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DETERGENT COMPOSITION HAVING SYNERGISTIC SUDSING PROPERTIES CONTAINING AMIDES AND SULFONATE-CONTAINING DETERGENTS

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ABSTRACT OF THE DISCLOSURE

Detergent compositions having synergistic sudsing properties containing amides and sulfonate-containing detergents mixed in essential proportions. These compositions are especially useful in detergent formulations in which a large amount of suds is desired.

BACKGROUND OF THE INVENTION

(1) *Field of the invention.*—The synergistic mixture of detergents of the present invention have wide application in detergent compositions of all types including solids and liquids, but they are especially valuable for light-duty liquid compositions useful for laundering fine fabrics and lightly-soiled fabrics, washing of glassware and ordinary dishwashing (handwashing) applications, and similar cleaning and washing applications in which a relatively large amount of suds is desired or needed. The synergistic sudsing mixtures are equally valuable, however, in heavy-duty cleaning situations such as ordinary household laundering situations involving heavily-soiled garments.

(2) *Description of the prior art.*—The special requirements associated with a detergent composition intended for use as a high sudsing detergent composition present unique and peculiar problems. These requirements are fairly well known and include such desiderata as mildness to hands (since many light-duty detergency applications involve hand washing), satisfactory cleaning properties in cool or warm water, and the detergent composition must be capable of providing a large amount of suds to serve as a suds blanket over the washing solution. A suds blanket serves as an indicator of the washing power of the solution and also satisfies the aesthetic desires of users who have come to expect copious amounts of suds for dishwashing and laundering situations.

In order to achieve these objectives, it has at times been necessary to combine detergents in order to improve upon the performance of individual detergents. Frequently such mixtures offer cumulative or additive benefits. At times, it is discovered that certain detergents cannot be mixed because of some interference or incompatability between them. In such cases, the overall performance characteristics of the mixture are found to be poorer than each of the ingredients used separately. Less frequently, it is unexpectedly discovered that mixtures of detergents behave synergistically with some desirable property being improved beyond expected or cumulative levels. This has been true, for instance, in areas of mildness, see U.S. Patent 3,223,647; cleaning, see U. S. Patent 2,383,737; and sudsing (copending patent application, Ser. No. 524,364, filed Dec. 23, 1965). While these isolated synergistic combinations have been found in each of these areas, the art has not advanced to a stage in any area where an element of predictability exists. Consequently, synergistic sudsing properties discovered with mixtures of detergents is an unexpected and valuable discovery which

makes possible new and improved detergent compositions. The present invention is an example of such a discovery.

SUMMARY OF THE INVENTION

According to the present invention, it has now been discovered that a detergent composition having synergistic sudsing properties can be prepared which consists essentially of a synergistic sudsing mixture of Detergent (A) and Detergent (B) wherein

Detergent (A) is an ingredient which comprises from about 30% to about 70% of Component A, from about 20% to about 70% of Component B and from about 2% to about 15% of Component C, wherein:

(a) Said Component A is a mixture of double-bond positional isomers of water-soluble salts of alkene-1-sulfonic acids containing from about 12 to about 16 carbon atoms, said mixture of positional isomers including by weight about 10% to about 25% of an alpha-beta unsaturated isomer, about 30% to about 70% of a beta-gamma unsaturated isomer, about 5% to about 25% of a gamma-delta unsaturated isomer, and about 5% to about 10% of a delta-epsilon unsaturated isomer.

(b) Said Component B is a mixture of water-soluble salts of bifunctionally-substituted sulfur containing saturated aliphatic compounds containing from about 12 to about 16 carbon atoms, the functional units being hydroxy and sulfonate radicals with the sulfonate radical always being on the terminal carbon and the hydroxyl radical being attached to a carbon atom at least two carbon atoms removed from the terminal carbon atom, at least 90% by weight of said Component B having a hydroxyl radical on the third, fourth or fifth carbon atom;

(c) Said Component C is a mixture comprising from 30–90% water-soluble salts of alkene disulfonates containing from about 12 to about 16 carbon atoms, and from about 5% to about 70% water-soluble salts of hydroxy disulfonates containing from about 12 to about 16 carbon atoms, said alkene disulfonates containing a sulfonate group attached to a terminal carbon atom and a second sulfonate group attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom, the alkene double bond being distributed between the terminal carbon atom and about the seventh carbon atom, said hydroxy disulfonates being saturated aliphatic compounds having a sulfonate radical attached to a terminal carbon, a second sulfonate group attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom, and a hydroxy group attached to a carbon atom which is not more than about four carbon atoms removed from the site of attachment of said second sulfonate group; and wherein

Detergent (B) is a fatty acid amide compound selected from the group consisting of unsubstituted fatty acid amide, fatty acid monoethanolamide, fatty acid monoisopropanolamide, and fatty acid glycerylamide, the fatty acid groups containing 10 to 14 carbon atoms; said synergistic sudsing mixture consisting of the detergents in the following proportions:

(1) when Detergent (B) is said unsubstituted fatty acid amide, the proportion of Detergent (A) to Detergent (B) being about 5:1 by weight;

(2) when Detergent (B) is said fatty acid monoethanolamide, the proportion of Detergent (A) to Detergent (B) being about 5:1 by weight;

(3) when Detergent (B) is said fatty acid monoisopropanolamide, the proportion of Detergent (A) to Detergent (B) being in the range of 9:1 to 3:1 by weight; and

(4) when Detergent (B) is said fatty acid glycerylamide, the proportion of Detergent (A) to Detergent (B) being in the range of about 11:1 to 1.5:1 by weight.

Compositions containing the foregoing critically-proportioned detergents provide unexpectedly large amounts of suds. Such compositions have general usefulness in all detergent compositions in which a large amount of suds is deemed desirable. In addition, these compositions are satisfactorily mild and clean effectively in water having a temperature ranging from cool tap water to more usual hot water temperature ranging up to 160–200° F.

Unexpectedly, significant differences have been discovered among fatty acid amide compounds when used in admixture with the detergent defined above as Detergent (A). Thus, the synergistic sudsing results which are obtain could not have been predicted and are consequently not fully understood. For instance, fatty acid amide compounds which are closely related in structure to amide compounds which do behave synergistically with Detergent (A) offer no sudsing advantages whatever. Coconut diethanolamide can be mentioned as an example. Some amides which structurally resemble those which are useful in this invention actually interfere with the sudsing properties of Detergent (A) when mixed with it even in small proportions. Examples of such incompatibilities include octylmonoethanolamide and lauroyl-N-methylglucamide.

Even with the satisfactory fatty acid amides mentioned above, unexpected behavior has been discovered. This is the reason for the different proportions listed for each fatty acid amide. These proportions are essential to the attainment of synergistic sudsing which is a primary object of the present invention. Thus, a mixture of Detergent (A) and an unsubstituted C_{10}–C_{14} fatty acid amide containing 10 to 14 carbon atoms and having a formula of $RCONH_2$ offers a synergistic mixture only when these compounds are mixed in a proportion of Detergent (A) to Detergent (B) of about 5:1 by weight. Larger or smaller amounts of the fatty acid amide cause a marked decrease in the amount of suds produced by the mixture. Increasing the amount of the fatty acid amide up to a proportion of 1:1 results in a mixture which is not significantly better in its sudsing properties than either Detergent (A) or the fatty acid amide alone.

A mixture of Detergent (A) and C_{10}–C_{14} fatty acid monoethanolamide also exhibits unexpected synergistic sudsing properties at a proportion of Detergent (A) to Detergent (B) of 5:1 by weight. Lesser amounts of fatty acid amide result in a sharp decrease in the amount of suds the binary mixture is capable of producing. Similarly, increasing the amount of the fatty acid amide in the binary mixture produces a corresponding decrease in the sudsing property of the resulting mixture.

A mixture of Detergent (A) and C_{10}–C_{14} fatty acid monoisopropanolamide surprisingly offers an unexcepted advantage in that the range of proportions within which synergistic sudsing results are achieved is somewhat broader than with either an unsubstituted fatty acid amide, a fatty acid monoethanolamide or a fatty acid glycerylamide. Synergistic results are achieved with mixtures of Detergent (A) and a C_{10}–C_{14} fatty acid isopropanolamide in a proportion of Detergent (A) to said amide of about 9:1 to about 3:1. Binary mixtures of Detergent (A) and C_{10}–C_{14} fatty acid isopropanolamides which contain proportionately lesser amounts of said amide below a 9:1 ratio by weight do not exhibit synergistic sudsing properties. As the proportionate level of said amide increases above a ratio of Detergent (A) to said amide of 3:1, there is a sharp decrease in sudsing properties in the mixtures. The interference between Detergent (A) and said amide in these latter mixtures is so marked that at proportions of about 1.5:1 to 1:1 the sudsing properties of Detergent (A) are totally offset and the mixtures do not produce enough suds to be measurable by the test procedures described hereinafter.

C_{10}–C_{14} glycerylamides offer further unexpected synergistic sudsing properties in admixture with Detergent (A) and approach the wider range of synergistic operability provided by mixtures of C_{10}–C_{14} fatty acid isopropanolamide and Detergent (A). With these amide components, i.e., C_{10}–C_{14} fatty acid glycerylamides, the range of synergistic proportions extend from about 11:1 to about 1.5:1 of Detergent (A) to C_{10}–C_{14} fatty acid glycerylamides. Both below and above these proportions, there is an unexpected sharp decline in sudsing properties of the mixtures. Mixtures containing equal weight proportions of Detergent (A) and C_{10}–C_{14} glycerylamides have sudsing properties which are not distinguishable from Detergent (A) used alone.

According to the present invention, Detergent (A) is itself a mixture of certain compounds containing from 12 to 16 carbon atoms, preferably 14 carbon atoms. As noted above, it is basically a mixture of three components each of which has a specific composition and each of which contains compounds containing from 12 to 16 carbon atoms. A detailed discussion of Detergent (A) is presented below.

A preferred percentage range by weight for Component A is from about 35% to about 65%, for Component B it is from about 25% to about 60%, and for Component C it is from about 3% to about 12%.

Component A is comprised essentially of the prescribed ranges of the following C_{12}–C_{16} compounds.

	Permissible Range, Percent	Preferred Range, Percent
$CH_3(CH_2)x-CH_2CH_2CH_2CH=CHSO_3M$	10–25	15–22
$CH_3(CH_2)x-CH_2CH_2CH=CHCH_2SO_3M$	30–70	40–65
$CH_3(CH_2)x-CH_2CH=CHCH_2CH_2SO_3M$	5–25	10–20
$CH_3(CH_2)x-CH=CHCH_2CH_2CH_2SO_3M$	5–10	7–9

In the preceding formulas x is an integer in the range from about 6 to about 10 and large enough to provide from 12 to 16 carbon atoms in the molecule. Preferably x is 8 in order to provide a molecule having 14 carbon atoms. M represents any cation that forms a water-soluble salt such as alkali metals, e.g., sodium and potassium, and ammonium, and substituted ammonium compounds, e.g., trialkylammonium and trialkylolammonium compounds. Specific examples of substituted ammonium compounds are triethylammonium, trimethylammonium, and triethanolammonium. Others will be apparent to those skilled in the art. The symbols x and M have the same meaning throughout this description of the present invention. There can also be present minor amounts of other double-bond positional isomers. This is the case, for example, when the composition is prepared by the sulfonation of alpha olefins with uncomplexed sulfur trioxide. Such minor amounts, i.e., less than about 10% by weight, do not materially alter the excellent detergent properties of the composition.

Whereas, Component A is a blend or mixture of certain C_{12}–C_{16} unsaturated isomeric aliphatic compounds, Component B consists of a mixture of certain C_{12}–C_{16} saturated aliphatic compounds. A minor amount of unsaturation can be included in this mixture but preponderantly the compounds are saturated. Bifunctionality of these alkane compounds is due to the presence of a hydroxyl group and a sulfonate radical on the same molecule. It has been discovered that the sulfonate radical must be located on the terminal carbon atom. It also has been discovered that the situs of the hydroxyl group is an especially important factor in the compounds that comprise Component B. For example, if the hydroxyl group and the sulfonate radical are attached to adjacent carbon atoms, the valuable detergent properties of the Component B compounds are substantially decreased. This is

especially true when the alpha and beta carbons are the two sites of attachment. The critical structural arrangement which must exist in order for the compounds to be detergents, is that the sulfonate radical must be in the alpha position and the hydroxyl radical must be attached to a carbon atom at least two carbons removed, for example, to the third, fourth or fifth carbons, i.e., on the gamma, delta, or epsilon carbons. In other words, the carbon to which the hydroxyl group is attached should be separated from the carbon bearing the sulfonate radical by at least one methylene group along the aliphatic chain.

Thus, Component B consists of a mixture of the following bifunctionally-substituted saturated aliphatic compounds.

	Permissible Range, Percent	Preferred Range, Percent
$CH_3(CH_2)x-CH_2CH_2CH(OH)CH_2CH_2SO_3M$	10-90	25-75
$CH_3(CH_2)x-CH_2CH(OH)CH_2CH_2CH_2SO_3M$	10-90	25-75
$CH_3(CH_2)x-CH(OH)CH_2CH_2CH_2CH_2SO_3M$	10-90	25-75

The value of x and M are as previously set forth.

Component B can also include minor quantities, for example, less than about 10% of compounds wherein the hydroxyl group is attached elsewhere along the carbon chain, e.g., on the sixth carbon atom, without materially altering the overall detergent properties of the compositions. The 3-, 4-, and 5-hydroxy n-alkyl sulfonate compounds, illustrated above, are preferred ingredients in Component B and they should constitute at least about 90% by weight thereof.

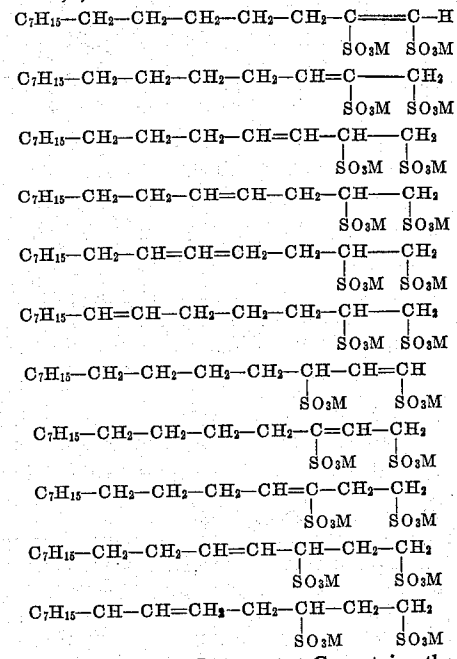
In this same connection, it has also been noted that corresponding beta-hydroxy n-alkyl sulfonate compounds are relatively poor detergent compounds. Not only are they comparatively poor detergents, but it has been discovered also that such compounds constitute an actual load on the present detergency system. For this reason, the level of such compounds should be held to a minimum. It is noted though, that minor amounts of beta-hydroxy n-alkyl sulfonate compounds can be tolerated in the synergistic compositions of this invention provided that Components A, B, and C of Detergent (A) otherwise contain the essential ingredients herein described in the proportions and percentages specified.

The alkene disulfonates should preferably comprise from about 40% to about 80% of the highly polar polyfunctionally substituted C_{12}–C_{16} aliphatic compounds which make up Component C. These alkene disulfonates should also contain about 12 to about 16 carbon atoms and, preferably, 14 carbon atoms. As seen above, one sulfonate group is attached to the terminal carbon atom. The second sulfonate group is attached to an internal carbon atom that is not more than about six carbon atoms removed from the terminal carbon. In other words, the second sulfonate functional group can be attached to the second through about the seventh carbon atom. Component C can also include minor amounts of compounds in which the second sulfonate is located more internally than the seven carbon, such as, for example, on the eighth carbon, etc. There is no apparent advantage in having these latter compounds present in the composition, however. According to a preferred embodiment, the major portion, that is from about 60% to about 95% of the alkene disulfonates, should be 1.2 and 1.3 disulfonates.

The alkene double bond can be distributed between the terminal carbon and about the seventh carbon atom; such unsaturation includes, for instance, alpha-beta, beta-gamma, gamma-delta, delta-epsilon, epsilon-zeta, and zeta-eta unsaturation. Preferably, the double bond should be distributed between the second to the sixth carbon atom. It should be noted that the alkene double bond can be even more internally located than between the zeta-eta carbons, but again no apparent advantage is gained thereby.

Thus, it can be seen that the alkene disulfonates of Component C contain the polyfunctional combination of a double bond and two sulfonate groups in an important structural relationship. The preferred compounds as ingredients of the alkene disulfonate portion of Component C are 2-alkene-1,2-disulfonate; 3-alkene-1,2-disulfonate; and 4-alkene-1,2-disulfonate of the 1,2 disulfonate species; and 3-alkene-1,3-disulfonate; 4-alkene-1,3-disulfonate; and 5-alkene-1,3-disulfonate of the 1,3 disulfonate species. The alkene group can contain from about 12 to about 16 carbon atoms and preferably about 14 to 16 carbon atoms. The sodium and potassium salts of these compounds are preferred.

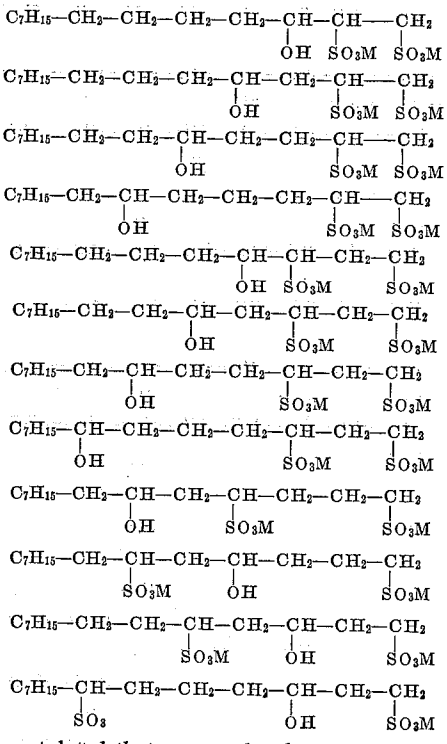
Examples of alkene disulfonate compounds are the following in which a carbon chain length of 14 is selected as being illustrative, having sulfonate attachment sites of 1,2 and 1,3;



As mentioned above, Component C contains the aforementioned and illustrated C_{12}–C_{16} alkene disulfonates. It also contains from about 5% to about 70%, and preferably about 20% to about 60%, water-soluble salts of hydroxy disulfonates containing from about 12 to about 16 carbon atoms. The terminal carbon atom has attached to it one of the sulfonate groups. The second sulfonate group can be attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom. The required hydroxy group is attached to a carbon atom which is not more than about four carbon atoms removed from the site of attachment of said second sulfonate group.

The preferred sites of attachment for the hydroxy group on the 1,2-disulfonate species are the fourth and fifth carbon atoms to yield 4-hydroxyalkane-1,2-disulfonates and 5-hydroxyalkane-1,2-disulfonates. For the 1,3-disulfonates the preferred sites of attachment for the hydroxy group are the fifth and the sixth carbon atoms to yield 5-hydroxyalkane-1,3-disulfonates and 6-hydroxyalkane-1,3-disulfonates. The alkane hydrocarbons as before are those having 12 to 16 carbon atoms and preferably 14. According to a preferred embodiment, the major portion, that is, from about 60% to about 95% of the hydroxy disulfonates should be 1,2 and 1,3 disulfonates.

Thus, for example, the following compounds are contemplated. Again, a 14 carbon 1,2 and 1,3 disulfonate compound is presented as being representative.



It is postulated that a second polar group, as in Components B and C, spaced a critical distance from a terminally attached polar group in a detergent molecule modifies the crystalline latice structure in such a way as to improve markedly the solubility characteristics of the compound. While this is not known for certain, it is offered as one possible explanation for the exceptional detergent properties of the compositions of the present invention.

Detergent (A) as described herein can be prepared in any suitable manner so long as the above teachings are adhered to. For instance, each of the ingredients can be synthesized separately and then mixed according to the stated proportions. On the other hand, it is possible to prepare Detergent (A) of the present invention according to a novel process described in copending patent application Serial No. 561,352, filed June 29, 1966, by Adriaan Kessler and Phillip F. Pflaumer.

If it is desired to synthesize separately the individual components of Detergent (A), it is possible to do so according to the procedures in the following discussion. Any other suitable methods can be used. The symbol R as used in the following equation represents an aliphatic hydrocarbon radical that would allow for a total of carbon atoms in the molecule between about 12 and about 16. The alpha-beta unsaturated sulfonate containing aliphatic compounds of Component A can be prepared readily by dehydrochlorinating a 2-chlorosulfonic acid derivative. A fairly detailed discussion of a suitable preparative route appears in an article in the Journal of Organic Chemistry, vol. 1949, page 46, written by J. D. Rose and A. Lambert. The starting step for this synthesis is a reaction between a long chain epoxide and sodium bisulfite to produce a 2-hydroxy-1-sulfonate derivative of the particular long chain epoxide used. This reaction product is condensed with PCl_5 to prepare the aforementioned 2-chlorosulfonic acid derivative which in turn is reacted with sodium carbonate to yield an alpha-beta unsaturated compound.

The other preferred double-bond positional isomers of Component A, i.e., the beta-gamma, gamma-delta, and delta-epsilon can be prepared by the thermal dehydration of hydroxysulfonates. According to the following reaction, the thermal dehydration of the sodium salt of 3-hydroxy-sulfonate results in the preparation of a reaction

mixture containing the beta-gamma isomer and the gamma-delta isomer.

$$RCH_2CH(OH)CH_2CH_2SO_3Na \xrightarrow[\Delta]{-H_2O} RCH_2CH{=}CHCH_2SO_3Na + RCH{=}CHCH_2CH_2SO_3Na$$

Similarly a reaction mixture of a gamma-delta and a delta-epsilon double-bond isomer compound can be prepared by using a 4-hydroxysulfonate as a starting material:

$$RCH_2CH(OH)CH_2CH_2CH_2SO_3Na \xrightarrow{-H_2O} RCH_2CH{=}CHCH_2CH_2SO_3Na + RCH{=}CHCH_2CH_2CH_2SO_3Na$$

The foregoing synthesis of the double-bond positional isomers follows closely the well known dehydration of an organic alcohol as is mentioned in such standard texts as Whitmore's Organic Chemistry, second edition, pages 39–41.

There is no need to separate the reaction product of the two illustrated dehydration reaction. The reaction product can be formulated directly into a detergent composition according to the present invention. If, for some reason, it is desired to work with pure ingredients, they can be separated into pure forms.

The hydroxy sulfonates of Component B, such as the preferred 3-, 4-, and 5-hydroxy compounds can be prepared by the free radical addition of sodium bisulfite to the corresponding 3-, 4-, or 5-hydroxy-1-olefin, respectively:

$$RCH(OH)CH{=}CH_2 + NaHSO_3 \xrightarrow[\text{Catalyst}]{\text{Free Radical}} RCH(OH)CH_2CH_2SO_3Na$$

$$RCH(OH)CH_2CH{=}CH_2 + NaHSO_3 \longrightarrow RCH(OH)CH_2CH_2CH_2SO_3Na$$

sodium 4-hydroxyalkane sulfonate

The hydroxy olefin for use as starting materials in the preceding free raidcal addition reaction can be prepared by well known organo-metallic reactions, e.g., involving an aldehyde and a Grignard reagent in which R' and R'' are organic radicals and X is a halogen. For example:

(a) $R'CHO + R''MgX \longrightarrow R'CH(OH)CH{=}CH_2$

aldehyde — Grignard reagent — 3-hydroxy-1-olefin

(b) $R'CHO + R''MgX \longrightarrow R'C(OH)CH_2CH{=}CH_2$

aldehyde — Grignard reagent — 4-hydroxy-1-olefin

A discussion of the conversion of hydroxyolefins produced by preceding Equations (a) and (b) to hydroxy sulfonates appears in an article written by J. Willens, Bulletin of the Chemical Society of Belgium, vol. 64, page 427 (1955).

It is to be understood that other hydroxy sulfonates as desired can be prepared by using different Grignard reagents in the reaction equation set forth above.

The alkene disulfonates and the hydroxy disulfonates which comprise Component C may also be prepared separately by any known manner. For instance, the hydroxy disulfonates may be prepared by epoxidizing olefin sulfonic acid isomers, and then opening the epoxide ring with sodium bisulfite by standard reaction techniques. The hydroxy disulfonates may then be dehydrated by reactions known to those skilled in the art to yield the corresponding isomeric alkene disulfonates.

As mentioned earlier, the Deteregnt (A) components should contain from about 12 to about 16 carbon atoms. In its preferred embodiment, Deteregnt (A) should consist of compounds containing 14 carbon atoms or compounds in the 12 to 16 carbon range but averaging 14 carbon atoms. It is not necessary that each of the compounds contain the same number of carbon atoms. Mixtures of different chain lengths within the prescribed ranges can be used.

For example, a Detergent (A) composition can be prepared by independently treating alpha olefin raw materials containing 12, 14 and 16 carbon atoms by the procedure described in copending patent application Ser. No. 561,352, filed June 29, 1966, by Kessler and Pflaumer, then mixing the portions of the resulting sulfonated products, e.g., 30% C_{12}, 40% C_{14}, 30% C_{16}; or as another example, 10% C_{12}, 80% C_{14}, 10% C_{16}; or another example, is mixing equal weight mixtures of C_{12}, C_{14} and C_{16} compounds having the compositions described above.

Alternatively, a mixture of alpha olefins containing 12, 14 and 16 carbon atoms can be treated according to the procedure described in copending patent application Ser. No. 561,352, filed June 29, 1966, by Kessler and Pflaumer.

The following compositions are illustrative of the make up of Detergent (A) according to the present invention wherein the percentages are by weight and wherein Components A, B and C total up to 100% of Detergent (A). The percentages listed for each ingredient are by weight of that particular ingredient in Detergent (A).

Detergent (A) can be comprised as follows with a chain length of 14 carbons being representative:

Component A:	Percent
$C_{12}H_{25}CH{-}CHSO_3Na$	13
$C_{11}H_{23}CH{=}CHCH_2SO_3Na$	33
$C_{10}H_{21}CH{=}CHCH_2CH_2SO_3Na$	13
$C_9H_{19}CH{=}CHCH_2CH_2CH_2SO_{3Na}$	6
Total	65

Component B:	Percent
$C_{11}H_{22}CH(OH)CH_2CH_2SO_2Na$	20
$C_9H_{10}CH{=}CHCH_2CH(SO_3Na)CH_2SO_3Na$	.5
Total	25

Component C:	Percent
$C_{11}H_{23}CH{=}CH(SO_2Na)CH_2SO_3Na$	1.0
$C_{10}H_{21}CH{=}CHCH(SO_3Na)CH_2SO_3Na$	3.0
$C_9H_{19}CH{=}CHCH_2CH(SO_3Na)CH_2SO_3Na$	.5
$C_9H_{19}CH_2CH{=}CH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_9H_{21}CH{=}CHCH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_8H_{17}CH{=}CHCH_2CH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_{10}H_{21}CH(OH)CH_2CH(SO_3Na)CH_2SO_3Na$	1.5
$C_9H_{19}CH(OH)CH_2CH_2CH(SO_3Na)CH_2SO_3Na$	1.5
$C_9H_{19}CH(OH)CH_2CH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_8H_{17}CH(OH)CH_2CH_2CH(SO_3Na)CH_2CH_2SO_3Na$	.5
Total	10

This Detergent (A) composition listed above has excellent detergent and synergistic sudsing properties when mixed with Detergent (B) according to the proportions described herein.

Another illustrative example of Detergent (A) is as follows: (C_{14} being represented)

Component A:	Percent
$C_{12}H_{23}CH{=}CHSO_3Na$	9
$C_{11}H_{23}CH{=}CHCH_2SO_3Na$	34
$C_{10}H_{21}CH{=}CHCH_2CH_2SO_3Na$	12
$C_9C_{19}CH{=}CHCH_2CH_2CH_2SO_3Na$	10
Total	65

Component B:	Percent
$C_{11}H_{23}CH(OH)CH_2CH_2SO_3Na$	10
$C_{10}H_{21}CH(OH)CH_2CH_2CH_2SO_3Na$	10
$C_9H_{19}CH(OH)CH_2CH_2CH_2SO_3Na$	3
Total	23

Component C:	Percent
$C_8H_{17}CH_2CH_2CH_2CH{=}C(SO_2Na)CH_2(SO_3Na)$	1.0
$C_8H_{17}CH_2CH_2CH{=}CHCH(SO_3Na)CH_2SO_3Na$	3.5
$C_8H_{17}CH_2CH{=}CHCH_2CH(SO_3Na)CH_2SO_3Na$	1.0
$C_8H_{17}CH_2CH{=}CHCH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_8H_{17}CH_2CH_2CH_2CH(SO_3Na)CH{=}CHSO_3Na$	.5
$C_8H_{17}CH_2CH_2CH_2C(SO_3Na){=}CHCH_2SO_3Na$	.5
$C_8H_{17}CH_2CH_2CH(OH)CH_2CH(SO_3Na)CH_2SO_3Na$	3.0
$C_8H_{17}CH_2CH(OH)CH_2CH_2CH(SO_3Na)CH_2SO_3Na$	1.0
$C_8H_{17}CHCH(OH)CH_2CH(SO_3Na)CH_2CH_2SO_3Na$	1.0
Total	12

This Detergent (A) composition also offers excellent detergent properties of cleaning and synergistic sudsing in admixture with Detergent (B) as described herein.

The synergistic sudsing properties of the novel compositions of the present invention were discovered by preparing detergent compositions containing different detergent compounds as sole cleaning agents and also representative mixtures of such detergent compounds. For purposes of these tests, the compositions were standardized to include a total of 30% by weight of an active detergent ingredient, 8% of an ethyl alcohol solubilizer with the balance, 62%, being water.

Detergent (A) was first tested separately and then in certain prescribed mixtures with amide compounds. Thus, for example, a composition was prepared consisting of 30% Detergent (A), 8% ethyl alcohol, and 62% water. Binary detergent mixtures were prepared consisting of 27.5% Detergent (A) and 2.5% Detergent (B), 25% Detergent (A) and 5% Detergent (B), 20% Detergent (A) and 10% Detergent (B), 15% Detergent (A) and 15% Detergent (B).

The specific testing procedure designed to evaluate these several detergent compositions is now described. A dishpan was prepared containing one gallon of water of 7 grains hardness, a temperature of 115° F. and a pH of 7. To this was added 7.25 cc. of the detergent composition being tested. The washing solution containing the detergent composition was mechanically agitated to produce the maximum suds level which was measured. This represents the original suds level. Agitation was by means of a mechanical stirrer.

After the original suds level was obtained, a series of five ordinary dinner plates each soiled with about 2 grams of standardized fatty soil (a triglyceride shortening) were washed in the prepared test solution. The suds height was again measured. This procedure was repeated a fixed number of times with a suds height measurement being taken after each set of five dishes was washed. An average was then calculated for the several suds height measurements, and the average was then expressed in terms of a percentage of the original suds level. This percentage figure is regarded as a relative measure of two important properties of detergent compositions, namely, initial suds volume capability and suds stability in the presence of increasing soil load in the dishwater or laundering solution. The results are highly dependable and reproducible. Those skilled in performing this evaluation know from experience that a difference in suds height of from about 3% to about 5% is considered statistically significant.

The results of these evaluations are presented below in Table I.

TABLE I.—SUDSING SYNERGISM

Examples	Detergent A:Detergent B	Percent Suds During Washing (Percent SDW)				
		30:0	27.5:2.5	25:5	20:10	15:15
1	Detergent A [1]:Coconut [3] Monoethanolamide	36	40	49	45	44
2	Detergent A [1]:Coconut [3] Monoisopropanolamide	36	42	44	40	(*)
3	Detergent A [1]:Lauroyl glycerylamide	36	46	47	51	38
4	Detergent A [2]:Coconut amide [3]	43	44	49	(*)	(*)

*Insufficient suds produced to conduct evaluation.
[1] See footnote below.
[2] See footnote below.
[3] Coconut alkyl group derived from the middle-cut of coconut fatty acid (distilled) which consists of a mixture of various chain lengths being approximately 2% C_{10}, 66% C_{12}, 23% C_{14}, and 9% C_{16}.

Footnote (1) from Table I.—Detergent (A) which was used in Examples 1, 2 and 3 in Table I was a 30% C_{12}, 40% C_{14}, and 30% C_{16} mixture.

The C_{12} material had the following composition:

Component A:	Percent
$C_{10}H_{21}CH{=}CHSO_3Na$	13
$C_9H_{19}CH{=}CHCH_2SO_3Na$	33
$C_8H_{17}CH{=}CHCH_2CH_2SO_3Na$	13
$C_7H_{15}CH{=}CHCH_2CH_2CH_2SO_3Na$	6
Total	65

Component B	Percent
$C_9H_{19}CH(OH)CH_2CH_2SO_3Na$	20
$C_8H_{19}CH(OH)CH_2CH_2CH_2SO_3Na$	5
Total	25

Component C	Percent
$C_8H_{17}CH{=}CHCH(SO_3Na)CH_2(SO_3Na)$	4.5
$C_7H_{15}CH{=}CHCH(SO_3Na)CH_2CH_2(SO_3Na)$	1.5
$C_8H_{17}CH(OH)CH_2CH(SO_3Na)CH_2(SO_3Na)$	3.0
$C_7H_{15}CH(OH)CH_2CH(SO_3Na)CH_2CH_2(SO_3Na)$	1.0
Total	10

The C_{14} had the following composition:

Component A	Percent
$C_{12}H_{25}CH{=}CHSO_3Na$	13
$C_{11}H_{23}CH{=}CHCH_2SO_2Na$	33
$C_{10}H_{21}CH{=}CHCH_2CH_2SO_3Na$	13
$C_9H_{19}CH{=}CHCH_2CH_2CH_2SO_3Na$	6
Total	65

Component B	Percent
$C_{11}H_{23}CH(OH)CH_2CH_2SO_3Na$	20
$C_{10}H_{21}CH(OH)CH_2CH_2CH_2SO_3Na$	5
Total	25

Component C	Percent
$C_{10}H_{21}CH{=}CHCH(SO_3Na)CH_2(SO_3Na)$	4.5
$C_9H_{19}CH{=}CHCH(SO_3Na)CH_2CH_2(SO_3Na)$	1.5
$C_{10}H_{21}CH(OH)CH_2CH(SO_3Na)CH_2(SO_3Na)$	3.0
$C_9H_{19}CH(OH)CH_2CH(SO_3Na)CH_2CH(SO_3Na)$	1.0
Total	10

The C_{16} had the following composition:

Component A	Percent
$C_{14}H_{29}CH{=}CHSO_3Na$	13
$C_{13}H_{27}CH{=}CHCH_2SO_3Na$	33
$CH_{12}H_{25}CH{=}CHCH_2CH_2SO_3Na$	13
$C_{11}H_{23}CH{=}CHCH_2CH_2CH_2SO_3Na$	6
Total	65

Component B	Percent
$C_{13}H_{27}CH(OH)CH_2CH_2SO_3Na$	20
$C_{12}H_{25}CH(OH)CH_2CH_2CH_2SO_3Na$	5
Total	25

Component C	Percent
$C_{12}H_{25}CH{=}CHCH(SO_3Na)CH_2(SO_3Na)$	4.5
$C_{11}H_{23}CH{=}CHCH(SO_3Na)CH_2CH_2(SONa)$	1.5
$C_{12}H_{25}CH(OH)CH_2CH(SO_3Na)CH_2(SO_3Na)$	3.0
$C_{11}H_{23}CH(OH)CH_2CH(SO_3Na)(CH_2CH_2(SO_3Na)$	1.0
Total	10

Footnote (2) from Table I.—In Example 4, Detergent (A) consisted of a 10% C_{12}, 80% C_{14}, 10% C_{16} mixture of the C_{12}, C_{14}, C_{16} compositions described immediately above.

The synergistic results presented in Table I were totally unexpected. Equally unexpected were the inferior results obtained with the amide compounds listed below in Table II. From a comparison of the amide compounds in Table I and Table II, it can be observed that even minor variations in the structural formula of a particular amide compound can markedly affect the sudsing properties of mixtures of Detergent A with such amide compounds. For example, replacing the coconut fatty acid group in coconut monoethanolamide with an octyl group totally upsets the synergistic sudsing effects observed with a mixture of coconut monoethanolamide and Detergent A. (See Run No. 5 in Table II below.) Similarly poor results are seen with mixtures of coconut diethanolamide and Detergent A. (See Run No. 6 in Table II below.) The introduction of a second ethanol group into the amide molecule offsets the synergistic sudsing advantages obtained with a coconut monoethanolamide. Synergistic sudsing properties are not observed with mixtures of Detergent A and lauroyl-N-methylglucamide. (See Run No. 7 in Table II below.)

The proportions of Detergent A to the amide ingredient in Table II are presented up to a 5:1 by weight ratio (25:5). Increasing the proportionate amount of amide does not offer any different results and for this reason they are omitted from Table II.

In Tables I and II, the percent SDW figures should be read by reading across the table. Comparisons should not be made between the numeral data obtained with one mixture with that obtained with another mixture. The presence or absence of synergistic results for each mixture can only be determined by examining figures obtained with different proportions of that particular mixture.

TABLE II.—SUDSING PROPERTIES

Runs	Detergent A:Detergent B	Percent Suds During Washing (Percent SDW)		
		30:0	27.5:2.5	25:5
5	Detergent A [1]:Octyl monoethanolamide	36	[3] 36	35
6	Detergent A [1]:Coconut [2] diethanolamide	36	36	36
7	Detergent A [1]:Lauroyl-N-methyl glucamide	36	[3] 35	33

[1] Detergent A was the same Detergent A in conjunction with Examples 1, 2, and 3 of Table I.
[2] The coconut group same as footnote (3) in Table I.
[3] These tests were not run to completion as all others were; the figures here are estimates.

According ot the present invention, the synergistic detergent compositions of the present invention consisting of the critically proportioned detergents can be incorporated readily into any of the usual forms of detergent compositions including liquids and solids such as spray dried blown granules, flakes, powders, tablets and the like.

Moreover, the advantages of these synergistic detergent mixtures can be embodied into light-duty unbuilt detergent compositions, built detergent compositions, and heavy-duty built detergent compositions. These terms have meaning in suggesting the intended purpose of a given detergent composition. Light duty implies a composition prepared more especially for dishwashing and laundering of fine fabrics or lightly soiled garments as well as other typical hand washing applications. The terms medium duty and heavy duty suggest detergent compositions which are fortified or strengthened with detergency aids such as inorganic alkaline builders, organic alkaline sequestering builders, and mixtures of such inorganic and organic builders.

The light-duty, unbuilt detergent compositions of the present invention consist essentially of from about 5% to about 60% by weight of the synergistic mixture of Detergent A and Detergent B, from about 2% to about 30% by weight of a solubilizing agent and the balance 40%–90% by weight being water.

A solubilizing agent is an essential component in the synergistically subsing light-duty unbuilt liquid detergent compositions of this invention. Such an agent prevents phase separation in the final formulation. Without the use of this essential ingredient, the synergistic unbuilt detergent mixtures can encounter complex phase problems which result in inferior performing sudsing compositions and the advantages of this invention cannot be enjoyed. The use of too little solubilizer does not solve the phase separation problems. By the same token, too much solubilizing agent would be too costly and tends to adversely affect viscosity. For these reasons, only enough solubilizing agent should be used in the composition to keep the composition in a pourable single phase under conditions of use. Accordingly, it has been discovered that in an unbuilt light-duty liquid detergent composition of this invention the proportion of the synergistic mixture of Detergent A and Detergent B to the solubilizing agent needs to be in the range of about 30:1 to about 1:6 by weight.

In addition to the synergistic mixture of Detergent A and Detergent B, as these terms are defined above, and the solubilizing agent, the other essential ingredients in a light-duty, unbuilt liquid detergent composition of the present invention is water which serves as a base for the complete formulation. Water can constitute from about 40% to about 95% by weight of the formulation.

The synergistic sudsing mixtures of Detergent A and Detergent B, as mentioned above, can also be formulated into built detergent compositions. Built detergent compositions of the present invention consist essentially of the synergistic mixture of Detergent A and Detergent B and a builder ingredient selected from the group consisting of inorganic alkaline builders, organic alkaline sequestering builders, and mixtures thereof in a proportion by weight of said synergistic mixture to said builder ingredient in the range of from about 5:1 to about 1:20. This range of proportions covers lightly built to heavily built detergent compositions. Such compositions should be so formulated that they provide a washing solution having a pH in the range of from about 8 to 12 and preferably 9.5 to about 11.5.

Built liquid detergent compositions have special requirements imposed by the physical form of the composition being liquid and the role of the solubility factor of the several ingredients together with phase stability problems due to the solution containing inorganic and organic compounds. Taking such items into consideration, built liquid detergent compositions are prepared according to this invention in which the proportion by weight of said synergistic mixture to said builder ingredient is in the range of from about 1:1 to about 1:3. Moreover, a built liquid detergent composition of the present invention contains from about 4% to about 25% by weight of the synergistic mixture of Detergent A and Detergent B as described herein, from about 10% to about 40% by weight of a builder ingredient selected from the group consisting of inorganic alkaline builders, organic alkaline sequestering builders and mixtures thereof, from about 0% to about 15% of a hydrotrope, and from about 35% to about 86% water.

A built solid, e.g., a blown granular, detergent composition of the present invention contains proportionately more builder ingredient than liquid compositions. The preferred range of the synergistic mixture of Detergent A and Detergent B to the builder ingredient in a built solid detergent composition is from about 2:1 to about 1:10, by weight. A solid detergent composition according to the present invention consists essentially of from about 5% to about 40% of the synergistic mixture of Detergent A and Detergent B, from about 40% to 95% of a builder ingredient selected from the group consisting of inorganic alkaline builders, organic alkaline sequestering builders, and mixtures thereof, from about 0% to about 15% of a hydrotrope and from about 0% to about 15% water.

According to the present invention, the water-soluble inorganic alkaline builder ingredients which can be used alone or in mixture thereof are alkali metal carbonates, borates, phosphates, polyphosphates, bicarbonates and silicates. Specific examples of such salts are sodium and potassium tripolyphosphate, sodium and potassium carbonate, sodium and potassium tetraborate, sodium and potassium pyrophosphate, sodium bicarbonate, sodium hexametaphosphate, sodium sesquicarbonate, sodium mono- and di-ortho phosphate and potassium bicarbonate. Such inorganic builder salts can enhance the overall cleaning characteristic of the novel synergistic mixtures of the present invention. Generally the potassium salts of these builder compounds are preferred for liquid detergent compositions for reasons of solubility, e.g., potassium pyrophosphate.

Examples of organic sequestering builders which can be used alone or in admixture either with each other or with the aforementioned inorganic alkaline builders are

alkali metal, ammonium or substituted ammonium, aminopolycarboxylates, e.g., sodium and potassium N-(2-hydroxyethyl)-ethylenediaminetriacetates, sodium and potassium nitrilotriacetates and sodium, potassium and triethanolammonium - N - (2 - hydroxyethyl) - nitrilodiacetates. Mixed salts of these polycarboxylates are also suitable. Other valuable polycarboxylate biulder compounds are the sodium and potassium salts of polymaleate, polyitaconate, and polyacrylate. The alkali metal salts of phytic acid, e.g., sodium phytate, are also suitable as organic alkaline builder salts (see U.S. Patent 2,739,942).

Polyphosphonates are also valuable organic builders in terms of the present invention including specifically sodium and potassium salts of ethane-1-hydroxy-1,1-diphosphonate, sodium and potassium salts of methylene diphosphonate, sodium and potassium salts of ethylene diphosphonate, and sodium and potassium salts of ethane-1,1,2-triphosphonate. Other examples include the alkali metal salts of ethane-2-carboxy-1,1-diphosphonic acid, hydroxymethanediphosphonic acid, carbonyldiphosphonic acid, ethane-1-hydroxy,1,1,2-triphosphonic acid, ethane-2-hydroxy-1,1,2-triphosphonic acid, propane-1,1,3,3-tetraphosphonic acid, propane-1,1,2,3-tetraphosphonic acid, and propane-1,2,2,3-tetraphosphonic acid.

In the embodiment of the present invention in which organic alkaline sequestering builders are used, especially in built liquid embodiments, it is desirable to also use a hydrotrope in order to provide a stable, clear liquid composition.

Hydrotropes can be added, therefore, if desired to increase the compatibility of the ingredients of both solid and liquid formulations of this invention. Preferred hydrotrope anions are benzene sulfonate, xylene sulfonate, and toluene sulfonate. They are preferably used as their soluble salts such as: ethanolammonium, diethanolammonium, and triethanolammonium, and especially as the alkali metal, potassium, or sodium salts. Sodium or potassium toluene sulfonate is especially preferred. The hydrotrope can be added at levels of from about 0% to about 15% by weight of the total composition. The upper limit of about 15% is set by increasing dilution of the product by an ingredient substantially inert so far as sudsing and detergency are concerned. The lower limit should be the amount required to achieve a homogeneous solution. It will be appreciated that it is necessary that the liquid formulations prepared according to this invention should be liquid at somewhat higher and at somewhat lower temperatures than usual room temperature. The amount of hydrotrope salt used is preferably the minimum amount which will hold the ingredients in solution at the temperature to which it is desired that the formula can be cooled without phase separation.

The detergent compositions of the present invention regardless of their physical form or their built or unbuilt status can contain other detergent aids which improve either the overall performance characteristics, physical attributes or aesthetic appeal of a complete detergent formulation. Thus, for example, complete formulations can contain buffering agents, anti-corrosion agents, perfumes, anti-redeposition agents, opacifiers, resin stabilizers, dyes and pigments, germicides and antibacterial agents, softening agents, viscosity control agents, and the like.

In such built detergent compositions a typical example of a heavy-duty or heavily built granular detergent composition can contain about 17.5% of an active detergent mixture described herein, about 59% sodium tripolyphosphate, about 24% sodium sulfate, and about 8.5% sodium silicate.

It has also been discovered that the synergistic sudsing properties of the novel detergent composition described herein can be even further enhanced by adding to said composition from about 0.1% to about 0.3% by weight of a water hardness salt such as magnesium sulfate, magnesium chloride, calcium sulfate and calcium chloride, or mixtures thereof. Other well-known water hardness salts can also be used such as iron salts and the like. Preferably from about 0.15% to 0.25% by weight of the inorganic salt should be present in the product.

The suds building effect is more pronouced in relatively soft water but it is also effective in so-called medium hard water or hard water. A surprising aspect of this discovery is that the marked improvement in sudsing is not obtained if the equivalent amount of water hardness salts is added to the water solution instead of being present in the detergent product.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention having been described above in general but essential terms, there is now presented a discussion of the preferred embodiments thereof.

Detergent (A)

The preferred Detergent (A) ingredient is one which contains Components A, B, and C each of which consists of compounds averaging 14 carbon atoms. An Example of a preferred Detergent (A) is given below in which each ingredient is listed as containing 14 carbon atoms.

The preferred Detergent (A) ingredient is one which contains from about 35% to about 65% Component A, 25% to about 60% Component B, and 3% to 12% Component C. The Components are described in detail above.

	Percent
Component A:	
$C_{12}H_{25}CH=CHSO_3Na$	13
$C_{11}H_{23}CH=CHCH_2SO_3Na$	33
$C_{10}H_{21}CH=CHCH_2CH_2SO_3Na$	13
$C_9H_{19}CH=CHCH_2CH_2CH_2SO_3Na$	6
Total	65
Component B:	
$C_{11}H_{22}CH(OH)CH_2CH_2SO_3Na$	20
$C_{10}H_{21}CH(OH)CH_2CH_2CH_2SO_3Na$	5
Total	25
Component C	
$C_{11}H_{23}CH=C(SO_3Na)CH_2SO_3Na$	1.0
$C_{10}H_{21}CH=CHCH(SO_3Na)CH_2SO_3Na$	3.0
$C_9H_{19}CH=CHCH_2CH(SO_3Na)CH_2SO_3Na$	.5
$C_9H_{19}CH_2CH=CH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_9H_{21}CH=CHCH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_8H_{17}CH=CHCH_2(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_{10}H_{21}CH(OH)CH_2CH(SO_3Na)CH_2SO_3Na$	1.5
$C_9H_{19}CH(OH)CH_2CH_2CH(SO_3Na)CH_2SO_3Na$	1.5
$C_9H_{19}CH(OH)CH_2CH(SO_3Na)CH_2CH_2SO_3Na$	.5
$C_8H_{17}CH(OH)CH_2CH_2CH(SO_3Na)CH_2CH_2SO_3Na$	.5
Total	10

Detergent (B)

The preferred compounds for use as Detergent (B) are fatty acid monoethanolamides and fatty acid isopropanolamide, the fatty acid group averaging about 12 carbon atoms. Specific preferred examples are coconut monoethanolamide and coconut isopropanolamide, the coconut groups being derived from the middle-cut of distilled coconut fatty acids which consists of a mixture of various chain lengths being approximately 2% C_{10}, 66% C_{12}, 23% C_{14} and 9% C_{16}. Other preferred examples are lauroyl monoethanolamide and lauroyl isopropanolamide.

Solubilizer

The preferred solubilizers for use in unbuilt liquid detergent compositions of the present invention are ethyl alcohol and isopropyl alcohol.

Formulation

The preferred formulation for the light-duty unbuilt liquid detergent composition of the present invention is as follows:

	Percent
Water	55–85
Synergistic sudsing mixture of Detergent A and Detergent B described above	10–45
Solubilizing agent described above	5–20

A preferred built liquid detergent composition of the present invention consists essentially of from about 6% to about 15% by weight of the synergistic mixture of Detergent A and Detergent B as described herein, from about 15% to about 35% by weight of a builder ingredient selected from the group consisting of inorganic alkaline builders, organic alkaline sequestering builders, and mixtures thereof, from about 2% to about 10% of a hydrotrope and from about 40% to about 79% water.

Table III below contains additional preferred examples of the light-duty liquid detergent compositions, each of which provide synergistic amounts of suds in light-duty cleaning applications.

TABLE III

Examples	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Detergent A:																
Detergent A as described in Ex. 1	25	20			18	28		16		40	15					
Detergent A as described in Ex. 4			10										45			
Detergent A (each ingredient being C_{12})												28		30		25
Detergent A (each ingredient being C_{14})				30					20						20	
Detergent A (each ingredient being C_{16})							25									
Detergent B:																
Coconut monoethanolamide	5	4	2	6												
Coconut isopropanolamide					2	4	5	4								
Dodecylglycerylamide									10	20	7.5	14				
Coconutamide													9	6	4	5
Water Solubilizer:																
Ethyl alcohol	8	6	3		4	8					10	9	6	10		8
Methyl alcohol										6						
Propyl alcohol							10		7							
Isopropyl alcohol				10				6							12	
Water	62	70	85	54	76	60	60	74	63	44	67.5	49	40	54	64	62
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Ratio by Weight of Detergent A:Detergent B	5:1	5:1	5:1	5:1	9:1	7:1	5:1	4:1	2:1	2:1	2:1	2:1	5:1	5:1	5:1	5:1

The preferred range of proportions for the synergistic mixtures of Detergent (A) and Detergent (B) are as follows:

Detergent (A) to unsubstituted fatty acide amide is about 5:1 by weight.

Detergent (A) to fatty acid monoethanolamide is about 5:1 by weight.

Detergent (A) to fatty acid monoisopropanolamide is about 7:1 to 4:1, by weight.

Detergent (A) to fatty acid glycerylamide is about 2:1, by weight.

The preferred range of proportions of said synergistic sudsing mixture consisting of Detergent (A) and Detergent (B) to the solubilizing agent in an unbuilt light-duty liquid detergent composition is in the range of from about 9:1 to about 1:2, by weight.

A built detergent composition prepared according to the present invention consists essentially of the synergistic sudsing mixture of Detergent (A) and Detergent (B) as described herein to the builder ingredient as defined herein in the preferred range of proportions of from about 2:1 to about 1:10 by weight.

Preferably, a built granular detergent composition contains from about 10% to 30% by weight of the synergistic mixture of Detergent A and Detergent B as described herein, from about 45% to about 80% of a builder ingredient selected from the group consisting of an inorganic alkaline builder, an organic alkaline sequestering builder, and mixtures thereof from about 5% to about 12% water and from about 3% to about 12% of a hydrotrope.

For a built liquid detergent composition, the proportion of said synergistic sudsing mixture to said builder ingredient should preferably be in the range of from about 1:1 to about 1:3 by weight.

The following compositions are additionally preferred embodiments of the present invention. Each composition exhibits the synergistic sudsing properties described above.

Liquid detergent composition:	Percent
Detergent A averaging 14 carbon atoms	12.5
Coconut monoethanolamide	2.5
Tripotassium - ethane - 1- hydroxy - 1,1 - diphosphonate	26
Potassium toluene sulfonate	6
Ethyl alcohol	2
Water	51

Granular detergent composition:	
Detergent A containing 14 carbon atoms	25
Coconut isopropanolamide	5
Trisodium - ethane - 1 - hydroxy - 1,1 - diphosphonate	45
Sodium sulfate	20
Sodium silicate ($Na_2O:SiO_2=1.6:1$)	5

It should be understood that the foregoing detailed description and specific examples, while indicating general and preferred embodiments of the present invention, are given by way of illustration only. Since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

All percentages given herein are by weight unless otherwise specified.

What is claimed is:

1. A detergent composition having synergistic sudsing properties consisting essentially of a synergistic sudsing mixture of Detergent A and Detergent B wherein

Detergent A is an ingredient which comprises from about 30% to about 70% of Component A, from

about 20% to about 70% of Component B and from about 2% to about 15% of Component C, wherein:

(a) said Component A is a mixture of double-bond positional isomers of water-soluble salts of alkene-1-sulfonic acids containing from about 12 to about 16 carbon atoms, said mixture of positional isomers including by weight about 10% to about 25% of an alpha-beta unsaturated isomer, about 30% to about 70% of a beta-gamma unsaturated isomer, about 5% to about 25% of a gamma-delta unsaturated isomer, and about 5% to about 10% of a delta-epsilon unsaturated isomer;

(b) said Component B is a mixture of water-soluble salts of bifunctionally-substituted sulfur containing saturated aliphatic compounds containing from about 12 to about 16 carbon atoms, the functional units being hydroxy and sulfonate radicals with the sulfonate radical always being on the terminal carbon and the hydroxyl radical being attached to a carbon atom at least two carbon atoms removed from the terminal carbon atom at least 90% by weight of said Component B having a hydroxyl radical on the third, fourth or fifth carbon atom;

(c) said Component C is a mixture comprising from 30–95% water-soluble salts of alkene disulfonates containing from about 12 to about 16 carbon atoms, and from about 5% to about 70% water-soluble salts of hydroxy disulfonates containing from about 12 to about 16 carbon atoms, said alkene disulfonates containing a sulfonate group attached to a terminal carbon atom and a second sulfonate group attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom, the alkene double-bond being distributed between the terminal carbon atom and about the seventh carbon atom, said hydroxy disulfonates being saturated aliphatic compounds having a sulfonate radical attached to a terminal carbon, a second sulfonate group attached to an internal carbon atom not more than about six carbon atoms removed from said terminal carbon atom, and a hydroxy group attached to a carbon atom which is not more than about four carbon atoms removed from the site of attachment of said second sulfonate group;

and wherein

Detergent B is a fatty acid amide compound selected from the group consisting of

unsubstituted fatty acid amide, fatty acid monoethanolamide, fatty acid monoisopropanolamide, and fatty acid glycerylamide,

the fatty acid groups containing 10 to 14 carbon atoms, said synergistic sudsing mixture consisting of said detergents in the following proportions:

(1) when Detergent B is said unsubstituted fatty acid amide, the proportion of Detergent A to Detergent B being about 5:1 by weight;

(2) when Detergent B is said fatty acid monoethanolamide, the proportion of Detergent A to Detergent B being about 5:1 by weight;

(3) when Detergent B is said fatty acid monoisopropanolamide, the proportion of Detergent A to Detergent B being in the range of 9:1 to 3:1 by weight;

(4) when Detergent B is said fatty acid glycerylamide, the proportion of Detergent A to Detergent B being in the range of about 11:1 to 1.5:1 by weight.

2. A light-duty liquid detergent composition according to claim 1 in which Detergent A consists of compounds averaging 14 carbon atoms.

3. A light-duty liquid detergent composition according to claim 1 in which Detergent A consists essentially of from about 35% to about 65% of Component A, from about 25% to about 60% of Component B, and from about 3% to about 12% of Component C.

4. A detergent composition according to claim 1 wherein Detergent B is coconut amide, the coconut alkyl group being derived from the middle cut of distilled coconut fatty acid, and the ratio of Detergent A to Detergent B is about 5:1, by weight.

5. A detergent composition according to claim 1 wherein Detergent B is coconut monoethanolamide, the coconut alkyl group being derived from the middle cut of distilled coconut fatty acid, and the ratio of Detergent A to Detergent B is about 5:1, by weight.

6. A detergent composition according to claim 1 wherein Detergent B is dodecylglycerylamide and the ratio of Detergent A to Detergent B is about 2:1, by weight.

7. A detergent composition according to claim 1 wherein Detergent B is coconut isopropanolamide, the coconut alkyl group being derived from the middle cut of distilled coconut fatty acid, and the ratio of Detergent A to Detergent B is in the range of about 7:1 to 4:1, by weight.

8. A detergent composition according to claim 1 in which the ratio of said synergistic sudsing mixture consisting of Detergent A and Detergent B to the solubilizing agent is in the range of from about 9:1 to about 1:2, by weight.

9. A light-duty liquid detergent composition having synergistic sudsing properties consisting essentially of from about 5% to about 60% by weight of the detergent composition described in claim 1, from about 2% to about 30% by weight of the composition of a solubilizing agent selected from the group consisting of methyl alcohol, ethyl alcohol, n-propyl alcohol, and isopropyl alcohol, and mixtures thereof, and from about 40% to about 90% by weight of the composition water.

10. A light-duty liquid detergent composition of claim 9 in which the solubilizer is selected from ethyl alcohol or isopropyl alcohol.

11. A detergent composition having synergistic sudsing properties consisting essentially of an active synergistic mixture described in claim 1, and a builder ingredient selected from the group consisting of inorganic alkaline builders, organic alkaline sequestering builders, and mixtures thereof in a proportion by weight of said synergistic mixture to said builder ingredient in the range of from about 5:1 to about 1:20.

12. A detergent composition of claim 11 in which the proportion by weight of said synergistic mixture to said builder ingredient is in the range of from about 2:1 to about 1:10.

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