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COMBINATIONS OF WASH-ACTIVE SUBSTANCES IN LIQUID OR PASTE FORM

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Liquid combinations of wash-active substances are used for most part in substantially concentrated form, for the manufacture of solutions for treating many different kinds of solid materials, and also for making liquid washing, cleaning and rinsing substances. These solutions can be used as household cleaners such as laundry detergents for heavy and fine clothing, washing compounds and general utility cleaners for polished or varnished surfaces, and for cleaning wall tiles, wall coverings and the like. These liquid concentrates are also employed commercially for cleaning or treatment of surfaces or solid materials such as in laundries, and other industrial applications or the like. In addition to the wash-active substances and accompanying substances originating in their manufacture, such as sodium sulfate, these liquid concentrates may also contain other conventional additives.

In all such cases, it is advantageous for the wash-active concentrates to have the lowest possible viscosity, because the viscosity is often increased by the use of accompanying substances, and because it is important to avoid excessive viscosities in the interest of easy handling, such as the rapid measurement and dilution of the concentrates with water.

In the industrial production of solid, especially dry flowing washing, cleaning and rinsing agents, concentrates of low viscosity, which are consequently easy to pump, are also desired, especially when the solids are formed from concentrates that are hot sprayed or otherwise dried after incorporation of the conventional additives if they are used.

It has now been found that salts of sulfofatty acids with 10 to 14 carbon atoms are capable of reducing the viscosity of aqueous pastes or solutions of surface-active alkylbenzenesulfonates which optionally contain surface-active salts of esters of sulfofatty acids having 8 to 24, preferably 10 to 20, and especially 12 to 18 carbon atoms, and monovalent or divalent alcohols.

The salts of 10-to-14 carbon-atom sulfofatty acids may be individual salts of 10-to-14-carbon-atom chain length or mixture of such salts. These sulfofatty acid ester salts are present in qauntities of from 5 to 80%, and preferably from 10 to 60%, of the mixture of alkylbenzenesulfonate and sulfofatty acid ester salt.

Since the sulfofatty acid salts are difficult to dissolve, their ability to reduce the viscosities of ABS pastes or solutions must be considered as very surprising. In addition to the disalts, still other components dissolved in the paste have an influence on its viscosity. These include especially inorganic salts. Nevertheless, the viscosity reduction of ABS pastes or solutions which is achieved by the addition of disalts remains unaffected.

For the sake of simplicity, the sulfofatty acid salts (monosalts and/or disalts) mentioned in the specification and claims will be referred to as "disalts," the sulfofatty acid ester salts will be referred to as "ester salts" and the alkylbenzenesulfonates as "ABS." The expression "total WAS" means the sum of the WAS (wash-active substances), disalts, ester salts and any other wash-active substances that may be present. U.S. Patent No. 2,915,473 discloses the 16 to 24 carbon atom sulfofatty acids in combination with alkylbenzenesulfonates or fatty alcohol sulfates. However, the viscosity reducing effect of disalts in combination with these sulfonates is completely unexpected in view of the diffiiculty encountered in dissolving disalts.

Hitherto, attempts have often been made to improve liquid detergents by the addition of known anionic hydrotropic substances, which comprise sulfonates of benzene, toluene or xylene. In contrast to the substances to be used according to the invention, these substances are not surface-active, while the surface-active additives of the invention achieve excellent success precisely in the case of such pastes.

The viscosity lowering effect of the dissalts of sulfofatty acids with 10 to 14 carbon atoms is so pronounced that it occurs even in the presence of disalts of higher sulfofatty acids, although the C_{10} to C_{14} percentage in the said disalt mixture is to amount to at least 25 wt. percent.

The total wash-active substance concentration of the pastes or solutions of the invention can range from 5 to 45 wt. percent, a range of 10 to 30 wt. percent being preferred, with reference to the weight of the total solution or paste, the remainder being water.

The alkylbenzenesulfonates contained therein, and having 8 to 18, and preferably 10 to 15 carbon atoms in the alkyl radical, may possess straight-chained or branched alkyl radicals.

The disalts will preferably comprise fatty acid mixtures in which those with 12 to 14 carbon atoms amount to at least 50%. The hydrogenated fatty acid fractions of coconut or palm kernel oil having 12 to 18 carbon atoms particularly suited for this purpose. Fatty acid mixtures of different composition are usable for the ester salts, as for example the hydrogenated fatty acids of palm oil, tallow, the oils of marine animals, and the like. Instead of the disalts or ester salts made from natural fatty acids, analogous products of fatty acids or fatty acid mixtures of synthetic origin can also be used, providing the chain length make-up corresponds to the above requirements.

The substantially saturated hydrophobic radicals of the sulfofatty acids, which are contained in the disalts or ester salts, can be straight-chained or branched; the sulfonic acid group is in the alpha position, in contrast to those obtained by sulfonation of unsaturated and/or hydroxyl group-containing acids or their derivatives involving sulfuric acid semiesters. The fatty acid radicals present in the disalts and ester salts may be all the same or different.

The alcohol radicals present in the ester salts can be derived from monovalent alcohols having approximately 1 to 12, and preferably 1 to 4 carbon atoms, or from polyvalent alcohols, especially divalent to tetravalent alcohols with 2 to 6 carbon atoms, such as glycol or glycerine.

The aliphatic monovalent or polyvalent alcohols named above may be substituted wholly or partially with monovalent ether alcohols containing up to 12 carbon atoms. These ether alcohols can be derived from the above-described monovalent or polyvalent alcohols. The ether alcohols themselves can also be monovalent or polyvalent. They can be derived especially from monovalent mono-alcohols containing no other groups and having 1 to 4 carbon atoms in the molecule, and be obtained by etherification with polyalcohols, especially polyglycols or polyglycerines, or by adding on ethylene oxide, propylene oxide or glycide. Examples of such ether alcohols are the monomethyl, monoethyl, monopropyl, monoisopropyl or monobutyl ethers of ethylene glycol, propylene

glycol, butylene glycol, di- or tri-ethylene glycol, and the products formed by adding from 1 to 7 mols of ethylene oxide or 1 to 5 mols of propylene oxide onto glycerin.

The wash-active substance pastes or solutions of the invention may contain, in addition to ABS compositions and ester salts, other WAS substances. Disalts that may be present containing more than 14 carbon atoms will also be considered WAS substances. These additional WAS substances, however, are to be present in a smaller quantity than the sum of ABS compositions and ester salt. Preferably, the WAS substances are to be present in smaller quantity than ABS compounds; this applies particularly to pastes in which the ABS content amounts to at least 5% of the mixture of ABS and ester salt. These WAS substances which may be present in addition to ABS compounds and ester salts, include primarily those of the sulfate type. These surface-active sulfates generally contain hydrophobic radicals, especially aliphatic or cycloaliphatic hydrocarbon radicals with 8 to 20 and preferably 12 to 18 carbon atoms.

The above WAS surface-active sulfates can be derived from saturated or unsaturated fatty alcohols, from fatty acid alkylolamides, partial ethers of fatty alcohols, alkylphenols or acylphenols or partial esters of fatty acids formed with polyvalent alcohols, such as ethylene or propylene glycols, glycerin, pentaerythritol, mannitol, hexitol and the like. Radicals of polyvalent alcohols which may be present in such partial ethers or partial esters are especially the radicals of polyethylene or polypropylene, glycols, polyglycerines, polypentaerythritols, etc. Particularly important are sulfates or partial ethers or patrial esters which are obtained by adding 1 to 4 mols of ethylene and/or propylene glycol onto fatty alcohols, fatty acid amides, fatty acids, alkyl phenols or acyl phenols.

When the alkyl radicals present in these compounds stem from natural products, as is the case, for example, with fatty acids, fatty alcohols of vegetable or animal origin, or derivatives obtained therefrom, they may be manufactured from coconut, palm kernel, palm oil, tallow and marine animal fats and oils. In this case, the fatty alcohols primarily may be fully saturated or they may be more or less unsaturated like the starting fatty acids. The sulfates obtainable from unsaturated fatty alcohols also include the products, like oleylsulfate-1, (which are made) in a conventional manner with the preservation of the double bond, (and) which are sulfatized at practically none but the hydroxyl group.

The hydrophobic radicals present in the surface-active sulfates may also be of synthetic origin, however, and they may be branched if desired, and be obtained for example from the products of oxosynthesis, Ziegler's synthesis, carbon monoxide hydrogenation, etc.

In liquid to pasty wash-active substance combinations of this kind, the viscosity reducing effect of the disalts occurs even when the disalt content is slight, amounting to 2.5% of the weight of the alkylbenzenesulfonates and at least 2.5% of the weight of the mixture of ABS substances and ester salt and, preferably, the weight of the disalts amounts to up to 10% of the weight of the ABS and ester salt mixture. In general, disalts are used at most in such quantities that their weight is equal to the weight of the ABS and ester salt mixture. In the case of ABS and ester salt mixtures consisting of a maximum of 50 wt. percent of ABS compounds, the weight of the disalts should preferably not exceed the weight of the ABS compounds.

When the wash-active substance combinations according to the invention contain no ester salts, the data on quantities or weights which have been given for the weight of the ABS and ester salt mixture shall apply to the weight of the ABS compounds.

The wash-active substance combinations of the invention are opaque pastes or more or less turbid or even clear solutions, depending on their concentration and the substances dissolved in them. In many cases, turbidity does not occur until after relatively long storage. This fact is immaterial to the use of the pastes or solutions because, when they are used for example as liquid detergents, they contain still other turbidity causing substances in solution or suspension.

The ABS compounds, ester salts, disalts and any other salt-like WAS compounds that may be present may be in the form of sodium salts or in the form of the salts of other cations. Such other cations are, in addition to potassium, lithium and ammonium, organic bases such as mono-, di- or triethanolamine. For the manufacture of wash-active substance combinations which contain practically no undissolved components, it may be advantageous to see to it that a plurality of cations is present simultaneously: for example, sodium and potassium salts can be used together, or potassium and triethonalamine salts, or sodium and potassium and triethanolamine salts.

The wash-active substance combinations according to the invention may also contain solubilizers, particularly water-soluble organic solvents such as monovalent or polyvalent alcohols, ethers of identical or different polyvalent alcohols, or partial ethers of polyvalent and monovalent alcohols. These include, for example, the aliphatic, monovalent alcohols containing 1 to 5 carbon atoms, glycols with 2 to 5 carbon atoms, di- or triethylene glycol, glycerine, polyglycerine and partial ethers of all these polyvalent alcohols formed with aliphatic monovalent alcohols containing 1 to 4 carbon atoms in the molecule. The amounts of these solvents may be from 1 to 20% and preferably from 2 to 10% of the weight of the mixture of water and solvent.

On account of their reduced viscosity, the wash-active substance combinations according to the invention are especially suitable for the incorporation of additional substances, such as those usually added to mixtures to be used for washing, cleaning and rinsing. These include the carbonates, orthophosphates, anyhdrous phosphates (pyrophosphates, polyphosphates and polymetaphosphates) and the silicates of the alkalies, as well as other conventional washing alkalies. The organic chelate formers of the prior art can also be incorporated into the preparations according to the invention. Lastly, organic or inorganic colloidal substances, water-soluble substances of high molecular weight, etc., can be added, such as the ones which serve as dirt carriers in the washing process. We shall mention in this connection water-soluble salts of polyacrylic acid or polymethacrylic acid, water-soluble cellulose or starch derivatives such as carboxymethylcellulose and ethers of cellulose and oxyalkylsulfonic acids, and also the cellulose sulfates.

Liquid wash-active susbtance combinations with a content of the wash-active substance combination of the invention may have approximately the following composition:

5–25%, preferably 7 to 20%, by weight, of wash-active substance combination;
0–45%, preferably 5 to 30%, by weight, of anhydrous phosphates or organic chelating agents, preferably pyrophosphates or polyphosphates;
0–6%, preferably 2–5%, by weight, of alkali silicates;
0–5%, preferably 0.5 to 2%, by weight, of foam stabilizers, such as fatty acid amides or fatty acid alkylalamides.
0–10%, preferably 2 to 4% of solubilizers.
0–10%, of neutrally reacting, especially inorganic, salts, such as Na_2SO_4 and/or NaCl and/or $NaNO_3$.
Balance, water.

By varying the formula within the above stated limits and by the selection of appropriate cations or cation combinations, liquid washing, cleaning and rinsing agents can be manufactured which contain all their components in solution or in stable suspension.

The following non-limiting examples are given as certain preferred embodiments of the invention and are

not to be construed as narowing the novel and inventive method (etc.) of applicant.

Examples

For the production of the liquid and paste wash-active substance concentrates described in the examples, the individual components were combined in the form of their technical crude products, either as aqueous pastes or as dry products, in the percentage composition (percentages by weight) stated in each case; they were then adjusted with water to the desired concentration and completely dissolved by heating. The clear solutions were poured into sealed containers and then stored for about three to four weeks. The concentrates thus obtained exhibit structural viscosity; the viscosity changes during the storage, the change diminishing in the course of time, becoming negligible after three to four weeks of storage. The change in viscosity is often accompanied by the formation of turbidity, segregation, inhomogeneities, etc., which also come practically to a stop after three to four weeks. Where such turbidity, segregation or inhomogeneities had settled to the bottom, they were stirred up prior to measuring the viscosity.

The absolute values of the viscosities of the wash-active substance concentrate depend more or less on the structure and composition of the starting products used for their manufacture; for example, the salt content of the technical wash-active substances has an influence. For this reason, precise comparisons of viscosities are possible only in the case of products which have been made from the same starting materials and have been treated in the same manner. In the tables below, such comparison is possible only in the case of product having the same example number. The variations in the absolute values of the viscosities which will be observed on account of these circumstances are, nevertheless, slight in comparison to the viscosity reduction achieved according to the invention.

Unless otherwise expressly stated in the following tables, the product designated as "TPS" is a technical alkylbenzenesulfonate made from tetrapropylene, while "ABS" stands for a straight-chained alkylbenzenesulfonate with 11 to 13 carbon atoms in the alkyl radical (percentage of C_{12} alkyl approximately 75%). "FAS" is a fatty alcohol sulfate made from a fatty alcohol produced by reduction of the C_{12} to C_{18} fraction of coconut fatty acid. The toal WAS substances were in the form of sodium salts, and the sulfofatty acid salts were in the form of disalts. The sulfofatty acid salts are identified by the chain length of the fatty acids or a statement of their origin, followed by the suffix "/Di." Accordingly, "10/Di" stands for the salt of sulfonated C_{10} fatty acid, while "HPK/Di" represents the salt of a sulfonated fatty acid made from hydrogenated palm kernel oil. This system applies in like manner to the ester salts, in which case the number after the diagonal gives the chain length of the alcohol. Accordingly, "10/10" stands for the sulfonate made from C_{10}-fatty acid C_{10}-fatty alcohol ester. In the same way, "HSt/1" stands for the sulfonate made from hydrostearing methyl ester. The hydrogenated palm kernel fatty acid had approximately the following composition:

	Approx. Percent
Lauric acid	58
Myristic acid	20
Palmitic acid	9
Stearic acid	13

For comparative purposes, the viscosities of TPS pastes of various concentrations are given below:

TABLE A. VISCOSITIES OF THE AQUEOUS PASTES AND SOLUTION OF TPS WHICH WERE USED IN MAKING THE WAS CONCENTRATES

Percent TPS	Viscosity, cp.	Percent TPS	Viscosity, cp.
30	2,430	15	54
25	950	10	4.2
20	670	5	1.4

The viscosities of the TPS pastes given in the above Table A are averages of the viscosities which were measured on the various TPS batches used for the production of the preparations described in the examples.

The viscosities of pastes containing 20 and 25% ABS amounted to 239 and 2340 cp., respectively. The viscosities of pastes containing 11% TPS and 9% FAS, and of a paste containing 20% ABS and 5% FAS, amounted to 6060 and 2690 cp., respectively.

The above-stated viscosities of the other pastes are the viscosities of those preparations from which the products of Examples 8 to 11 were made.

TABLE I

	WAS combination		Viscosities in cp.
	Substance	Wt. Percent	
Example No.:			
1a	TPS	5	22.4
	HPK/2	20	
1b	TPS	5	4.9
	HPK/2	15	
	12+14/Di	3.9	
	16+18/Di	1.1	
2a	TPS	10	776
	HPK/2	15	
2b	TPS	10	33.3
	HPK/2	10	
	12+14/Di	3.9	
	16+18/Di	1.1	
2c	TPS	10	105
	HPK/2	5	
	12+14/Di	7.8	
	16+18/Di	2.2	
3a	TPS	15	1,110
	HPK/2	10	
3b	TPS	15	602
	HPK/2	5	
	12+14/Di	3.9	
	16+18/Di	1.1	
4a	TPS	25	535
	10/1	5	
	10/Di	5	
4b	TPS	25	123
	10/10	5	
	10/Di	5	

TABLE II

	WAS combination		Viscosities in cp.
	Substance	Wt. Percent	
Example No.:			
5	TPS	30	436
	12+14/Di	3.9	
	16+18/Di	1.1	
6a	TPS	20	402
	12+14/Di	3.9	
	16+18/Di	1.1	
6b	TPS	20	490
	HPK/2	2.5	
	12+14/Di	1.95	
	16+18/Di	0.55	
6c	TPS	20	705
	HPK/1	2.5	
	12+14/Di	1.95	
	16+18/Di	0.55	
6d	TPS	20	930
	HPK/2	5	
	12+14/Di	3.9	
	16+18/Di	1.1	
7a	TPS	25	426
	12+14/Di	3.9	
	16+18/Di	1.1	
7b	TPS	25	163
	HPK/1	2.5	
	12+14/Di	1.95	
	16+18/Di	0.55	
8a	TPS	11	70
	FAS	9	
	12+14/Di	3.9	
	16+18/Di	1.1	
8b	TPS	11	2,560
	FAS	9	
	HPK/1	2.5	
	12+14/Di	1.95	
	16+18/Di	0.55	

TABLE III

	WAS combination		Viscosities in cp.
	Substance	Wt. Percent	
Example No.:			
9a	ABS	20	60
	12+14/Di	2.4	
	16+18/Di	2.6	
9b	ABS	20	120
	12+14/Di	2.0	
	16+18/Di	3.0	
9c	ABS	20	250
	12+14/Di	1.15	
	16+18/Di	3.35	
10a	ABS	20	97
	HSt/1	1	
	HPK/1	1.5	
	12+14/Di	1.2	
	16+18/Di	1.3	
10b	ABS	20	90
	HSt/1	1.25	
	HPK/1	1.25	
	12+14/Di	1.0	
	16+18/Di	1.5	
10c	ABS	20	97
	HSt/1	1.5	
	HPK/1	1	
	12+14/Di	0.8	
	16+18/Di	1.7	
11a	ABS	20	2,060
	FAS	5	
	12+14/Di	1.15	
	16+18/Di	3.35	
11b	ABS	20	2,150
	FAS	5	
	HSt/1	1.5	
	HPK/1	1	
	12+14/Di	0.8	
	16+18/Di	1.7	

Examples 12 and 13

To show the influence of the presence of dissolved salts in the paste, pastes were prepared with the compositions stated below in Tables IV and V and the viscosities of the pastes were measured.

TABLE IV.—VISCOSITIES OF THE AQUEOUS PASTES AND SOLUTIONS OF TPS AND TPS-FAS MIXTURES WHICH WERE USED TO PREPARE THE WAS CONCENTRATES ARE AS FOLLOWS:

	WAS combination		Viscosities in cp.
	Substance	Wt. Percent	
Example No.:			
12a	TPS	15	400
	$NaNO_3$	5	
12b	TPS	20	1,050
	$NaNO_3$	5	
12c	TPS	11	4,750
	FAS	9	
	$NaNO_3$	5	
12d	TPS	15	100
	$NaNO_3$	5	
	12+14/Di	3.9	
	16+18/Di	1.1	
12e	TPS	15	17
	$NaNO_3$	5	
	HPK/1	2.5	
	12+14/Di	1.95	
	16+18/Di	0.55	

TABLE V

	WAS combination		Viscosities in cp.
	Substance	Wt. Percent	
Example No.:			
13a	TPS	13.75	5,250
	FAS	11.25	
	$NaNO_3$	5	
13b	TPS	11	300
	FAS	9	
	$NaNO_3$	5	
	12+14/Di	3.9	
	16+18/Di	1.1	

Thus, there has been disclosed and described a novel method and composition for reducing the viscosity of liquid or paste wash-active substance combinations comprising alkylbenzenesulfonates, wash-active substances and 10 to 14 carbon atom disalts, whereby the disalts reduce the viscosity of the composition. These compositions find utility as cleaners and in any other applications, where wash-active substances are employed.

Although the invention has been described with reference to certain preferred embodiments, it is not the intention of the applicant to be limited thereby and certain obvious modifications of the novel composition of matter, method, etc. are intended to be included within the broad scope of the invention as embodied in the following claims.

What is claimed is:

1. Wash-active aqueous concentrate having a liquid to pasty consistency which consists essentially of

(a) 5–45% of wash-active substances constituting a mixture of surface-active alkylbenzenesulfonates having 8–18 carbon atoms in the alkyl moiety and α-sulfofatty acid salt having 10–14 carbon atoms in the fatty acid radical, in which said α-sulfofatty acid salt is present in an amount of about 2.5–50% of said mixture; and

(b) 95–55% of water.

2. Concentrate according to claim 1 wherein said mixture includes, as further wash-active substances, α-sulfonated fatty acid aliphatic ester salts having 8–24 carbon atoms in the corresponding α-sulfofatty acid radicals and 1–12 carbon atoms in the corresponding aliphatic ester radicals, said ester salts constituting 5–80% of the combined content of such ester salts and said alkylbenzenesulfonate and said α-sulfofatty acid salts constituting about 2.5–50% of the total wash active substances present.

3. Concentrate according to claim 2 wherein said ester salts have 12–18 carbon atoms in the corresponding fatty acid radicals and constitute about 10–60% of the combined content of such ester salts and said alkylbenzenesulfonate, and said α-sulfofatty acid salt constitutes about 10–50% of the total of said alkylbenzenesulfonate and said ester salt wash-active substances present.

4. Concentrate according to claim 1 wherein a mixture of α-sulfofatty acid salts having 10–14 carbon atoms in the fatty acid radicals is present.

5. Concentrate according to claim 1 wherein a mixture of a α-sulfofatty acid salts having 12–18 carbon atoms in the fatty acid radicals is present, at least 50% of said α-sulfofatty acid salts having 12–14 carbon atoms in the fatty acid radicals and such content of α-sulfofatty acid salts having 12–14 carbon atoms constituting about 2.5–50% of the mixture thereof with said alkylbenzenesulfonate.

6. Concentrate according to claim 1 wherein said alkylbenzenesulfonate has 10–15 carbon atoms in the alkyl moiety.

7. Concentrate according to claim 1 wherein at least one supplemental washing and cleansing substance is present which is selected from the group consisting of neutrally reacting inorganic salts selected from the group consisting of alkali metal sulfates, chlorides, nitrates and mixtures of such salts, alkali carbonates, alkali metal phosphates, alkali silicates, organic chelate formers, foam stabilizers, dirt carriers, and 1–20% by weight of water-soluble organic solvents for said wash-active concentrate based on the water present.

8. Method of improving the viscosity of a wash-active aqueous concentrate having a liquid to pasty consistency and consisting essentially of surface-active alkylbenzenesulfonates having 8–18 carbon atoms in the alkyl moiety, which comprises admixing such concentrate with α-sulfofatty acid salt having 10–14 carbon atoms in the fatty acid radical, in a quantity sufficient to provide a resulting wash-active mixture in which the α-sulfofatty acid salt is present in an amount of about 2.5–50% of said mixture, and in which the improved viscosity concentrate consists essentially of 5–45% of such wash-active mixture and 95–55% of water, with heating of at least one of the mixture components to dissolve at least some of the resulting mass in the water present.

9. Method according to claim 8 wherein said mixture includes, as further wash-active substances, α-sulfonated fatty acid aliphatic ester salts having 8–24 carbon atoms in the corresponding α-sulfofatty acid radicals and 1–12 carbon atoms in the corresponding aliphatic ester radicals,

said ester salts constituting 5–80% of the combined content of such ester salts and said alkylbenzenesulfonate, and said α-sulfofatty acid salt constituting about 2.5–50% of the total wash-active substances present, and wherein the resulting improved viscosity concentrate is thereafter recovered.

10. Method according to claim 8 wherein a mixture of α-disulfofatty acid salts having 10–14 carbon atoms in the fatty acid radicals is present.

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