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AEROSOL FOAM COMPOSITION SUITABLE FOR DISPENSING WHEN WARM

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ABSTRACT OF THE DISCLOSURE

The present invention relates to aerosol foam compositions and, more particularly, to aerosol foam compositions having improved propellant emulsification, having superior shaving characteristics, having sufficient viscosity when warm to hold individual hairs of a beard erect and providing good heat-transfer properties without excessive loss of moisture.

It is generally recognized in the shaving product art that regardless of the form in which it is to be used, a product must conform to certain requirements in order to aid the shaver. Among those requirements may be enumerated (1) it must be nonirritating; (2) it must retain moisture during the time required for shaving; (3) it must soften the beard; (4) it must lubricate the razor; and (5) it must have sufficient viscosity to hold the individual hairs of the beard erect.

Classically, a shaving composition basically is an aqueous alkaline medium consisting of the saponification product of a fatty acid. This, by definition, is a soap solution. Alkalinity greater than pH 10 is seldom used because of the probability of irritation when used daily. However, an aqueous alkaline medium satisfies the first step in beard softening. The usual shaving soap is a stearic acid soap solution although other soaps are used. Soaps comprise the sodium, potassium, or alkanolamine salts of various fatty acids, but chiefly of oleic, stearic, palmitic, lauric and myristic acids and usually mixtures of all or several of the enumerated fatty acids. Alkanolamine salts of fatty acids, such as triethanolamine stearate are organic soaps soluble in organic solvents, e.g., low molecular weight halogenated hydrocarbon propellants such as the "Freons" and "Genetrons" and hydrocarbon propellants, e.g., isobutane and propane. As a result these propellants containing an organic soap, such as a triethanolamine soap, represent the classic means of achieving propellant emulsification.

In contrast to the prior art method of achieving propellant emulsification by the use of organic soap the present invention provides an aerosol foam composition of improved propellant emulsification without the use of organic soaps. However, problems arise from the use of a soap solution devoid of, or substantially devoid of organic soap. A shaving soap containing a considerably proportion of potassium soap of stearic acid with stearic acid in excess of that amount theoretically neutralized by the amount of alkaline potassium compound, i.e., potassium hydroxide, will produce a slow-drying lather. The choice of stearic acid or the proper blend of fatty acids of different chain lengths enables one skilled in the art to obtain the desired fluidity. However, use of the afore-

mentioned slow-drying lather i.e., potassium soap with free stearic acid, in an aerosol does not result in efficient propellant emulsification. This inefficient and undesirable partial emulsification of the propellant can be overcome by the incorporation in the soap solution of an alkanolamide provided the alkanolamide is correlated with the specific formulation, propellant blend and propellant system.

Alkanolamides are nonionic surface active agents which are widely used as foam stabilizers, emulsifiers, viscosity builders, etc. They are prepared by condensing a primary or secondary alkanolamine with a fatty compound such as a free fatty acid, a methyl or ethyl fatty acid ester, or a triglyceride oil. (A continuous method for making fatty acid alkanolamides in a thin film reactor is described in U.S. Pat. No. 2,863,888 issued in 1958 to J. V. Schurman.) The reaction involves condensation of a methyl ester of a fatty acid with mono- or di- alkanolamine in the presence of alkali metal, alkali metal alkoxide or alkali metal amide catalyst. A short contact time in the reactor produces an alkanolamide of high purity.

There are two types of alkanolamide product. The first is the "Kritchevsky" type liquid product produced by the condensation of two mols of alkanolamine with one mol of fatty acid. These 2:1 type or "Kritchevsky" type condensates are not single chemical entities but a complex mixture of at least six or seven different constituents. The condensates also contain significant amounts of unreacted alkanolamine which tends to render the "Kritchevsky" type alkanolamide water-soluble. With increasing chain lengths of the fatty acid, the condensates become less water-soluble and more oil-soluble and exhibit increasing thickening power.

The second type of alkanolamide is the so-called "super" amide. The "super" amide is prepared by reacting an alkanolamine, mono- or di-alkanolamine, with fatty compound such as a fatty acid, a methyl or ethyl ester of a fatty acid, or a triglyceride oil in equimolar proportions. These 1:1 amides or "super" amides have an alkanolamide content above 90 percent and contain only relatively small amounts of free alkanolamine. Consequently, the "super" amides have poor water solubility. "Super" amides derived from monoalkanolamines are less water-soluble than those derived from dialkanolamines.

It has now been discovered that the emulsification of the propellant of an aerosol foam composition comprising inorganic soaps substantially devoid of organic soaps is satisfactory when there is incorporated in the aqueous soap solution an amount of alkanolamide effective to emulsify said aqueous soap solution and an amount of diol effective to couple said soap solution and said propellant, to enhance heat transfer and lubricity. Said alkanolamide being selected from the 1:1 type and the 2:1 type and comprising at least fifty percent of said 1:1 type.

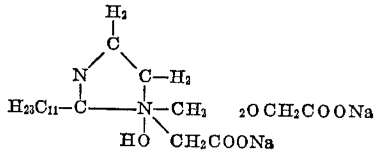
The emulsification of the propellant of an aerosol foam composition is improved by complementing the distribution of fatty acids in the alkali metal soap with the distribution of fatty acids in the alkanolamide. Since the preferred basic soap of the present formulation, potassium soap with free stearic acid, is a water-soluble slow-drying lather the preferred alkanolamide is one of the "super" amide type and especially a "super" amide derived from a monoalkanolamine with the following fatty acid distribution.

Carbon atoms in fatty acid moiety of the "super" amide	Percent
8 and 10	Not more than 1.
12	64 to 72.
14	14 to 25.
16	8 to 11.
18	Less than 10.

To improve the coupling of the alkanolamide with the propellant into the water of the soap solution one or more diols are included in the formulation. As those skilled in the art know the diols are characterized by two hydroxyl groups. Illustrative of the diols are the glycols. The hydroxyl groups contribute water solubility and hygroscopicity. The extent to which hydroxyl groups influence the properties of the molecule depends on the position of the hydroxyl groups, the length of the hydrocarbon chain of the diol, the presence of branched chains, and repeating ether linkages. In effect, the more closely the molecule resembles a hydrocarbon molecule, the more it acts like a hydrocarbon. Propylene glycol is very effective in coupling alkanol-amides and propellants into an aqueous potassium soap solution. In addition, propylene glycol imparts lubricity, heat transfer, and humectant properties to the composition. Hexylene glycol is another diol which provides satisfactory results. To the problems discussed hereinbefore are added others when the shave lather is to be dispensed in a heated condition. Moisture retention with a warm foam is difficult but is improved by incorporating ethoxylated glycerine, e.g., glycerine ethoxylated to contain about 10 mols of ethylene oxide per mol of glycerine. Foam dry out studies show that untreated or regular glycerine provides a foam which has a weight loss of three to four percent in five minutes whereas incorporating ethoxylated glycerine in the lather formulation provides a lather which under the same conditions has a weight loss of about 2.5 percent. Ethoxylated glycerine in addition assists in coupling oils, alkanolamide and propellant into an aqueous potassium soap-free stearic acid aqueous solution. The preferred humectant comprises ethoxylated glycerine.

The speed with which alkaline moisture reaches the hairs of a beard is essential for conventional beard softening. Surface-active agents such as sodium lauryl sulfate, sodium di-octyl sulfosuccinate and sodium dicarboxylates of a coconut imidazolinium group are very effective wetting agents. These compounds or other compatible surface-active agents can be used in the shaving foam formulation to accelerate contact of the alkaline moisture with the hairs of the beard. The choice depends upon the surface tension of the composition, the after-feel desired, the razor-lubricity desired and the firmness or stability of the foam which it is desired to provide within a given volume of foam.

With a warm foam, the difficulty is to maintain sufficient viscosity while wetting or softening the beard without loss of moisture. The addition of a sodium dicarboxylic coconut imidazolinium, which according to the disclosure in U.S. Pat. No. 2,773,068 is represented by the formula



to the formulation provides lubricity, a very good after feel, excellent razor rinseability and wetting of the beard without loss of foam firmness and without excessive loss of moisture.

A small proportion of coconut oil, e.g., about 0.25 percent added to the composition provides for foam spread and lubricity. (Various additives such as lanoline and silicone known to the art can be added to the composition but appear to be unnecessary.)

In general, a suitable formulation of inorganic soap substantially devoid of organic soap for use in a pressurized container to be dispensed as a shaving lather or foam is the following:

Ingredient:	Weight percent
Stearic acid	About 5 to 10.
Coconut fatty acids	About 0.25 to 2.0.
"Super" amide	About 0.25 to 5.0.
Diol	About 0.5 to 6.0.
Glycerine	About 0.25 to 6.0.
Ethoxylated glycerine	About 0.1 to 6.0.
Sodium dicarboxylic coconut imidazolinium	About 0.1 to 2.0.
Coconut oil	About 0.1 to 1.0.
Sodium and potassium hydroxides	Sufficient to saponify the fatty acids but to leave unsaponified about 0.1 to 2.0 percent of the stearic acid. The potassium hydroxide to be proportioned to the sodium hydroxide to provide that the ratio of potassium soap to other soap is greater than 3.5.
Perfume, color, medication, q.s.	
Deionized water	Balance to make 100%.

Illustrative of the afore-provided general formulation are the following:

(A)

Ingredient:	Weight percent
Stearic acid	7.16
Coconut fatty acids	1.00
2:1 type modified diethanolamine from coconut oil	0.50
1:1 type amide from 70:30 mixture of lauric-myristic acids	0.75
Propylene glycol	4.00
Ethoxylated glycerine (10 mols ethylene oxide/glycerine molecule)	2.705
Aqueous 34.2 percent solution of KOH	3.42
Aqueous 19.2 percent solution of NaOH	0.96
Coconut oil	0.25
Deionized water	Balance
Total	100.00

(B)

Ingredient:	Weight percent
Stearic acid	8.75
2:1 type modified diethanolamide from coconut oil	0.25
1:1 type amide from mixture of 70:30 lauric-myristic acids	0.75
Propylene glycol	0.50
Glycerine	0.50
Ethoxylated glycerol monostearate [1]	1.50
Ethoxylated glycerine (10 mols ethylene oxide/glycerine molecule)	1.25
Aqueous 34.2 percent solution of KOH	3.42
Aqueous 19.2 percent solution of NaOH	0.96
Medicament, perfume and deionized water	Balance
Total	100.00

[1] Saponification number ---- 39–49
Acid number (maximum) ---- 5.0
pH 1% solution ---- 5–7.5

(C)

Ingredient:	Weight percent
Stearic acid	7.16
Coconut fatty acids	1.00
2:1 modified diethanolamide from coconut oil	0.50
1:1 amide from 70:30 mixture of lauric-myristic acids	0.50
Propylene glycol	1.205
Regular glycerine	0.75
Ethoxylated glycerine (10 mols ethylene oxide/glycerine molecule)	0.75
Sodium dicarboxylic coconut imidazolinium	0.25
Aqueous 34.2% solution of KOH	3.42
Aqueous 19.2% solution of NaOH	0.96
Coconut oil	0.25
Perfume, medicament, deionized water	0.25
Total	100.00

(D)

Ingredient:	Parts by weight to make 600
Stearic acid	52.50
2:1 type modified diethanolamide from coconut oil	1.50
1:1 type amide from 70:30 mixture of lauric-myristic acids	4.50
Propylene glycol	3.00
Glycerine	3.00
Ethoxylated glycerol monostearate [Saponification No. 39–49; Acid No. (Max.) 5.0; pH 1% solution 5–7.5]	9.00
Ethoxylated glycerine (10 mols ethylene oxide/mol glycerine)	7.50
Aqueous 34.2% KOH solution	20.52
Aqueous 19.2% NaOH solution	5.76
Medicament, perfume, color, q.s.	
Deionized water	Balance
Total	600.00

As propellants, any suitable liquefied, normally gaseous, organic material, including mixtures, can be used. In general, the selection of the particular propellant is integrated with the type of container and the particular vapor pressure desired. It is preferred to use the liquefied normally gaseous low molecular weight halogenated hydrocarbon propellants, such as halogenated ethane, methane and mixtures thereof. The halogenated hydrocarbons known in the art as the "Freons" and "Genetrons" and the like have been found to be particularly suitable. Specific examples of such propellants are dichlorodifluoromethane ("Freon–12"), dichlorotetrafluoroethane ("Freon–114"), monochlorodifluoromethane ("Freon–22"), trichloromonofluoromethane ("Freon–11"), and mixtures thereof.

Other materials which can be used as part of the propellant system are methylene-chloride and methylchloroform which act as vapor pressure depressants in order to adjust the pressure. Various gaseous hydrocarbon propellants can be employed in a liquefied state, such as the aliphatic hydrocarbons having three to four carbon atoms in the molecule, e.g., propane, butane, isobutane and mixtures thereof.

Accordingly, about 80–97 parts of 80° to 95° F. soap solution are placed in a pressure container and the container sealed. Three to ten parts of propellant, e.g., 60:40 mixture of dichlorotetrafluoroethane ("Freon–114") and dichlorodifluoromethane ("Freon–12") are added to the contents of the container by a pressure gassing machine.

After warming to room temperature the product can be dispensed through a manually operated valve.

Thus, for example, a pressure container is charged in the usual manner with the following:

Ingredient:	Weight percent
Stearic acid	6.444
Coconut fatty acid	0.900
2:1 modified diethanolamide from coconut oil	0.450
1:1 amide from 70:30 lauric-myristic acids	0.675
Propylene glycol	3.600
Ethoxylated glycerine (10 mols ethylene oxide/glycerine molecule)	2.475
Aqueous 34.2% solution of KOH	3.078
Aqueous 19.2% solution of NaOH	0.864
Deionized water, perfume, medicament	71.514
Propellant (propane/isobutane–A–46)	10.000
Total	100.000

From the foregoing, those skilled in the art will recognize that the present invention provides (1) an aerosol foam composition in which the propellant is emulsifiable with the aqueous soap solution and in which the aqueous soap solution is about 80 to 97 percent by weight of the aerosol foam composition and the balance propellant comprising liquefied normally gaseous organic material; (2) that said soap solution preferably comprises about 5.25 to about 12 percent of fatty acids of which fatty acids stearic acid is about 80 to about 95 percent; (3) that said soap solution contains potassium and sodium hydroxides preferably in an amount sufficient to saponify all of the fatty acid content except for about 0.1 to about 2.0 percent by weight of the stearic acid; (4) that said potassium and sodium hydroxides are in the ratio of at least 3.5 to 1; (5) that said soap solution contains 1:1 alkanolamide containing at least 90 percent alkanolamide or a mixture of 2:1 and 1:1 alkanolamide in a ratio in the range of 1:1 to 1:3 in amount effective to emulsify said aqueous solution with said propellant; (6) diol in amount effective to couple said soap solution and said propellant, to enhance heat transfer and lubricity; (7) surface active agent in amount effective to accelerate wetting beard hair and stabilizing the foam; (8) liquid acid triglyceride in amount effective to enhance spread and lubricity, and the balance perfume, medicament and water. It is to be observed that said aerosol foam composition is substantially devoid and preferably devoid of organic soaps of the alkanolamine type soluble in organic solvents such as fluorocarbon and hydrocarbon propellants.

Thus, the aerosol foam composition of the present invention comprises about 80 to about 97 percent by weight of an aqueous inorganic soap solution and the balance propellant, said propellant comprising liquefied normally gaseous organic material and said inorganic soap solution preferably consisting essentially of about 5.25 to about 12 percent by weight of fatty acids of which fatty acids stearic acid is about 80 to about 95 percent, alkanolamide about 0.25 to about 5.0 percent by weight of which the 1:1 type alkanolamide is at least 50 percent, diol about 0.5 to about 6.0 percent by weight, ethoxylated glycerine about 0.1 to about 6.0 percent, surface active agent effective to soften beard hair about 0.1 to about 2.0 percent, liquid fatty acid triglyceride about 0.1 to about 1.0 percent, sodium and potassium hydroxides to saponify said fatty acids and to leave about 0.1 to about 2 percent by weight of said stearic acid unsaponified, said hydroxides being in a ratio of potassium to sodium of at least 3.5 to 1, and the balance perfume, medicament and deionized water to make 100 percent.

What is claimed is:

1. An aerosol foam composition consisting essentially of an emulsion of about 3% to 20% by weight of a liquefied, normally gaseous, organic propellant and 80% to 97% by weight of an aqueous soap solution which consists essentially of about 5% to 12% by weight of fatty acids containing 8 to 18 carbon atoms of which 80% to 95% by weight is stearic acid; a mixture of potassium and sodium hydroxides in an amount sufficient to saponify said fatty acids to yield a potassium soap to sodium soap ratio of at least 3.5 to 1.0 and leave 0.1% to 2% by weight of said stearic acid unsaponified; 0.25% to 5% by weight of a monoalkanolamide or dialkanolamide of a fatty acid containing 8 to 18 carbon atoms, said alkanolamide being a condensate containing equimolar proportions of said fatty acid and monoalkanolamine or dialkanolamine; 0.1% to 6.0% by weight of ethoxylated glycerine humectant containing about 10 moles of ethylene oxide per mole of glycerine; 0.5% to 6% by weight of a diol containing from 3 to 6 carbon atoms; 0.1% to 2.0% by weight of the disodium salt of coconut imidazolinium dicarboxylic acid; and water; said composition being characterized by a slow-drying foam of sufficient viscosity to wet and soften the beard effectively when warm.

2. An aerosol foam composition as set forth in claim **1** wherein said soap solution contains in addition 0.1% to 1.0% of a liquid fatty acid triglyceride and up to 50% by weight of said alkanolamide is substituted by the alkanolamide condensation product of one mole of C_8–C_{18} fatty acid with two moles of monoalkanolamine or dialkanolamine.

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U.S. Cl. X.R.

252—117, 152, 305; 424—73