergents are capable of cleaning the hair and removing excess oil from it. In fact, most of them are almost too good in this respect, because they leave the hair devoid of oil, excessively dry and subject to "fly-away" electrostatic effects, frizziness, brittleness and splitting, all of which are characteristics of hair from which desired "conditioning" oil has been removed. In addition to cleaning too well, many of the shampoo active ingredients are so effective that only small proportions of them are used in shampoos and the results are often products of low viscosity, which appear to the consumer to be watery. Additionally, although most of the shampoos possess significant foaming powers, often the foams are lacy, drain excessively fast, and the bubbles break and disappear quickly. Furthermore, some give a very thin lather.

For the above reasons, shampoos for use on the human hair based only on higher alcohol sulfates are often not satisfactory. Thus, to such shampoos there are usually added foam builders or stabilizers, thickeners, and conditioning agents, such as lipophilic materials which may be deposited to some extent on the hair to replace the removed oils.

The substituted imidazolines such as 1-beta-hydroxy-lower alkyl, 2-higher alkyl imidazolines, are known surface active materials, the salts of which are of higher water solubilities than the free amines. The substituted imidazolines of this type are unsatisfactory as the sole or principal detersive constituents of shampoos intended for use on human hair. They often behave much like cationic compounds and therefore, are generally considered to be incompatible with anionic surface active agents.

DESCRIPTION OF THE INVENTION

Despite the objectionable reaction which might have been expected, it has now been found that an aqueous shampoo can be made comprising a higher alcohol sulfate detergent salt and a substituted imidazoline, such as 1-beta-hydroxy-lower alkyl, 2-higher alkyl imidazoline. Such shampoo, in addition to possessing excellent detersive powers, is of improved foaming and lathering characteristics, even when compared to the best commercially available foaming agents, the higher acyl di-lower alkanolamides and the higher alkyl di-lower alkyl amine oxides. The shampoos made are also af desirable increased viscosity and satisfactorily condition the hair, minimizing dryness and electrostatc effects, giving good wet combing characteristics and improving the lustre of the hair.

In accordance with the present invention, an aqueous shampoo composition of improved foaming and lathering power comprises a major proportion of aqueous solvent medium, a minor proportion of a higher alcohol sulfate and a minor proportion, less than half the higher alcohol sulfate content, of a 1-hydroxylower alkyl, 2-higher alkyl imidazoline, at a pH of from about 7.5 to 9.5. In a preferred embodiment of the invention the higher alcohol sulfate detergent is a fatty alcohol sulfate, e.g., triethanolamine lauryl sulfate, the substituted imidazoline is 1-beta-hydroxyethyl, 2-higher alkyl imidazoline, in which the higher alkyl portion is fatty, preferably a mixture of long, straight-chain hydrophobe groups derived from coconut oil, the pH is from 7.6 to 8.4 and the composition includes from 15 to 25% of the alcohol sulfate, from 1 to 10% of the substituted imidazoline and 65 to 84% of the aqueous solvent medium, which is essentially water.

The higher alcohol sulfate detergent constituent of the invention includes various compounds of this type which are sufficiently water soluble, very effective in cleaning human hair and compatible with the present imidazolines. The higher alkyl portion is preferably lauryl or myristyl or mixtures of higher alkyls, preferably straight chained or fatty alkyls which average about 12 to 14 carbon atoms per group. Although various mixtures of such alkyls, substantially all of which are within the carbon content range of 8 to 18, are useful, those which are either pure lauryl or myristyl or which are mixtures of alkyls corresponding to the higher fatty alcohols derivable from natural oils, such as coconut oil, are preferred. The alkyl mixture derived from coconut oil is designated as cocyl herein and contains about 8% C_8, 7% C_{10}, 48% C_{12}, 18% C_{14}, 9% C_{16} and 10% C_{18}. Generally, such alkyls will have an even number of carbon atoms and will be terminally joined to the sulfate portion of the molecule but groups of odd number of carbon atoms may also be used. Also, a proportion of the higher alkyl content may be non-terminally sulfated but usually this is only a minor proportion, preferably less than 10%.

The salt-forming portions of the higher alkyl sulfates may be any of the various suitable bases generally employed to make such detergents that are used in shampoos. Although sodium, potassium, magnesium and ammonium ions have been so utilized, the most highlv preferred compounds, which exhibit a surprisingly effective foam- and lather-enhancing activity, in addition to increasing viscosity and improving conditioning properties. are the lower alkanolamines. Of these, the mono- and dialkanolamines are useful but the trialkanolamines are considered far superior, having exceptionally good improving effects on the shampoos with respect to the properties previously mentioned. Of the alkanolamines, the lower alkanolamines, in which the alkyl is of 1 to 4 carbon atoms, are useful in the practice of this invention and the most preferred are those of 2 to 3 carbon atoms, e.g., ethyl, propyl and isopropyl.

Exemplary of the best higher fatty alcohol sulfates for the practice of this invention are triethanolamine lauryl sulfate; triisopropanolamine lauryl sulfate; triethanolamine myristyl sulfate; triethanolamine higher fatty cocyl (cocyl being a mixture of higher alkyls obtainable from coconut oil) sulfate; tri-isopropanolamine cocyl sulfate; and triethanolamine mixed lauryl-myristyl sulfate. Other alcohol sulfate detergents that may be used, preferably in mixture with those previously mentioned, are the corresponding dialkanolamine and monoalkanolamine salts, e.g., diethanolamine lauryl sulfate; monoethanolamine myristyl sulfate; monoisopropanolamine cocyl sulfate; and di-t-butanolamine cocyl sulfate.

In addition to the various lower alkanolamine sulfates, there may be employed, preferably mixed with such compounds, other alcohol sulfate salts, such as the ammonium, sodium, potassium and magnesium salts, also usually as minor proportions of the shampoo alcohol sulfate content. Most preferred of these compounds are such as magnesium lauryl sulfate, ammonium lauryl sulfate, sodium cocyl sulfate and potassium cocyl sulfate.

The substituted imidazolines which coact with the alcohol sulfates to produce improved shampoo compositions are those in which substitution is by a hydroxy-lower alkyl group and a higher alkyl, which substituents are on a nitrogen and a carbon of the imidazoline. The particular substituted imidazolines which have been found to produce greatly improved foaming, lathering, thickening and conditioning properties are those wherein substitutions are at adjoining ring atoms, particularly the 1- and 2- atoms. Thus, 1-hydroxy-lower alkyl, 2-higher alkyl imidazolines produce the effects mentioned. Although in various compositions and sometimes, even in solutions, it may be considered that the substituted imidazolines form salts, they will be discussed herein as if this is not the case, especially because the present compounds are employed primarily in basic solutions and salt formation usually occurs principally by reaction with acidic compounds, such as hydrochloric acid. Furthermore, many of the imidazoline salts, such as those formed with higher fatty acids, alkyl aryl sulfonic acids or similar surface active or detergent acids, are often water insoluble and would not be useful to make improved shampoo compositions such as those of the present invention. Although the free base form of the substituted imidazoline may also normally be considered to be insoluble in water, it has been found that it is sufficiently soluble in aqueous detergent solutions, such as the alcohol sulfates previously mentioned, to be useful in shampoos and to improve their properties in the ways mentioned. Solubilities of these compounds in such solutions are increased by having the free hydroxyl group on the lower alkyl in the 1-position and having the carbon atom content of the alkyl substituent in the 2-position sufficiently low to produce satisfactory solubility.

The hydroxyalkyl substituent on the 1-nitrogen of the ring is a hydroxy-lower alkyl, usually of 1 to 6 carbon atoms, preferably of 1 to 4 carbon atoms and most preferably of 2 to 3 carbon atoms, e.g., hydroxyethyl. Although it is preferred for the hydroxyl group to be terminally located on the alkyl substituent, as far away from the nitrogen as possible, in some cases intermediate positions will also be active. Similarly, whereas straight chain alkyl groups are also most useful, in some cases branched chain hydroxyalkyl groups may comprise a part or all of the substituent on the 1-nitrogen. The alkyl substituent at the 2-position is a higher alkyl of 7 to 17 carbon atoms, which is preferably a normal alkyl and which is terminally joined to the 2-carbon. In some cases branching and non-terminal joinders may be useful. For best water solubility, the carbon content and chain length of the higher alkyl substituent may be comparatively low. Thus, it is preferred to employ such higher alkyl groups containing from 7 to 13 carbon atoms, if pure materials are used, with the 11 carbon atom alkyl being the best. Instead of pure materials, mixtures may be employed, including those obtained from fatty acids derived from natural oils, such as coconut oil. These acids generally have most of the acyl groups of from 8 to 18 or 10 to 16 carbon atoms, with the constituents in larger proportions being those of 12 to 14 carbon atoms. It will be noted that the fatty acids used to make the substituted imidazolines, as by reaction with an N-substituted ethylene diamine, are of one carbon atom more than the alkyl substituents on the imidazoline. See p. 142 of the text "Surface Active Agents and Detergents," vol. II (1958), by Schwartz, Perry and Berch. To vary the properties of the product it is possible to use other substituents on the 2-carbon, including unsaturated radicals, usually of 15 to 17 carbon atoms. Nevertheless, it will most often be desirable to mix such materials with other compounds of greater hydrophilic nature so as to promote solubility of the imidazoline and to prevent precipitation of this active ingredient from the shampoo.

In addition to the discovery that the substituted imidazolines described herein are unexpectedly beneficial in improving foam, lather and other properties of the present anionic detergent shampoos, it has been noted that such properties of the products, especially with respect to viscosity increases, may be even further improved by having present a small proportion of a strong electrolyte salt. Such salts are usually inorganic salts although in some cases organic salts such as sodium acetate, potassium glyconate, triethanolamine hydrochloride and other salts having properties similar to those of a strong inorganic electrolyte are useful, especially when they constitute only a part of the electrolyte content. Nevertheless, the best materials are those which are inorganic and which comprise salts of strong acids and bases, such as those of sulfuric acid, hydrochloric acid, hydrobromic acid or equivalent or similar acids and sodium hydroxide, potassium hydroxide, ammonium hydroxide, or similar bases. Of these compounds, the chlorides are preferred, especially the alkali metal chlorides, e.g., sodium chloride, potassium chloride. The presence of small proportions of such materials increases the viscosities of alcohol sulfate-substituted imidazoline shampoos or allow a reduction in the content of substituted imidazoline, with the obtaining of a similar viscosity despite omission of some of the active ingredient.

The solvent medium employed may be water, preferably deionized water or water low in hardness ions, e.g., containing less than 50 parts per million of such ions, calculated as calcium carbonate. To aid in solubilizing active and adjuvant materials, e.g., perfumes, viscosity modifiers, coloring agents, comparatively small proportions of organic solvents, such as alcohols, preferably the lower monohydric alcohols of 2 to 4 carbon atoms, e.g., ethanol, may be employed and it will sometimes be desirable also to use dihydric and trihydric alcohols of 2 to 6 carbon atoms, e.g., ethylene glycol, propylene glycol, glycerol, diethylene glycol, dipropylene glycol. Other known solvents which are useful in shampoo compositions may be included, providing that they have no unacceptable adverse effects on the final products of this invention.

Most shampoos contain minor proportions of adjuvants to modify their properties and to improve acceptance by the consumer. Although the present shampoos are of desirable cleaning, foaming, lathering and conditioning properties and therefore do not require additives to produce these characteristics, they may still be benefited by the use of certain compatible adjuvants for other purposes and, in some cases, the product may even be improved by suplemental effects of adjuvants to modify the properties of the lather and further to condition the hair. Among the adjuvants that may be used are coloring agents, including water soluble dyes and water dispersible pigments, ultraviolet-absorbing chemicals; fluorescent

dyes; perfumes, preservatives; hydrolyzed animal protein conditioning agents; pH-adjusting materials, e.g., sodium hydroxide, sodium bicarbonate, buffers; lather and foam modifiers, e.g., dimethyl lauryl amine oxide; hair conditioners, e.g., lauric myristic diethanolamide, free oils, monoglycerides; detergents, e.g., nonionic detergents such as the block copolymers of ethylene and propylene oxides (Pluronics®); bactericides; fungicides; bleaches; and sequestering agents, e.g., sodium salts of ethylene diamine tetraacetic acid and alkali metal salts of nitrilotriacetic acid.

The pH of the invented aqueous shampos will usually be slightly alkaline. It has been found that acidic pH's favor an interaction between the alcohol sulfate detergent constituent and the substituted imidazolines. Thus, pH's will be at least 7 but, to prevent irritation of the scalp, will be held to less than 11. Generally, the pH will be from 7.5 to 9.5, preferably from 7.6 to 8.4 and most preferably will be about 8. The pH's of 10% water dispersions of the various substituted imidazolines are usually over 11, making them generally unacceptable as shampoo constituents unless the pH is lowered. The presence of the trialkanolamine higher alkyl sulfate has the desirable effect of moderating the pH of the substituted imidazoline and the alcohol sulfate additionally aids in solubilizing the imidazoline. Furthermore, the desirable hair conditioning, foaming, lathering and thickening properties of the described compositions are evidenced at the mentioned pH's.

pH adjustment may be effected by using the desired proportions of trialkanolamine alkyl sulfate and substituted imidazoline, as will be described hereafter, or acids, bases or buffering agents may be utilized for such purpose.

The higher alcohol sulfate, which is preferably a trilower alkanolamine alcohol sulfate, to be present in an effective cleansing proportion, generally constitutes a minor proportion, from 8 to 40% of the final shampoo composition, preferably from 10 to 30% and most preferably from 15 to 25% thereof. When more than 40 to 49% is employed, shampoos will generally be too concentrated and the desired effects of the compositions may not be obtained to the greatest extent. When less than 8% is used, detergency is diminished and solubilizing effects on the substituted imidazolines not sufficient to have those compounds exert their beneficial effects to the desired extent.

The substituted imidazolines of the said 1-hydroxylower alkyl, 2-higher alkyl imidazoline type usually constitute 10% of the shampoo, preferably from 1 to 8% and most preferably from 2 to 5% thereof. In such proportions they can be satisfactorily solubilized and will have their desired thickening, foaming, lathering and conditioning effects on the alcohol sulfate shampoos. Normally, the contents of the mentioned substituted imidazolines will be less than half of the proportions of the higher alcohol sulfate constituents present. Of course, proportions of the imidazolines used will be adjusted, depending on the solubilities of these and the other component compounds.

The electrolyte salt, present to aid in increasing the shampoo viscosity, will usually be in a proportion less than that of the 1-beta-hydroxy-lower alkyl, 2-higher alkyl imidazoline present and will generally be from 0.4 to 10%, preferably from 0.9 to 8% and most preferably from about 1 to 6% of the shampoo. In such proportions the electrolyte effects a significant thickening action on the shampoo, while not adversely affecting clarity or solubility of the alcohol sulfate and the substituted imidazoline. Neither is it insolubilized by the presence of such materials, the organic solvent and adjuvants.

The solvent system will normally comprise a major proportion of the shampoo, except in some borderline cases wherein paste, cream or solid shampoos are made. With liquid shampoos, the solvent medium will be the major component, generally comprising from 51 to 90% of the shampoo and preferably from 65 to 84% thereof. Preferably, the solvent medium will be at least 80% water and the balance will be 1 to 10% a lower monohydric alcohol of 2 to 3 carbon atoms, but may also include glycerol, glycols and equivalent solvent materials. The proportions of the various solvents and components will be chosen for best compatibility and desired solvent effects with the other shampoo constituents.

The various adjuvants previously mentioned may be present in the shampoos in proportions from 0 to 10% each but normally the amounts will be sufficiently low so that the total proportion of adjuvants is 10% or less of the shampoo, preferably 5% or less thereof. Each individual constituent will preferably comprise less than 5% of the shampoo and most often will be less than 2% thereof.

The present shampoo compositions may be made in any suitable form, as clear liquids, solutions, lotions, pastes, gels or solids, but the liquids, especially the clear liquids, are preferred. The shampoos may be made by suitably blending the various constituents by any generally accepted technique for making such compositions. Usually, the alcohol sulfate will be dissolved in a portion of the water, the substituted imidazoline will be dispersed in another portion of water, sometimes with some additional solvent present, and the various adjuvants, especially those which are considered to be lipophilic, will be dispersed in a different portion of the solvent medium, preferably with a solubilizing proportion of a suitable solvent included. The imidazoline and alcohol sulfate portions will be blended together, with agitation, and possibly, with some heating to solubilize the constituents better. Generally, however, the temperature will not be raised over 60° C. After cooling of such mixture or solution, the solvent-water medium containing adjuvants will be added to it. Heating will be avoided, if possible. In some circumstances, some of the adjuvants may accompany either the alcohol sulfate or imidazoline constituent, rather than being initially blended with the other additives.

No special instructions are required for use of the present compositions. The shampoos may be employed as shampoos normally are, usually being applied in two treatments to the hair, the initial application being to remove gross amounts of oils, sebum, dirt, hardness ions, lacquers and hair treatment chemicals and other materials, and the second application being to remove balances of such materials and to deposit conditioning agent from the shampoo on the hair. To make a lather, from 1 to 50% by weight of shampoo may be employed with water, preferably warm water, and usually from 5 to 30% and most preferably from about 8 to 25% of the shampoo will be used. This results in a thick cleansing and conditioning lather which helps to float away the various undesirable materials from the hair and yet, leaves it satisfactorily conditioned and not unduly dry or "electrostatic."

The advantages of the present shampoos were alluded to above, especially with respect to the superiorities of the substituted imidazolines over comparable additives mentioned earlier. They are of improved viscosity, foaming, lathering and haid conditioning powers, comparable to the best agents for such purposes previously discovered. They are often superior to the higher fatty acid di-lower alkanolamides and higher fatty alkyl dimethyl amine oxides. The substituted imidazolines and the alcohol sulfates both exert their cleansing effects and the alcohol sulfates help to solubilize the substituted imidazolines. Despite the insolubility of the imidazolines in water, they are active in the present shampoos and do not adversely interact with the higher alkyl sulfates. Then too, the compositions are compatible with various adjuvants for other purposes. The washed hair is easy to control, (manageable) and is not dry, brittle, frizzy or susceptible to "fly-

away" due to the presence of electrostatic charges. The cleaning, lathing and conditioning properties are obtainable despite the presence of comparatively large amounts of greases, oils, sebum or other deposits on the hair being washed. Thus, significant advantages attend the use of the present shampoos, which advantages are unpredictable from the natures of the constituents and are unobviously beneficial.

The following examples describe preferred embodiments of the present composition. It will be realized that modifications may be made in them by substitutions of equivalents or obvious replacements, without departing from the principles of the invention or its spirit. All parts given are by weight and all temperatures are in degrees centigrade, unless otherwise specified.

EXAMPLE 1

	Percent
Triethanolamine lauryl sulfate	20.0
1-beta-hydroxyethyl, 2-higher alkyl * imidazoline	2.0
Water, deionized	71.0
Ethanol (95%)	7.0

*Higher alkyl mixture derived from coconut oil fatty acids by "removal" of COOH therefrom in the reaction of the acids with substituted ethylene diamine.

The above composition is prepared by dissolving the triethanolamine lauryl sulfate in half of the combined solution of water and alcohol and the substituted imidazoline is dispersed in the remaining half of such solution, after which the two are admixed at room temperature. A clear shampoo is obtained, with a pH of 7.8, without the addition of any pH modifier or buffer. The shampoo produced is of sparkling appearance and shows no insoluble residue or dispersed particles. It is stable for over one year and the constituents do not settle out in that time.

When employed to shampoo the hair of human subjects with normal, dry or oily hair and skin, whether brunette or blonde, the shampoo gives excellent cleaning, removing lacquers and residues from hair sprays, sebum, oil, soap film, dirt and other deposits on the hair and leaving it shining clean. Yet, the hair is not unduly dry and exhibits very little static or "flyaway" properties. It is readily manageable, combs easily, even when wet, and possesses an attractive lustre after drying.

Some of the desirable properties of the shampoo in use are tested by both laboratory and actual use tests. Thus, foaming power and foam stability are measured in the presences of substantial proportions (3%) of synthetic sebum, which normally acts to destroy foam. In such tests, the composition is compared to a similar one, in the formulation of which the only change is to utilize 2% of myristyl dimethyl amine oxide, a known foaming agent of excellent properties, in place of the substituted imidazoline. Tests are conducted by measuring the volume, in milliliters of foam generated from 100 milliliters of aqueous solution of shampoo, at both 10% and 20% shampoo concentrations, after standard agitation procedures. Also measured are the times for the foams to drain from the maximum volumes generated to 75 milliliters of liquid. Such time measurements are indicators of foam stability and lathering power. Table 1 below shows the results of such tests.

TABLE 1

Shampoo compositions (active ingredients)	pH	10% concentration Volume (ml.)	10% concentration Time (sec.)	20% concentration Volume (ml.)	20% concentration Time (sec.)
20% triethanolamine lauryl sulfate plus 2% 1-beta-hydroxyethyl, 2-alkyl* imidazoline	7.8	325	16	375	24
20% triethanolamine lauryl sulfate plus 2% myristyl dimethyl amine oxide	7.3	325	16	300	17

*See footnote in Example 1.

As is seen from the table, at 10% shampoo concentration in water the substituted imidazoline is as effective in foaming power and stability (related to lathering power) as a well recognized foaming agent, myristyl dimethyl amine oxide, when employed with the higher alkyl sulfate of this invention. At 20% concentration, corresponding more to the higher lathering concentrations, it is clearly superior, showing a 25% improvement in foam volume and about a 40% increase in the time in which the foam remains stable. Such results are consistent with in vivo test results on "dirty" hair being shampooed. Similar results are also obtainable when the load of synthetic sebum is increased or decreased, within the range of from 0.5 to 5% of the sum of wash water and shampoo, instead of the 3% load employed in the present tests. Similarly, the presence of good wet combing, dry hair lustre and low static properties of the shampoo, as shown by in vivo tests, is verified by controlled in vitro tests on human hair.

When there is present 2% of sodium chloride in such shampoos, the shampoos are thickened even more than observed with the above formulas and the desirable conditioning properties, etc., are similarly obtained. The thickening effect noted with the above formulas, without additional electrolyte salt, is about the same as that observed with good thickening agents, such as lauric myristic diethanolamide.

When the pH of the above composition is varied within the range of 7.5 to 9.5, corresponding good end use properties, viscosities and foaming characteristics are observed. In some cases, such properties extend beyond this range but the best results are obtained within the pH range of 7.6 to 8.4. Also, when the amount of alcohol sulfate is changed, within the range of from 8 to 40%, and the amount of the substituted imidazoline is changed, within the range of from 0.5 to 10%, with the proportion of imidazoline being kept at less than about half that of the alcohol sulfate, good detersive, viscosity, foaming, lathering and manageability characteristics are noted, comparable, and in some cases superior, to those obtainable when the best of other foaming and conditioning agents are employed. Such is also the case when different higher alkyl sulfates, within the present invention are used and when the substituted imidazoline is one containing nonyl or undecyl as the higher alkyl radical, or with an alpha-hydroxyethyl, hydroxypropyl or hydroxyisopropyl substituent as the hydroxy-lower alkyl radical.

When adjuvants such as thickeners, e.g., sodium carboxymethyl cellulose; perfumes; dyes; dispersible pigments; other detergents; additional solvents; stabilizers; sequestrants; and pearlescent materials are also present, similar improvements in foaming, lathering and conditioning powers, plus viscosity increases are obtainable.

EXAMPLE 2

The formula for the preferred "experimental" shampoo of Example 1 is modified by replacing 3% of the water thereof with an additional 3% of the preferred substituted imidazoline therein, making a total of 5% of such compound, and its properties are compared to those of a comparable composition containing 5% of lauric myristic diethanolamide, a preferred viscosity improving, foaming, lathering and conditioning agent. Again, the in vitro tests are conducted in the presence of 3% of synthetic sebum and deionized wash water, following the procedures described above. Results are reported in the following Table 2:

TABLE 2

Shampoo compositions (active ingredients)	pH	10% concentration Volume (ml.)	10% concentration Time (sec.)	20% concentration Volume (ml.)	20% concentration Time (sec.)
20% triethanolamine lauryl sulfate plus 5% 1-beta-hydroxyethyl, 2-alkyl* imidazoline	8.2	275	15	375	30
20% triethanolamine lauryl sulfate plus 5% lauric myristic diethanolamide	7.6	300	15	325	25

*See footnote in Example 1.

From the table it is seen that the "experimental" formula has a higher pH, is of about the same foaming and lathering characteristics at a 10% concentration and is decidedly superior in both these properties at a 20% concentration. Reference to the data of Table 1, in which pH, foaming and lathering properties of a similar shampoo, containing only 2% of 1-beta-hydroxyethyl, 2-cocyl imidazoline are given, indicates that even with only 40% as much of such additive, the present shampoos are as good as or better in the mentioned properties than those containing 5% of lauric myristic diethanolamide. The results of such tests are reproducible and confirmable by in vivo shampooing. By such tests it is found that the invented shampoos also leave the hair conditioned, manageable, of low flyaway properties and with a good lustre.

When changes are made in the above formulas and similar tests are run on the changed compositions, comparable data are obtained. Thus, when in place of 5 to 10% of the triethanolamine lauryl sulfate there is present an equivalent amount of sodium lauryl sulfate or potassium lauryl sulfate, the substituted imidazoline still has desirable thickening, foaming-improving and conditioning effects. When other similarly soluble substituted imidazolines of the 1-beta-hydroxy-lower alkyl, 2-higher alkyl imidazoline type are used, such as 1-alpha-hydroxyethyl, 2-undecyl imidazoline or 1-gamma-hydroxy-n-propyl, 2-n-octyl imidazoline, viscosity, foam, lathering and conditioning improvements are obtained. This is also the case when to such compositions there is added about 2 to 4% of sodium chloride or potassium chloride, either in the absence of adjuvants or with other materials, such as other thickeners, e.g., polyvinyl alcohol; bactericides, e.g., hexachlorophene, tetrachlorosalicylanilide; conditioning agents, e.g., proteinaceous hair treating compounds, monoglycerides, fatty oils, mineral oils; sequestrants, e.g., glucono-delta-lactone; and other biodegradable detergents, e.g., coconut oil fatty acids monoglyceride sulfates. Proportions of such materials that are non-interfering with the actions of the alkyl sulfate and substituted imidazoline are described in the aforementioned specification. Such effects are obtained whether the physical form of the shampoo is liquid, paste, lotion, cream or gel. The products made are stable for long periods of time and are excellent commercially acceptable shampoos.

The following are formulas of useful shampoos of satisfactory detergency, foaming power, foam stability, lathering ability, viscosity, conditioning properties, etc. When tested according to the foam tests previously described, when checked for viscosity or when evaluated in vivo for foaming on oily hair and scalp, conditioning effects and cleaning properties, such formulations, containing the imidazoline derivatives, are found to be superior to comparable compositions to which the imidazoline has not been added.

EXAMPLE 3

	Percent
Diisopropanolamide myristyl sulfate	18.0
1-gamma-hydroxy - n - propyl, 2-n-undecyl imidazoline	3.0
Water	70.0
Isopropanol	9.0

EXAMPLE 4

	Percent
Potassium lauryl sulfate	15
1-beta-hydroxyethyl, 2-n-nonyl imidazoline	4
Water, distilled	73
Ethanol	5
Sodium chloride	3

EXAMPLE 5

Triethanolamine lauryl sulfate	28
1-beta-hydroxypropyl, 2-n-tridecyl imidazoline	2
Water, deionized	59
Ethanol (95)	6
Glycerol	2
Diethylene glycol	1
K_2SO_4	2

The invention has been described with respect to specific examples of compositions and methods within it. It is clear that the invention is not to be limited by the particular embodiments thereof illustrated in the specification, including the working examples, since to one of ordinary skill in the art equivalents that can be substituted and changes that can be made will be apparent and will still be within the spirit of the invention and the scope of the claims.

What is claimed is:

1. An aqueous shampoo composition of improved foaming and lathering power which comprises from about 51% to about 90% by weight of an aqueous solvent medium, from about 8% to about 40% by weight of a water soluble salt of a higher alcohol sulfate of from about 8 to about 18 carbon atoms and from about 0.5% to about 10% of 1 hydroxy-lower alkyl, 2-higher alkyl imidazoline, having 1 to 6 carbon atoms in the 1-hydroxy-lower alkyl and 7 to 17 carbon atoms in the higher alkyl, at a pH of from about 7.5 to 9.5.

2. An aqueous shampoo composition according to claim 1 wherein said imidazoline is less than half the content of higher alcohol sulfate.

3. An aqueous shampoo composition according to claim 2 wherein the higher alcohol sulfate is a tri-lower alkanolamine higher fatty alcohol sulfate in which the alkanol group is of 1 to 4 carbon atoms.

4. An aqueous shampoo composition according to claim 3 wherein the tri-lower alkanolamine higher fatty alcohol sulfate is triethanolamine higher fatty alcohol sulfate, the imidazoline is 1-beta-hydroxyethyl, 2-higher alkyl imidazoline, and the aqueous solvent medium is at least 80% water.

5. An aqueous shampoo composition according to claim 4 wherein the alcohol sulfate is triethanolamine lauryl sulfate, the imidazoline is 1-beta-hydroxyethyl, 2-higher alkyl imidazoline wherein higher alkyl is a mixture of alkyls of 7 to 17 carbon atoms, corresponding to the mixture of reactant fatty acids derivable from coconut oil, from which the imidazoline is formed, the aqueous solvent medium is essentially water and the pH is from about 7.6 to 8.4.

6. An aqueous shampoo composition according to claim 5 wherein the alcohol sulfate is from 15 to 25%, the imidazoline is from 1 to 6% and the aqueous solvent medium is from 65 to 84% of the shampoo.

7. An aqueous shampoo composition according to claim 1 which also comprises, in a proportion less than

that of the 1-hydroxy-lower alkyl, 2-higher alkyl imidazoline, 0.4 to 10% by weight of a strong electrolyte salt, which further increases the viscosity of the shampoo.

8. An aqueous shampoo composition according to claim **5** which also contains from 0.4 to 10% of sodium chloride to further increase the viscosity of the shampoo.

References Cited

UNITED STATES PATENTS

2,267,965	12/1941	Wilson	260—309.6
2,950,255	8/1960	Goff	252—DIG. 13
3,222,201	12/1965	Boyle et al.	252—542 X
3,313,734	4/1967	Lang et al.	252—542
3,325,414	6/1967	Inamorato	252—532 X
3,400,198	9/1968	Lang	252—542 X

OTHER REFERENCES

Mona Industries Inc., "Monazolines," Tech. Bull. 280b, November 1966, pp. 1, 2.

Knaggs et al.; Alpha Olefin Sulfonates-New Cosmetic Surfactants, Stepan Chemical Co., Society of Cosmetic Chemists' Annual Meeting, New York, N.Y., December 1967, pp. 10, 11.

"Clear Detergent Shampoos," Soap & Chemical Specialties, July 1954, pp. 77, 79.

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U.S. Cl. X.R.

252—550, DIG. 13