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DETERGENT BARS

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This invention relates to detergent compositions in the form of bars or cakes, which compositions comprise mixtures of higher fatty acid soaps and synthetic organic detergents.

It has been recognized for sometime that soap bars possess certain undesirable properties such as scum formation and poor lathering, especially in hard water. Efforts to overcome these shortcomings of soap bars by preparing synthetic detergent bars have not been notably successful—the synthetic detergent bars have generally been found, in comparison to soap, to be costly, difficult to process, and so water-soluble as to be short-lived and subject to excessive "sloughing," i. e., formation of a soft, jelly-like layer on the surface of the bar when in contact with water, even such relatively small quantities of water such as are typically found in "soap" dishes and holders.

It has previously been suggested that soap and various synthetic detergents such as certain of the anionic sulfate and sulfonate salts be compounded in order to achieve a compromise between the properties of these materials. Such bars are intended to possess improved foaming and cleansing action, particularly in hard water, while the problems characteristic of synthetic detergent bars are allegedly partially alleviated by dilution of the synthetic detergent with the soap.

A detergent composition has now been found which, in the form of bars or cakes, has improved lathering and reduced sloughing and scum formation properties (in comparison to soap) but which possesses the physical properties of the higher fatty acid soaps as regards processing (e. g. milling, extruding and stamping). In accordance with the present invention such a composition consists essentially of at least about 50% by weight of higher fatty acid soap; about 5 to 12% by weight of moisture; about 5 to 30% by weight of water soluble salt of higher fatty acid monoglyceride monosulfate; about 3 to 7% by weight of non-ionic detergent comprising hydrophobic polyoxypropylene glycol of molecular weight at least 900 condensed with sufficient ethylene oxide to prepare a water soluble product; and about 0.5 to 3% by weight, sufficient to improve the physical processing characteristics and sloughing resistance of said bars or cakes but insufficient to deleteriously affect the foaming properties thereof, of a polymeric material prepared by adding propylene oxide to ethylene diamine until a condensation product having a molecular weight of about 2,000 to 6,000 is obtained, and then adding ethylene oxide to said condensation product until said ethylene oxide constitutes about 10 to 80% by weight of the final polymer.

Higher fatty acid soap constitutes at least 50%, and preferably more than 60%, by weight of the bars of the present invention. This soap may be produced by the saponification of fatty materials suitable for use in soap making, suitable fatty materials comprising, for example, the fats, oils, and waxes of animal, vegetable, and marine origin, and the fatty acids derived therefrom or of synthetic origin. More specifically, the fatty acids

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may be of mixed character such as are derived from natural or hydrogenated tallow, cottonseed oil, coconut oil, palm oil, palm kernel oil, babassu nut oil, grease, fish oils, and fatty acids derived therefrom by hydrolysis or saponification or may be pure materials such as lauric, myristic, palmitic, stearic and oleic acids. It is generally preferred to use in the present invention the sodium salts of the mixed fatty acids derived from tallow, coconut oil and mixtures thereof.

As indicated, an essential ingredient of the present detergent bars is a water soluble salt of a monosulfuric acid ester of a higher fatty acid monoglyceride such as the alkali metal (e. g. sodium, potassium), ammonium and amine salts. The higher fatty acid radicals are also derived from natural fats, oils, and waxes or fatty acids of natural or synthetic origin and may be of mixed or unitary nature. It is a more specific feature of this invention that these water soluble monoglyceride sulfates may be derived more particularly from hydrogenated fatty materials such as hydrogenated coconut oil and tallow since a higher proportion of more saturated fatty acid radicals tends to equalize the solubility of the soap and the sulfated detergent and to produce a harder and less soluble bar. The monosulfate detergent employed in preparing the detergent bars of the present invention should be essentially free of inorganic salts, i. e., should not contain more than 10–20% by weight of inorganic salt. Such "salt-free" products are readily obtainable by processes known to the art.

In the instant detergent bars, the aforesaid higher fatty acid monoglyceride monosulfate salt acts as a soap scum dispersing agent and serves to produce detergent bars which foam freely even when used in relatively hard water. This sulfated detergent, in amounts about 5 to 30% and preferably about 10 to 20% by weight of the compositions of the present invention, is unique in the desirable physical characteristics it contributes to the detergent mixture during processing and when in bar form.

The non-ionic detergent of the present invention is a polyoxypropylene glycol-ethylene oxide condensate which serves primarily as an auxiliary soap scum dispersing agent, being particularly effective in relatively dilute solutions (e. g. less than about 0.1% total solids) wherein the concentration of the monoglyceride monosulfate detergent is relatively low. The condensate comprises those compounds, singly and in admixture, having the formula:



where y equals at least 15, and $(\text{C}_2\text{H}_4\text{O})_{x+x'}$ equals 20–90% of the total weight of the compounds. These compounds are prepared by adding propylene oxide to propylene glycol in the presence of an alkaline catalyst, such as anhydrous sodium hydroxide, so as to prepare polyoxypropylene glycols of molecular weight of at least about 900, and then adding ethylene oxide thereto (also in the presence of an alkaline catalyst such as anhydrous sodium hydroxide) until a water soluble condensation product containing from 20 to 90% by weight of oxyethylene groups is obtained. These condensations are carried out at slightly elevated temperatures, e. g. 120° C.

The said polyoxypropylene glycol-ethylene oxide condensates form about 3 to 7% and preferably 5 to 6% by weight of the final bar, and may be in liquid or solid form depending on the ethylene oxide content thereof. The range of 3 to 7% is critical in that if exceeded the compositions become extremely difficult to extrude and/or stamp or press. Use of less than 3% of this condensate is unsatisfactory in that the desired auxiliary scum dispersing properties are not obtained.

The excellent processing and sloughing resisting charac-

teristics of the compositions of the present invention are derived from the presence therein of a polyoxypropylene-polyoxyethylene compound prepared by adding propylene oxide to ethylene diamine until a condensation product having a molecular weight of about 2,000 to 6,000 is obtained, and then adding ethylene oxide thereto until a water soluble condensation product containing from 10 to 80% by weight of oxyethylene groups is obtained. The preparation of these polymers is similar to the preparation of the aforesaid polyoxypropylene glycol-ethylene oxide condensates with the exception that the propylene glycol is replaced by ethylene diamine.

It has been found that relatively small amounts of the ethylene diamine-based polymers are sufficient to noticeably improve the processing properties and sloughing resistance characteristics of the instant detergent bars or cakes. However larger quantities have been found to have an adverse effect on the foaming characteristics of the bars. Therefore such polymers are employed in an amount sufficient to contribute improved physical processing and sloughing resisting characteristics to the bars but insufficient to deleteriously affect the foaming characteristics thereof. This amounts to about 0.5 to 3% and preferably 1.5 to 2.5% by weight of the finished bars.

In order to achieve a plastic composition which can be milled, extruded and stamped, it is essential that the composition being processed contain a certain minimum proportion of moisture. On the other hand, if excessive moisture is present, the material being processed will be fluid rather than plastic and will fail to retain its shape. A critical range of moisture contents for the present bars is from 5 to 12% by weight, 7 to 11% being preferred.

In order to better illustrate the invention, the preparation of detergent bars of a preferred composition is set forth below.

EXAMPLE

	Percent by weight
Soap chips (sodium soap of a mixture of 15 parts of coconut oil and 85 parts of tallow (contain 13% moisture))	80.5
Sodium salt of coconut oil monoglyceride monosulfate	12.0
Non-ionic detergent ¹	5.5
Ethylene diamine-based polymers ²	2.0

¹ Liquid polyoxypropylene glycol of molecular weight about 1500 condensed with ethylene oxide in an amount equal to 40% by weight of the resulting polymer.

² Prepared by adding propylene oxide to ethylene diamine until a condensation product of molecular weight about 3,000 is obtained, and then adding ethylene oxide thereto until it amounts to about 70% by weight of the resulting polymer.

The bars are prepared by dry mixing the soap chips, the monosulfate detergent (employed in spray-dried form), the non-ionic detergent and the ethylene diamine-based polymer. The mixture is then milled and plodded, cut to length, and stamped. In its physical properties, e. g. plasticity, tendency to adhere to handling equipment such as stamping dies, workability, etc., the composition is virtually identical to soap and is far easier to handle than is a composition which is similar to but lacks the ethylene diamine-based polymer of the compositions of the instant invention.

A sloughing test is carried out on weighed bars measuring approximately 1" x 2" x 3" by placing the bars, large face down, in 35 ml. of distilled water contained in a 3.75-inch diameter Petri dish. The test is carried out overnight at room temperature, the bars are then removed and scraped free of any soft, jelly-like material adhering to their surface, and are re-weighed. The net loss in weight of each bar is a measure of its sloughing susceptibility. Typical data, set forth below, show that bars, prepared as set forth in the above example, are even more resistant to sloughing than is soap.

Table.—Sloughing of various detergent bars

Composition:	Net weight loss grams
Sodium salt of coconut oil monoglyceride monosulfate (containing 7% sodium sulfate and 1% moisture)	18.0
Sodium soap of 25 parts of coconut oil and 75 parts of tallow (containing 13% of moisture)	7.3
Bars of above example	6.0

Soap scum evaluation tests, in which soap curd is filtered and weighed, show that under the same conditions, dilute solutions (ranging from 0.05% to 0.1% by weight in water of 125 p. p. m. hardness) of the composition of the above example produce less soap curd than do control bars composed of 85% of the soap and 15% of the monosulfate detergent of the previous example, the diminishment being as great as about 50% in some cases. Comparative lathering tests, also conducted in water of 125 p. p. m. hardness, show that the bars of the above example lather more readily than do bars of the 85:15 control.

It should be noted that the invention is not specific to milled and plodded bars which have been prepared by dry mixing of ingredients. Thus, advantages as to ease of handling and sloughing resistance are realized when kettle soap (containing about 30% moisture), an aqueous solution of the monosulfate detergent, and the two essential polymeric components are mixed in the proper proportions, formed into ribbons, dried in a tunnel drier, milled, plodded and stamped.

It is within the scope of the invention and the following claims are intended to include the components of the present composition in unitary or admixed form. Thus the higher fatty acid soap component may be derived from a single or mixed higher fatty acids. This is also true of the higher fatty acid of the higher fatty acid monoglyceride monosulfate component. Likewise, either or both the non-ionic detergent and the ethylene diamine-based polymeric components may be present as single compounds or, more generally, in the form of a mixture of compounds of varying molecular weight, the major portion of which is encompassed by the ranges defined herein.

The term "consisting essentially of" as used in the definition of the ingredients present in the composition claimed is intended to exclude the presence of other materials in such amounts as to interfere substantially with the properties and characteristics possessed by the composition set forth but to permit the presence of other materials in such amounts as not substantially to affect said properties and characteristics adversely.

Having thus described the invention, what is claimed is:

1. A detergent composition in the form of bars or cakes having improved processing properties and reduced tendency to slough, said composition consisting essentially of at least about 50% by weight of higher fatty acid water soluble soap; about 5 to 12% by weight moisture; about 5 to 30% by weight of water soluble salt of higher fatty acid monoglyceride monosulfate; about 3 to 7% by weight of non-ionic detergent comprising hydrophobic polyoxypropylene glycol of molecular weight at least 900 condensed with sufficient ethylene oxide to prepare a water soluble product; and about 0.5% to 3% by weight, sufficient to improve the physical processing characteristics and sloughing resistance of said bars or cakes but insufficient to deleteriously affect the foaming properties thereof, of polymeric material prepared by adding propylene oxide to ethylene diamine until a condensation product having a molecular weight of about 2,000 to 6,000 is obtained, and then adding ethylene oxide to said condensation product until said ethylene oxide constitutes about 10 to 80% of the final polymer.

2. A detergent composition in the form of bars or cakes having improved processing properties and reduced tendency to slough, said composition consisting essentially of at least about 60% by weight of higher fatty acid water

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soluble soap; about 7 to 11% by weight moisture; about 10 to 20% by weight of water soluble salt of higher fatty acid monoglyceride monosulfate; about 5 to 6% by weight of non-ionic detergent comprising hydrophobic polyoxypropylene glycol of molecular weight at least 900 condensed with sufficient ethylene oxide to prepare a water soluble product; and about 1.5% to 2.5% by weight, sufficient to improve the physical processing characteristics and sloughing resistance of said bars or cakes but insufficient to deleteriously affect the foaming properties thereof, of polymeric material prepared by adding propylene oxide to ethylene diamine until a condensation product having a molecular weight of about 2,000 to 6,000 is obtained, and then adding ethylene oxide to said condensation product until said ethylene oxide constitutes about 10 to 80% of the final polymer.

3. A detergent composition in the form of bars or cakes having improved processing properties and reduced tendency to slough, said composition consisting essentially of at least about 60% by weight of sodium soap of a mixture of tallow and coconut oil fatty acids; about 7 to 11% by weight moisture; about 10 to 20% by weight of water soluble sodium salt of higher saturated fatty acid monoglyceride monosulfate; about 5 to 6% by weight of non-ionic detergent compounds having the formula



where y equals at least 15, and $(\text{C}_2\text{H}_4\text{O})_{x+x'}$ equals 20-90% of the total weight of the said compounds; and about 1.5 to 2.5% by weight, sufficient to improve the physical processing characteristics and sloughing resistance of said bars or cakes but insufficient to deleteriously affect the foaming properties thereof, of polymeric material prepared by adding propylene oxide to ethylene diamine until a condensation product having a molecular

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weight of about 2,000 to 6,000 is obtained, and then adding ethylene oxide to said condensation product until said ethylene oxide constitutes about 10 to 80% of the final polymer.

4. A detergent composition in the form of bars or cakes having improved processing properties and reduced tendency to slough, said composition comprising at least about 60% by weight of sodium soap of a mixture of tallow and coconut oil fatty acids; about 7 to 11% by weight moisture; about 10 to 20% by weight of water soluble sodium salt of higher saturated fatty acid monoglyceride monosulfate; about 5 to 6% by weight of polymeric non-ionic detergent compounds having the formula



where y equals at least 15, and $(\text{C}_2\text{H}_4\text{O})_{x+x'}$ equals 20-90% of the total weight of the compounds; and about 1.5 to 2.5% by weight, sufficient to improve the physical processing characteristics and sloughing resistance of said bars or cakes but insufficient to deleteriously affect the foaming properties thereof, of polymeric material prepared by adding propylene oxide to ethylene diamine until a condensation product having a molecular weight of about 3,000 is obtained, and then adding ethylene oxide to said condensation product until said ethylene oxide constitutes about 70% of the final polymer.

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