

1

2,894,912

ISETHIONATE DETERGENT BAR

Robert C. Geitz, Demarest, N.J., assignor to Lever Brothers Company, New York, N.Y., a corporation of Maine

No Drawing. Application September 21, 1954
Serial No. 457,525

14 Claims. (Cl. 252—121)

This invention relates to a detergent bar having superior use properties and comprising as the major detergent an acyl isethionate with supplemental detergent, binder and plasticizer components.

The formulation of a bar or cake competitive with soap, yet composed entirely or predominantly of synthetic detergents, presents many problems which are quite different from the formulation of granulated or liquid synthetic detergent compositions. Nonsoap detergents do not have the unique physical properties of soap which so adapt the latter material for use in bar form. Nonsoap detergents usually are not susceptible to being formed in shaped masses without the incorporation of some material which will hold the mass together. They do not have the desirable solubility characteristics of soap, and therefore an ingredient must be included which will reduce the rate of solubility of the detergent. Their lathering properties also do not correspond to their detergent properties and they do not in many instances possess a desirable surface texture and a mild feel.

The requirements for a good toilet bar are well known. Soap is the accepted standard of comparison, and the bar of synthetic detergents should have at least the desirable characteristics of soap and if possible, none of the defects. The lathering properties of a perfect toilet bar in hot or cold, soft or hard (180 p.p.m.) water must be adequate and should be equal in each, in speed of lather generation, quantity and stability. Soap of course does not give adequate sudsing in hard water. The skin should not be left feeling sticky or itchy.

The bar itself should have a good feel and slip. Many nonsoap detergent bars, however, tend to be sandy, flake-like, greasy or sticky. The bar must be mild and non-irritating. Detergency must be good and the skin must be cleaned readily in the presence of oil. After cleaning the skin should not be left feeling dried out.

The odor of the bar should permit the incorporation of a pleasant perfume and should not deteriorate on ageing. The bar should be white in color before addition of other colors, i.e., free of colors, and the color should not deteriorate with age.

The bar should be reasonably plastic and should remain so. It should not be so brittle that it will shatter when dropped. The surface should be uniform and homogeneous, without striations, and it should be glossy and live, not dull and chalky. The washstand characteristics should be equal at least to soap, which means that the solubility rate should not exceed that of soap, and the actual use rate should be less than soap in order to compete with it economically.

The water penetration of the bar should not exceed that of soap. A bar left overnight in a soap dish full of water should not deteriorate materially in appearance. Moreover the bar should not develop extensive face cracks on alternate wetting and drying out. The development of minor end cracks in a manner similar to soap can be tolerated, but in the ideal bar this tendency

2

should not exist. Of course, and perhaps most important, the bar must be capable of being processed and shaped in conventional bar-forming equipment, that is, in the milling and plodding machines generally used to form soap bars and cakes.

Many nonsoap bars have been described in the literature. They are however wanting in one or more of the above desired characteristics. It is significant that the great advances in sales in recent years of synthetic detergent compositions have been at the expense largely of powdered and liquid soaps. Bar and cake soaps have not lost an appreciable part of their market to nonsoap bars. It cannot be said that any nonsoap bar which is available is competitive with bar soap.

The detergent bars and cakes in accordance with the invention approach soap bars closely in their properties, and are superior to soap in mildness and in detergency in hard water. The major synthetic detergent is an aliphatic higher fatty acid ester of an alkali metal isethionic acid salt. Isethionic acid also is referred to as hydroxyethane sulfonic acid. The esters of isethionic acid salts are referred to hereinafter, and in the claims, as acyl isethionates. The acyl isethionate will comprise from 30 to 70% of the bar.

The preferred acyl isethionates tend to be deficient in sudsing, and therefore from 2 to 10% of a supplemental suds-boosting detergent is included, together with from 10 to 40% of an aliphatic fatty acid as a binder and plasticizer, up to 9% water as a plasticizer and up to 25% of a water-soluble higher aliphatic fatty acid soap as a water-resistant improving agent and supplemental binder and plasticizer. The bar has a pH, measured in a 10% aqueous solution of the bar composition at 35° C., of from 6 to 8, which means that a part of the fatty acid binder may exist as soap in the bar if the pH is adjusted to within this range by addition of alkali. Thus, the pH in a sense is a measure of the free fatty acid binder content.

The acyl isethionate can be defined by the following general formula:



where R is the aliphatic radical or mixed aliphatic radicals of a higher fatty acid or mixture thereof having from six to eighteen carbon atoms and an iodine value of less than about 20, and M is an alkali metal cation, such as sodium, potassium or ammonium, or the cation of an organic amine base such as triethanolamine, triisopropanolamine, diethanolamine and monoethanolamine. The iodine value of mixed aliphatic fatty acids is the average value of the mixture and is measured on the mixture. The sodium salt is somewhat less water-soluble than the potassium salt, and gives a firmer bar. The potassium salt produces a bar having better lathering properties and a better feel, but is more difficult to process.

The number of carbon atoms of the acids constituting the R radical is quite critical. 100% of the acid or mixed acids can have from twelve to eighteen carbon atoms. In the case of acid mixtures, at least 75% of the acids should have from twelve to eighteen carbon atoms, and a small amount of acids of six to ten carbon atoms is permissible, up to about 25% being satisfactory.

Such acid mixtures can be made up synthetically, but they are conveniently available as the mixed fatty acids derived from coconut oil and palm kernel oil, hydrogenated and unhydrogenated; lauric, caprylic, caproic, myristic, palmitic, stearic, palmitoleic and oleic acids also can be used, alone or in admixture, or in substitution for a part of the coconut oil fatty acids. An acyl isethionate derived from 100% coconut oil fatty acids is preferred, and acyl isethionates derived from 50% to

100% coconut oil fatty acids, the remainder being sixteen to eighteen carbon atom saturated aliphatic fatty acids, are next preferred.

Bars prepared from isethionates derived from fatty acids of hydrogenated fats and oils which have an iodine value of below about 20 are especially desirable because they are harder; in fact, they may even have a brittle consistency. Also, they are less susceptible to oxidation. For these reasons, the isethionate fatty acids preferably are derived wholly from whole hardened coconut oil. Also, acyl isethionates prepared from fatty acid mixtures containing at least 50% hardened coconut oil fatty acids have superior sudsing properties.

It is desirable to have the iodine value of the coconut oil fatty acids as low as possible in order to produce a lighter colored product and to minimize the development of rancidity with resultant poor odor. However, the higher iodine value fatty acids give better sudsing, better bar texture and better bar plasticity. As a desirable compromise of these two factors, the coconut oil fatty acids should be brought to an iodine value within the range from about 3.5 to about 7.5.

High quality sixteen carbon and eighteen carbon aliphatic acids of an iodine value below 20 may be substituted for up to 50% of the coconut oil fatty acids without appreciably affecting the color and reducing the odor or stability of the product. Products made using acyl isethionates based on mixtures of at least 50% coconut oil fatty acids and the remainder saturated sixteen carbon and eighteen carbon, e.g., palmitic and stearic, acids suds quite well, but similar products made using coconut oil fatty acids alone will suds better.

Useful sixteen carbon and eighteen carbon saturated and unsaturated (iodine value below 20) aliphatic fatty acids include double-pressed stearic acid, palmitic acid, triple-pressed stearic acid and various mixtures of palmitic and stearic acids, and mixtures consisting primarily of such acids, such as hydrogenated palm oil fatty acids, hydrogenated tallow fatty acids, hydrogenated lard fatty acids and hydrogenated white grease fatty acids. The iodine value should not exceed 20, and preferably is below 8.

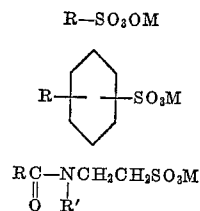
The sixteen carbon and eighteen carbon acids perform a number of functions in such mixtures. They are lower in cost and this is important, but they also give a harder, glossier appearing bar. The lather produced has a smaller bubble size and therefore is tighter and creamier. The entirely saturated sixteen carbon and eighteen carbon fatty acids give a very white product with good stable odor. However, they have poorer lathering qualities than the unsaturated acids and tend to give a grainy bar texture. These effects can be overcome by addition of the plasticizer and binder together with the sudsing detergent. Good grades of triple-pressed stearic acid and of the true eutectic mixture of palmitic and stearic fatty acids are especially desirable.

The amount of the acyl isethionate may range from 30 to 70%, based on the active detergent, by weight of the nonsoap bar. Because of the cost of these materials the amounts are kept as low as possible while maintaining hard water sudsing at a high level. In hard water, in the case of bar compositions containing 10 to 20% soap and 40% or less acyl isethionate, lime soap curds may be formed. At between 40 and 48% traces of curds may be formed. At 48%, the elimination of lime soap curds is assured. A limit of 53% is suggested from the standpoint of cost. For all-around hard and soft water use, preferably from 48 to 53% of the finished composition is acyl isethionate.

The suds-boosting detergent is desirable because the use of partially or completely saturated fatty acids in the acyl isethionate (which are desired to improve the product odor and color) causes a substantial reduction in sudsing ability. This can be restored by introduction of a supplemental detergent.

As a supplemental suds-boosting synthetic detergent there can be used the higher aliphatic fatty alcohol sulfates, the alkyl aryl sulfonates and the higher aliphatic fatty acid taurides, particularly the fatty acid esters of N-methyl taurine, or a mixture of one or more of these detergents. The alkyl aryl sulfonates have the best suds-boosting properties and are preferred.

These compounds can be described by the following general formulae:

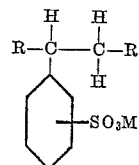


where R in each case is an aliphatic radical, which may be saturated or unsaturated and straight or branched chain, having from six to twenty-four carbon atoms, preferably from twelve to eighteen carbon atoms, M is a cation selected from the group consisting of an alkali metal, such as sodium, potassium or ammonium, or the cation of an organic amine base such as triethanolamine, triisopropanolamine, diethanolamine and monoethanolamine, and R' is hydrogen or a lower alkyl radical of up to five carbon atoms, such as methyl, ethyl, butyl and pentyl.

The triethanolamine, triisopropanolamine and ammonium salts give maximum improvement in sudsing and bar texture, slip or feel, but color and odor are less good. Therefore, the sodium and potassium salts are preferred.

Typical alkyl sulfates are sodium lauryl sulfate, sodium palmityl sulfate and triethanolamine myristyl sulfate.

A preferred class of alkyl aryl sulfonates are the phenyl polypropylene sulfonates described in U.S. Patent No. 2,477,383 to Lewis. These are phenyl alkanes in which the alkyl carbon at the benzene ring is tertiary:



where R and R' taken together with the remainder of the polypropylene radical form an alkyl group having an average molecular weight corresponding to from about twelve to about fifteen carbon atoms, and M is as above. Also useful are the sodium and potassium tertiary-octyl benzene sulfonates, the sodium and potassium keryl benzene sulfonates obtained by condensing kerosene with benzene and then sulfonating the product, sodium nonyl benzene sulfonate, potassium nonyl toluene sulfonate, sodium dodecyl toluene sulfonate, potassium dodecyl benzene sulfonate and sodium ethyl hexyl benzene sulfonate.

Typical fatty acid taurides are sodium palmityl N-methyl tauride, sodium oleyl N-methyl tauride, sodium stearyl tauride, potassium palmitic-stearyl N-methyl tauride, sodium oleyl tauride, and sodium coconut oil fatty acids N-methyl tauride.

The amount of supplemental suds-boosting synthetic detergent or detergent mixture may range from 2 to 10%. Generally, increasing the amount from 5 to 10% does not appreciably improve sudsing, and may lead to increased stickiness, making processing more difficult. Therefore, the optimum amounts are from 3 to 5%. The amount is critical, from the standpoint of the physical properties of the bar, as will be made clear in the ensuing discussion.

In general, it can be said that as the iodine value of the acyl isethionate approaches zero, the sudsing decreases, and it is necessary to use more of the suds-boosting

detergent, to bring the sudsing at least to the level obtained with the unsaturated fatty acid isethionates. The suds-boosting detergent may further improve the high level of sudsing obtained with the unsaturated fatty acid isethionates. Of the group named, the taurides are the poorest in sudsing, the alkyl sulfates are intermediate, and the alkyl aryl sulfonates are the best. The amount of the supplemental suds-boosting detergent should be kept at a minimum since these detergents, especially the alkyl aryl sulfonates and alkyl sulfates, are somewhat harsher to the skin than the isethionates. However, the products containing any of the suds-boosting detergents described in the amounts stated are as mild to the skin as fine toilet soap.

In order to hold the nonsoap bar together and make the mass plastic enough to be shaped by plodding, it is necessary to incorporate a binder and plasticizer in the mix. The aliphatic carboxylic acids described below in greater detail act both as binders and plasticizers. From 10 to 40% of the finished bar may be aliphatic carboxylic acid, with the preferred range from 18 to 24%. This amount is critical, inasmuch as the acid contributes much to the physical properties of the bar, as will be evident later in the discussion. Some commercial preparations of the acyl isethionates contain free fatty acids, as will be seen, and this will be taken into account in computing the total amount of acid.

The aliphatic carboxylic acids which are employed as binder-plasticizers in the free acid form have a relatively high molecular weight, to take advantage of the waxy and lubricant characteristics of such acids. They are preferably solids at normal atmospheric temperatures but should soften under pressure at plodding temperatures, i.e., from about 95 to about 170° F. The desired characteristics are possessed by the aliphatic saturated and unsaturated (iodine value below 20) straight and branched chain carboxylic acids having from about twelve to about twenty-five carbon atoms, preferably the saturated sixteen and eighteen carbon acids, of which the following are exemplary: lauric acid, lignoceric acid, myristic acid, arachidic acid, behenic acid, palmitic acid, stearic acid, oleic acid, iso-oleic acid, octadecenoic acid, ricinoleic acid, erucic acid, elaeostearic acid, palmitoleic acid, linoleic acid, dihydroxystearic acid, and the mixed higher fatty acids derived from naturally-occurring oils and fats (preferably hydrogenated to an iodine value below 20, if the normal value is higher), such as coconut oil, lard, tallow, palm kernel oil, myristica fat, stearin, seed fats, linseed oil, cottonseed oil, fish oils, whale oil, tall oil, rosin, greases, soybean oil, olive oil, babassu oil, castor oil, peanut oil, and mixtures of any of such acids. Acids liquid at normal atmospheric temperatures can be used, preferably with amounts of a solid acid so that the acid mixture is solid at normal atmospheric temperatures.

The preferred binder-plasticizer is a mixture of sixteen carbon and eighteen carbon saturated fatty acids, i.e., palmitic and stearic acids. 30-70, 50-50 and 70-30 mixtures of stearic and palmitic acids are commercially available, and these can be used. Commercially available triple-pressed stearic acid and its mixtures with palmitic acid are especially preferred binder-plasticizers.

A solid polyethylene glycol can be substituted for a part of the acid binder-plasticizer. The polyethylene glycol makes plodding and stamping of the bar easier, and improves the feel of the bar in very cold water. A mixture of 5% polyethylene glycol and 20% triple-pressed stearic acid is satisfactory. However, these materials are water-soluble and tend to make the bar more soluble in water, leading to excessive wasting, and therefore the amount of this material would be kept at a minimum. No more than 20% by weight of the nonsoap bar should be a solid polyethylene glycol.

The aliphatic carboxylic acid serves as the principal plasticizer in the non soap bars of the invention. Water is used as a supplemental plasticizer. Bars may be made

without water. However, to improve plasticity and reduce brittleness so that the bars have little or no tendency to shatter on impact, water should be present. Too much water will make the bar too sticky to process, while if too little is used, the bar will become hard and brittle shortly after being stamped. The amount of water may range up to 9%, preferably from 3.5 to 7%, of the finished bar, depending somewhat upon processing limitations in the available equipment; the amount of water is closely correlated with the plodding conditions, as will be shortly seen.

The presence of the supplemental detergent in the amounts stated is important in the plasticity. Without the supplemental detergent, enough water to obtain the best plasticity, i.e., over 3.5%, cannot be added to the composition without making the mix too sticky to plod and stamp, because it adheres to the metal surfaces of the processing equipment, and cannot be fed and compressed properly.

The detergent composition of the invention has the advantage of being capable of being brought to any desired solution pH (measured as a 10% aqueous solution of the composition at 35° C.). However, solution pH's approaching neutrality, i.e., from about 6 to about 8, are of course more desirable and there would be no reason to adjust pH to a value lower than 6 or higher than 8.

The pH has an effect upon the use properties of the bar.

Bars having a pH of about 6.5 resist water penetration more satisfactorily and bars of a similar composition having a pH of about 7.5 are easier to process.

A desirable balance of these properties is had by adjusting the pH to within the range from 6.8 to 7.2.

Most toilet soaps are highly alkaline, having a pH of about 10 or higher, and because of this may affect the skin of some users. The bars of the invention at a pH of 6.8 to 7.2 are neutral, and consequently the possibility of any deleterious effect due to pH is eliminated.

Further, the bar composition tends to have a buffering action on the water in which it is dissolved, and will bring the pH of this water to within the range stated.

In the presence of the unneutralized coconut oil fatty acids in a sufficient amount, and at a pH of 6 to 6.5, the water penetration of the nonsoap bar of the invention is superior to soap with respect to overnight sloppiness due to water penetration. Increasing the pH tends to lessen the resistance of the bar to water penetration, but at pH's up to 7.2 resistance to water penetration still is satisfactory.

The acyl isethionate after incorporation in the bar mix has a tendency to lower the pH of the composition. This can be counteracted and the pH brought to within the desired range either by adding the proper amount of alkali to the acyl isethionate or by adding the necessary amount of alkali to the bar mix.

Pickup and/or loss of water by the bar during use may produce some undesirable effects. Through gain and loss of water in normal use, many nonsoap bars containing only the detergents, binder and water develop surface cracks which become so severe that the bars eventually break into pieces. A second phenomenon results from water penetration. When a bar is left overnight in a soap dish full of water it will absorb water forming a soft gel. Many bars will dissolve and flake off into the water, presenting a generally unpleasing appearance.

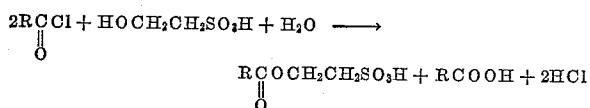
One approach to the solution of the first-mentioned cracking phenomenon would be the incorporation of a humectant in the formulation. However, the recognized humectants, including polyethylene glycols, glycerol, sorbitol, polyethylene glycol condensates of sorbitol and stearic esters of polyethylene glycol condensates of stearic acid, are not satisfactory. In accordance with the inven-

tion, the cracking phenomenon can be overcome by incorporating up to 25% of a fatty acid soap, in addition to the fatty acid previously described.

As stated above, some soap may be formed in situ in the nonsoap mix by reaction of the binder acid with alkali. Soap also is present in the impure commercial preparations of acyl isethionates. The acyl isethionates are prepared by reaction of isethionic acid with the corresponding fatty acid halide, usually the chloride,



and the reaction results in the formation of the acid as a byproduct:



When the reaction mixture is neutralized by alkali, soap is formed. Large amounts of soap may be present; a typical acyl isethionate prepared from 80% coconut oil fatty acids and 20% triple-pressed stearic acid will contain about 80% acyl isethionates, about 12% free fatty acids and about 3% fatty acid soap, of which the free fatty acids are 60–70% coconut fatty acids and the soaps are about 90–100% coconut fatty acid soaps. Commercial acyl isethionates may contain from 5 to 20% free fatty acids and from 2 to 10% fatty acid soaps. These fatty acids may form additional soaps when the pH of the bar composition of the invention is adjusted with alkali.

It is evident from this that all of the soap required to inhibit cracking may be formed in situ. However, soap can be added to the bar composition, if an additional amount is necessary, together with the soap formed in situ, in order to bring the total amount to within the range stated, up to 25%, preferably 10 to 18%. Any water-soluble soap of a higher fatty acid or mixture thereof having from six to eighteen carbon atoms and an iodine value below 20 can be added. In general, soaps derived from the mixtures of fatty acids obtained from naturally-occurring and hydrogenated fats and oils would be employed, such as coconut oil, palm oil, palm kernel oil, tallow, hydrogenated tallow, hydrogenated lard, hydrogenated white grease, stearic acid, palmitic acid, hydrogenated palmitoleic acid, hydrogenated oleic acid, and lauric acid. From 10 to 18% of soap by weight of the bar composition will improve sudsing as well as bar texture or feel, and allow adjustment of processing conditions to eliminate the end cracks that develop in the bar surface during use.

The total amount of soap added will depend to a certain extent upon the amount of fatty acid binder, the range being from 10:6 to 10:2.5. For optimum performance and a striation-free surface, the ratio of binder to soap should be about 10:4 or 5. If the ratio is reduced to 10:2.5, undesirable striations in the finished bar may appear. At ratios of 10:6 and above, the sudsing is reduced.

It has been noted that a bar containing from 5 to 15% sodium tallow soap is more resistant to cracking than a bar containing only the soap formed in situ from coconut oil fatty acids or stearic acid. Tallow soaps therefore are preferred additions. Tallow soaps also can be formed in situ by adding tallow fatty acids as the binder-plasticizer and neutralizer by addition of alkali. However, it is thought that from 10 to 50% of the coconut oil fatty acids normally present as an impurity in the isethionate contribute to a desirable minimizing of the effect of water penetration and/or loss of water by the bar during use.

Thus, a bar prepared using an acyl isethionate containing only a total of about 6 or 7% coconut fatty acids and coconut acid soaps will have good water penetration properties if adjusted to a pH value within the range stated, i.e., from 6 to 7.2, but it will not be as resistant to water penetration as a bar prepared from acyl isethionates containing a total of 13 to 15% coconut oil fatty acids and coconut oil fatty acid soaps. If 5 to 8% additional coconut oil fatty acids is added to the 6 to 7% material, so as to bring the total amount to from 11 to 15%, the resistance to water penetration will be better than that of the first-mentioned material.

The detergent composition of the invention may be formed into a bar or cake by conventional soap milling and plodding equipment, and these are well known to the art.

The exact conditions will depend to some extent upon the composition of the bar.

The plodding temperature is closely correlated with the water content of the bar because of the effect of water upon the plasticity. For any given plasticity the plodding temperature will be found to be limited to a narrow range, usually $\pm 5^\circ$ F. from the optimum. Compositions which do not contain water should be plodded at the upper portion of the range, i.e., approximately 120 to 170° F. Compositions containing from 1 to 2% water are plodded at from 120 to 160° F. When the amount of water is increased beyond 2%, the plodding temperature can be appreciably reduced, so that at 3% water approximately $125^\circ \pm 15^\circ$ F. is satisfactory, and at 5 to 6% water $105^\circ \pm 5^\circ$ F. is satisfactory. At 9% water, temperatures as low as 90° F. can be used. Thus, the range of plodding temperatures will be from 90 to 170° F.

The components of the bar composition should be intimately mixed before plodding. This can be done by mixing the components in an aqueous slurry, say a 40 to 50% slurry, at from 100° up to about 200° F. The slurry can be drum-dried to a moisture content up to 9% in the dry mix. Alternatively, the components can be mixed dry, preferably in a mechanical mixer such as a Werner-Pfleiderer mixer. At 85° C. (185° F.) a few hours mixing may be necessary, while at 115° C. (240° F.) which is a preferred minimum temperature, a smooth blend will be obtained within a half hour. The time can be reduced by further increasing the temperature, which will of course be kept below a temperature at which any of the components would be decomposed. All of the components can be added together, or it may be desirable to mix the sudsing detergent with the amount of water desired first and then incorporate the other ingredients.

After mixing it is usually desirable to cool and compress the detergent composition in the form of ribbons or short pieces in a soap mill equipped with cooling for the rolls. Thereafter, the ribbons or pieces of detergent composition are broken up in a dry mixer and fed into a conventional vacuum soap plodder. During compression of the composition considerable heat may be generated and this is dissipated or controlled by surrounding the screw and compression cylinder with a cold water jacket. At the end of the cylinder there is an orifice, from which the composition emerges continuously in bar form. The shape of the orifice is determined by the desired shape of the finished bar or cake. The temperature of the orifice may be controlled by a suitable heater, usually electric, in order to permit the extrusion of a smooth and polished continuous bar.

A pre-plodder or refiner which discharges into the plodder may also be employed; this may act to increase the capacity of the plodder. In this arrangement the composition is fed to the refiner, from which it is discharged through a perforated plate having fairly large holes and is broken up by a revolving blade. It is then fed to the finishing plodder, which, if desired, may be

operated conveniently under a vacuum at the inlet end.
See Soaps and Detergents, Thomssen and McCutcheon,
MacNair-Dorland Company, 1949, pp. 195-207, for ad-

Examples 2 to 4

Three types of bars were prepared according to the following formulations:

Bar Composition	Example 2		Example 3		Example 4	
	Dry Mixer Charge, Percent	Bar, Percent	Dry Mixer Charge, Percent	Bar, Percent	Dry Mixer Charge, Percent	Bar, Percent
Sodium salt of isethionic acid esterified with coconut oil fatty acids (7.7 iodine value)	56	53.2				
Sodium salt of isethionic acid esterified with coconut oil fatty acids (0.25 iodine value)			52	48.07	60	54.9
Sodium salt of isethionic acid esterified with stearic acid	14	13.3	13	12.05		
Sodium phenyl polypropylene sulfonate (95% active)	5	4.75	5	4.63	5	4.6
Sodium lauryl sulfate					35	32.20
Triple-pressed stearic acid	20	19	30	27.75		
Commercial palmitic acid						
Polyethylene glycol (molecular weight 4000) ..	5	4.75			6	7.0
Water		3.5			1.5	1.5
Perfume and pigment		1.5		7.0		6.2
pH		6.9				

ditional information on conventional bar soap-making techniques involving milling, plodding and shaping, by means of which techniques the detergent compositions of the invention can be shaped into bars.

The named ingredients were mixed at 100° C. in a mixer of the type described in Example 1 and plodded in the range at 105 to 125° F. The bars obtained had the following properties:

	Example 2	Example 3	Example 4
Soft water lather	Good	Good	Excellent.
Hard water lather	do	Fair	Do.
Lather type	Thick open	Thick, tight, creamy	Thin open.
Rinsability	Good	Excellent	Fair.
Lather feel	do	do	Do.
Bar slip	do	Fair	Excellent.
Color	Cream	Dead white	Glossy white.
Surface striated	Some	Most	Least.
Plasticity	Good	Good	Good.
Surface cracking	Fair	Below average	Do.
Resistance to water penetration	Good	Fair to good	Excellent.
Solubility rate	Low	Very low	Low.
Detergency	Good	Good	Good.
Distinctive characteristics		Tight creamy lather pleasant after feel.	Most voluminous, lather unaffected by water, closely resembles soap in feel and appearance.
Processing	Fair	Fair	Fair.

Example 1

A bar was prepared having the following composition:

	Percent
Sodium salt of isethionic acid esterified with mixed hydrogenated coconut oil fatty acids and the fatty acids obtained from hydrogenated white grease ¹ ..	70
Sodium phenyl polypropylene sulfonate (95% active)	5
Polyethylene glycol (molecular weight 4000) (Carbowax 4000)	5
Stearic acid	20

¹ 20% hydrogenated white grease fatty acids (10 iodine value) and 80% hydrogenated coconut oil fatty acids (5 iodine value) condensed as the acid chloride with sodium hydroxyethane sulfonate.

The pH of the bar was 7±.5.

The named ingredients were mixed at 100° C. in a Werner-Pfleiderer type mixing apparatus having a capacity of ten gallons and fitted with hollow mixing blades which allowed steam or water to be passed through the blades as well as the jacket to give good temperature and mixing control. The hot, pasty mass then was run through a conventional three roll mill equipped with cooling water and milled into solid ribbons and chips. These were broken up in a dry mixer, 1% perfume added and remilled through a conventional three roll soap mill, and then plodded at 160° F. in a conventional vacuum soap plodder. The bar had a bright, white color. In hand lathering tests using soft and hard water the product was rated excellent.

Examples 2 and 4 are generally superior to Example 3, but the last-mentioned has lather that is superior in appearance and feel, and leaves an especially pleasant after-feel on the skin.

Example 5

A detergent bar was made having the following composition:

Sodium salt of isethionic acid esterified with coconut oil fatty acids (100% active)	49.4
Sodium dodecyl benzene sulfonate	4.87
Triple-pressed stearic acid	24.0
Water	4.4
Anhydrous sodium talow soap	10.03
Miscellaneous sodium sulfate, perfume and pigment	7.3
pH of 10% solution at 35° C.	7.0

This bar had excellent soft water lather and excellent hard water lather. The lather was thick, tight and creamy and the lather feel was excellent. It had fair slip and good color (dead white). There were some surface striations. The plasticity of the bar was good, the surface cracking also was good but not quite as good as soap. Resistance to water penetration was excellent. The solubility rate was low. Detergency was good.

The soap composition was easily plodded as in the preceding examples at 105° F.

The term "consisting essentially of" as used in the specification and claims means that the named ingredients are the essential ingredients and that the composition may

contain additional ingredients not named which do not disadvantageously affect or detract from the desirable use properties thereof.

All parts and percentages in the specification and claims are by weight.

I claim:

1. A detergent bar consisting essentially of from 30 to 70% of water-soluble alkali metal detergent salts of esters of isethionic acid with mixed aliphatic fatty acids having from six to eighteen carbon atoms and an iodine value of less than 20, of which mixed acids at least 75% have from twelve to eighteen carbon atoms and up to 25% have from six to ten carbon atoms, from 2 to 10% of at least one water-soluble suds-boosting detergent salt selected from the group consisting of alkali metal and organic amine higher aliphatic fatty alcohol sulfates, alkyl aryl sulfonates, and higher aliphatic fatty acid taurides, from about 1% to about 9% water, from about 2.5% to about 25% of water-soluble higher fatty acid soap, and from 10 to 40% of at least one higher fatty acid having from about twelve to about twenty-five carbon atoms as a binder and plasticizer, said bar having a pH within the range from 6 to 8, measured as a 10% aqueous solution of the bar composition at 35° C.
2. A detergent bar in accordance with claim 1 in which at least 50% of the mixed acids of the isethionate are coconut oil fatty acids.
3. A detergent bar in accordance with claim 1 in which 100% of the mixed acids of the isethionate are coconut oil fatty acids.
4. A detergent bar in accordance with claim 1 in which the suds-boosting detergent is an alkali metal alkyl aryl sulfonate.
5. A detergent bar in accordance with claim 1 in which the suds-boosting detergent is an alkali metal higher aliphatic fatty alcohol sulfate.
6. A detergent bar in accordance with claim 1 in which the suds-boosting detergent is an alkali metal higher aliphatic fatty acid tauride.
7. A detergent bar in accordance with claim 1 which includes up to 20% by weight of the binder of a solid polyethylene glycol in place of part of the higher fatty acid binder.
8. A detergent bar in accordance with claim 1 in which the binder is triple-pressed stearic acid.
9. A detergent bar consisting essentially of from 48 to 53% of water-soluble alkali metal detergent salts of esters of isethionic acid with mixed aliphatic fatty acids having from twelve to eighteen carbon atoms and an iodine value of less than 8, from 3 to 5% of at least one water-soluble suds-boosting detergent salt selected from the group consisting of alkali metal and organic amine higher fatty alcohol sulfates, alkyl aryl sulfonates and higher aliphatic fatty acid taurides, from 18 to 24% of at least one higher

fatty acid having from about twelve to about twenty-five carbon atoms as a binder and plasticizer, from 4 to 7% of water, and from 5 to 15% of at least one water-soluble higher fatty acid soap, said bar having a pH within the range from 6.8 to 7.2, measured as a 10% aqueous solution of the bar composition at 35° C.

10. A detergent bar in accordance with claim 9 in which at least 50% of the mixed acids of the isethionate are coconut oil fatty acids.

11. A detergent bar in accordance with claim 9 in which 100% of the mixed acids of the isethionate are coconut oil fatty acids.

12. A detergent bar in accordance with claim 9 in which the suds-boosting detergent is an alkali metal alkyl aryl sulfonate.

13. A detergent bar consisting essentially of from 30 to 70% of a water-soluble alkali metal detergent salt of isethionic acid esterified with from 75 to 100% of an aliphatic fatty acid having from twelve to eighteen carbon atoms and an iodine value of less than 20, and the remainder of the isethionic acid, if any, esterified with an aliphatic fatty acid having from six to eighteen carbon atoms and an iodine value of less than 20, from 2 to 10% of at least one water-soluble suds-boosting detergent salt selected from the group consisting of alkali metal and organic amine higher aliphatic fatty alcohol sulfates, alkyl aryl sulfonates, and higher aliphatic fatty acid taurides, from about 1% to about 9% water, from about 2.5% to about 25% of water-soluble higher fatty acid soap, and from 10 to 40% of at least one higher fatty acid having from about twelve to about twenty-five carbon atoms as a binder and plasticizer, said bar having a pH within the range from 6 to 8, measured as a 10% aqueous solution of the bar composition at 35° C.

14. A detergent bar consisting essentially of from 48 to 53% of water-soluble alkali metal detergent salt of esters of isethionic acid esterified with coconut oil fatty acids having an iodine value of less than 20, from 2 to 10% of alkali metal salt of dodecylbenzene sulfonate, from 18 to 40% of at least one higher fatty acid having from about 12 to about 25 carbon atoms, from about 5 to about 15% of at least one water-soluble higher fatty acid soap, and from about 1% to about 9% water, said bar having a pH within the range from 6 to 8 measured as a 10% aqueous solution of the bar composition at 35° C.

References Cited in the file of this patent

UNITED STATES PATENTS

1,906,484	Nuesslein	May 2, 1933
2,407,647	Bodman	Sept. 17, 1946
2,678,921	Turck	May 18, 1954
2,749,315	Faier	June 5, 1956
2,781,321	Mayhew et al.	Feb. 12, 1957