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54 **Tablet detergent composition.**

57 A tablet type detergent composition which comprises a nonionic surface active agent having specified range of HLB value, as a main surface active agent, and potassium carbonate which is blended with the nonionic surface active agent at a specified weight ratio.

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FIELD OF THE INVENTION

This invention relates to a tablet detergent which has improved solubility and is especially suitable for use in cleaning of clothing in electric washing machines.

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BACKGROUND OF THE INVENTION

Conventionally used detergents are divided into two main classes, liquid type and granule type. However, many attempts have been reported on the development of tablet detergents with the aim of improving handling convenience such as easy carrying and convenient storage.

Most of such tablet detergents are prepared by blending an anionic surface active agent as the main washing surface active agent, but several tablet detergents in which a nonionic surface active agent is used as the main washing surface active agent have been disclosed, for instance, in U.S. Patent 3,231,506, U.S. Patent 3,247,123, U.S. Patent 3,331,780, U.S. Patent 3,344,076, U.S. Patent 3,417,024, U.S. Patent 4,370,250 and U.S. Patent 4,451,386. A tablet detergent in which a nonionic surface active agent is used as the main washing agent and an oil absorbent builder is blended with the washing agent and has been disclosed in JP-A-63-135498 (the term "JP-A" as used herein means an "unexamined published Japanese patent application").

These tablet detergents have the advantage of easy use in comparison with the aforementioned liquid and granule detergents. On the other hand, however, they are required to have certain specific properties such as a mechanical strength sufficient enough to protect the tablets from crumbling during handling and transportation, quick solubilization at the time of their use and the like. The strength of tablets can be improved by increasing the molding pressure used to form the tablets, but this generally results in the disadvantage of decreasing their solubility in water.

In order to overcome such disadvantages, a number of processes have been proposed such as a process where a decomposable or volatile material is mixed with a washing agent and molded into tablets followed by heat treatment to make the tables porous. JP-A-62-30198 discloses a process in which a carbonate and a solid acid are blended with a washing agent so that the resulting tablets quickly dissolve in water when used to generate carbon dioxide. Also, each of JP-B-44-17745 and JP-A-47-27208 discloses a process in which a disintegrator as is commonly used in the field of pharmaceuticals is added to a detergent composition in such a way that the resulting tablets are easily disintegrated in water. (The term "JP-B" as used herein means an "examined Japanese patent publication")

The solubility of tablet detergents in water can be improved to some degree by any of these prior art processes, but not to a practically satisfactory level. It seems that in the case of tablets containing a large quantity of a surface active agent as a detergent, the surface active agent becomes highly viscous in water due to hydration thereof and this hinders the permeation of water into the tablets, thus resulting in insufficient solubilization of the tablets.

SUMMARY OF THE INVENTION

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With the object of overcoming the aforementioned problems involved in the prior art, the inventors of the present invention conducted intensive research and found that a tablet detergent having markedly improved solubility can be obtained by using a specific nonionic surface active agent as the main surface active agent and by blending it with potassium carbonate at a specified weight ratio. The present invention was researched has as a result of such research.

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Therefore, in accordance with an embodiment of the present invention, there is provided a tablet detergent which comprises a nonionic surface active agent as the main surface active agent and potassium carbonate, wherein the nonionic surface active agent has an HLB value of from 8.0 to 16.0, and a weight ratio of potassium carbonate to the nonionic surface active agent ranges from 5/1 to 1/5.

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The present invention further provides, as another embodiment of the invention, a tablet detergent composition comprising the following components (1) to (4):

- (1) from 5 to 40 % by weight of a nonionic surface active agent having an HLB value of from 8.0 to 16.0;
- (2) from 5 to 30 % by weight of potassium carbonate;
- (3) from 5 to 25 % by weight of a porous oil absorbent carrier; and
- (4) from 10 to 60 % by weight of a crystalline aluminosilicate.

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DETAILED DESCRIPTION OF THE INVENTION

The nonionic surface active agent used in the present invention has an HLB value of from 8.0 to 16.0, preferably from 8.2 to 14.0. Nonionic surface active agents having an HLB value (hydrophilic-lipophilic balance; defined by J.T. Davies and E.K. Rideal, Interfacial Phenomena, p371-383 (1963) Academic Press, New York) outside of this range are disadvantageous in terms of detergency of the resulting detergent composition.

The a nonionic surface active agent to be used in the present invention may be selected from those containing an alkyl group having 8 to 18 carbon atoms and/or having a mean added ethylene oxide mol number per one molecule of from 4 to 8 and/or having a mean added propylene oxide mol number per one molecule of from 2 to 8. Illustrative examples of such nonionic surface active agents include a polyoxyethylene alkyl ether, a polyoxyethylene alkylphenyl ether, a polyoxyethylenesorbitan fatty acid ester, a polyoxyethylenesorbitol fatty acid ester, a polyethylene glycol fatty acid ester, a polyoxyethylene polyoxypropylene alkyl ether, a polyoxyethylene castor oil, a polyoxyethylene hydrogenated castor oil, a polyoxyethylene alkyl amine, a glycerol fatty acid ester, a higher fatty acid alkanol amide, an alkyl glucoside, an alkylamine oxide and the like.

As the main surface active agent component, i.e., the nonionic surface active agent, a polyoxyethylene alkyl ether consisting of a straight or branched primary or secondary monohydric alcohol having 12 to 18 carbon atoms and ethylene oxide molecules with a mean added mol number of from 4 to 18 is preferably used, with a preferred example being a polyoxyethylene dodecyl ether having a mean added ethylene oxide mol number of 8.

The nonionic surface active agent may be used in the tablet detergent composition of the present invention in an amount of from 5 to 40% by weight, preferably from 10 to 30% by weight based on the total weight of the composition.

Potassium carbonate may be used in an amount as to give a weight ratio of potassium carbonate to the nonionic surface active agent of from 5/1 to 1/5, preferably from 3/1 to 1/3. If the weight ratio of potassium carbonate to nonionic surface active agent is less than 1/5 no significant solubility improving effect is encountered.

Potassium carbonate may be used in the tablet detergent composition in an amount of from 1 to 40% by weight, preferably from 5 to 30% by weight, based on the total weight of the composition. In the tablet detergent composition of the present invention, the nonionic surface active agent and potassium carbonate may preferably be used in the detergent composition in a total amount of from 20 to 50% by weight based on the total weight of the composition.

Sodium carbonate may preferably be used in combination with potassium carbonate. In this instance, sodium carbonate is used in an amount to give a weight ratio of sodium carbonate to potassium carbonate of from 1/100 to 10/1, preferably from 1/20 to 3/1, and a total amount of sodium carbonate and potassium carbonate of from 10 to 40 % by weight based on the total weight of the composition.

Preferably, the tablet detergent composition of the present invention may be further mixed with a crystalline aluminosilicate (zeolite). As such a crystalline aluminosilicate, synthetic zeolites having a mean primary particle size of from 0.1 to 10 μm as typically exemplified by a type A zeolite and a type X zeolite are preferred. A crystalline aluminosilicate (or zeolite) is used in the form of zeolite powder or as aggregated and dried zeolite particles obtained by drying a zeolite slurry, and it may be used in the detergent composition of the present invention in an amount of from 10 to 60% by weight, preferably from 20 to 50% by weight, based on the total weight of the composition.

Oozing of nonionic surface active agent through the tablet detergent of the present invention can be prevented by adding a porous oil absorbent carrier to the detergent composition. In this instance, the porous oil absorbent carrier may have a pore volume in the range of from 50 to 700 $\text{cm}^3/100 \text{ g}$ as measured in the high pressure mercury porosimeter measurement as described in Barrett, E.P., Joyner, L.G. and Halenda, P.P., J. Am. Chem. Soc., 73, p373 (1951), and a mean particle diameter in the range of from 5 to 200 μm , preferably from 10 to 100 μm . Preferred examples of the porous oil absorbent carrier are oil absorbing amorphous silica carriers, especially a carrier which contains 30% by weight or more of the amorphous silica (anhydrous basis) based on the total weight of the carrier.

Illustrative examples of such porous oil absorbent carriers include TOKUSIL AL-1 (pore volume: 280 $\text{cm}^3/100 \text{ g}$; SiO_2 content: 94 % by weight), TOKUSIL NR (pore volume: 300 $\text{cm}^3/100 \text{ g}$; SiO_2 content: 94 % by weight) and Florite RN (pore volume: 450 $\text{cm}^3/100 \text{ g}$; SiO_2 content: 61 % by weight) (all trade names of Tokuyama Soda Co., Ltd.), Nipsil NA (trade name of Nippon Silica Co., Ltd.) (pore volume: 265 $\text{cm}^3/100 \text{ g}$; SiO_2 content: 93 % by weight), Tixolex 25 (pore volume: 245 $\text{cm}^3/100 \text{ g}$; SiO_2 content: 72 % by weight) and Tixosil 38 (pore volume: 300 $\text{cm}^3/100 \text{ g}$; SiO_2 content: 90 % by weight) (trade names of Rhone-Poulenc),

Carplex #100 (trade name of Shionogi & Co., Ltd.) (pore volume: 240 cm³/100 g; SiO₂ content: 93 % by weight), SIPERNAT D10 (pore volume: 250 cm³/100 g; SiO₂ content: 98 % by weight) and the like. The porous oil absorbent carrier may be used in the absorbent composition in an amount of from 2 to 25% by weight, preferably from 3 to 15% by weight.

5 The shelf life of the tablets of the present invention can be improved by further blending the detergent composition of the present invention with polyethylene glycol having a molecular weight of 2,000 to 30,000 in an amount of from 0.5 to 10% by weight, preferably from 1 to 7% by weight.

According to one embodiment of the present invention, muddy stain detergency of the tablet detergent composition can be improved by jointly using thereinto an ionic surface active agent. Examples of the ionic surface active agent suitable for use in the present invention include: anionic surface active agents such as an alkylbenzenesulfonate salt, an olefin sulfonate salt, an alkyl ether sulfate salt, a fatty acid salt, an α -sulfo fatty acid ester salt, an α -sulfo-fatty acid salt and the like, with preferred counter ions therefor being sodium and potassium; ampholytic surface active agents such as sulfobetaine, hydroxysulfobetaine and the like; and cationic surface active agents such as a quaternary ammonium salt and the like.

15 Among the ionic surface active agents, anionic surface active agents are preferred, and, in particular, a sodium salt or a potassium salt of an alkylbenzenesulfonate, a fatty acid or an alkyl ether sulfate each of which the alkyl group contains 8 to 20 carbon atoms are preferred, and those of which the alkyl group contains 12 to 18 carbon atoms are more preferred.

However, since these ionic surface active agents, including anionic, ampholytic and cationic surface active agents, have the effect of the decreasing solubility of the tablets, the ionic surface active agent may be used in an amount of 0 to 50% by weight, preferably 0 to 30% by weight or less, based on the weight of the nonionic surface active agent.

For the purpose of enhancing detergency, the tablet detergent of the present invention may be further mixed with divalent metal ion scavengers. Examples of such scavengers include sodium nitrilotriacetates, sodium ethylenediaminetetraacetates, sodium succinates, sodium malates, sodium citrates, and water soluble salt (e.g., sodium) of carboxylic acid-based polymers such as polymers of polyacrylic acid, of acrylic acid/maleic anhydride copolymers and of olefin/maleic anhydride copolymers. Especially, the combined use of a carboxylic acid based polymer can exhibit desirable effects. The divalent metal ion scavengers may preferably be used in the tablet detergent of the present invention in a total amount of from 10 to 60% by weight based on the total weight of the composition.

25 The tablet detergent of the present invention may be mixed further with other additives which have been conventionally used in prior art detergents. Examples of these additive components include: alkali compounds such as sodium bicarbonate, potassium bicarbonate, sodium silicate and the like; extending agents such as sodium sulfate, potassium sulfate and the like; resoiling preventing agents such as carboxymethyl cellulose; bleaching agents such as sodium percarbonate, mono- or tetrahydrate of sodium perborate and the like; enzymes such as a protease, a lipase, a cellulase, an amylase and the like; enzyme stabilizers such as sodium sulfite; and other additives such as an antioxidant, a fluorescent dye, a perfume and the like. Also useful as additives are disintegrators which are commonly used in prior art tablet detergents, such as, for instance, starch, hydroxypropyl starch, carboxymethyl cellulose, hydroxypropyl cellulose, crystalline cellulose, α -cellulose, carboxymethyl starch and the like.

Though processes for the production of the tablet detergent composition according to the embodiment of the present invention are not strictly limited, the inventive tablet detergent may easily be obtained, for example, by charging a batch kneader with predetermined amounts of potassium carbonate and other powder components (a crystalline aluminosilicate (e.g., type A zeolite), an oil absorbent carrier (e.g., TOKUSIL NR), and polyethylene glycol (e.g., polyethylene glycol having a molecular weight of 15,000), uniformly mixing these ingredients with gradually added or sprayed liquid nonionic surface active agent (e.g., polyoxyethylene dodecyl ether (the mean added ethylene oxide mol number of 8, the melting point of 15 °C and the HLB value of 10.14)) in the kneader, transferring the thus uniformly mixed components into a cylindrical vessel, and subsequently molding the mixture into tablets by loading a pressure of 10 to 150 kg/cm² from both the upper and lower parts of the cylindrical vessel onto the mixed components.

50 Examples of the present invention are given below to describe the present invention in detail by way of illustration and not by way of limitation.

EXAMPLE 1

Based on the formulations shown in Table 1, powder components for each composition were uniformly mixed and the resulting mixture was subjected to melt kneading with the indicated respective amount of a nonionic surface active agent. A 15 g portion of the composition thus melt kneaded was transferred into a cylinder having an inner diameter of 25 mm and molded at a pressure of 100 kg/cm² for 1 minute to form a tablet detergent.

Solubility evaluation

The tablet detergent thus prepared was put into a double bucket type electric washer (GINGA 3.0 VH-300S1, by Toshiba Corp.) which had been filled with 30 ℓ of 20 °C tap water. Immediately thereafter, the washer was operated for 1 minute by setting its agitation power to "normal" as indicated on its control panel. After draining off the resulting tap water, the solubility of the tablet detergent was evaluated based on the amount of its residue in the wash bucket using the following criteria.

A: no residue (completely dissolved)

B: some particles (no evidence of original tablet shape due to crumbling but with some residual particles of 2 to 5 mm in size)

C: half solubilized (about half of the tablet remained without crumbling)

D: no changes in original shape

Results of the evaluation are shown in Table 1.

Table 1

Component *2)	Products No.										
	1*1)	2	3	4*1)	5	6	7	8	9	10*1)	11
Nonionic surface active agent *3)	20	5	15	15	15	15	15	20	20	5	25
Potassium carbonate	0	20	15	2	5	15	30	20	20	0	10
Ionic surface active agent *4)	0	0	0	0	0	0	0	0	10	40	0
Type 4A zeolite	35	35	35	35	35	35	35	35	35	35	60
Sodium carbonate	10	10	10	10	10	10	10	10	10	10	0
Sodium sulfate	balance	balance	balance	balance	balance	balance	balance	balance	balance	balance	balance
Sodium polyacrylate *5)	1	1	1	1	1	1	1	1	1	1	1
Polyethylene glycol *6)	1	1	1	1	1	1	1	1	1	1	1
Total	100	100	100	100	100	100	100	100	100	100	100
<u>Solubility</u>	D	A	A	D	A	A	A	A	B	D	A

- Notes; *1) Nos. 1, 4 and 10 represent Comparative Examples.
- 5 *2): All values indicated in Table 1 are % by weight.
- 10 *3): Nonionic surface active agent; a primary straight-chain alcohol having 12 to 16 carbon atoms with added ethylene oxide mol numbers of 4 to 10 (8 in average) and having a melting point of 22°C and an HLB value of 12.8.
- 15 *4): Ionic active agent; sodium straight-chain alkylbenzenesulfonate having 14 carbon atoms on the average.
- 20 *5): Average molecular weight: 5,000
- *6): Average molecular weight: 20,000

EXAMPLE 2

25 Based on the formulations shown in Table 2, powder components for each composition were uniformly mixed and the resulting mixture was subjected to melt kneading with the indicated respective amounts of nonionic surface active agent. A 25 g portion of each composition thus melt kneaded was transferred into a cylinder having an inner diameter of 40 mm and molded at a pressure of 100 kg/cm² to form a tablet detergent.

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Solubility evaluation

The tablet detergent thus prepared was put into a double bucket type electric washer (GINGA 3.0 VH-300S1, by Toshiba Corp.) which had been filled with 30 l of 20°C tap water and charged with 1.5 kg of towels as test clothing to be washed. Immediately thereafter, the washer was operated for 3 minutes by setting its agitation power to "normal" as indicated on its control panel. After draining off the resulting tap water, the solubility of the tablet detergent was evaluated based on its residue in the wash bucket and on the towels using the following criteria, with the results being shown in Table 2.

35 1: residue of detergent not detectable

40 2: residue of detergent detected

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TABLE 2

Component ^{*1)}	Product the Invention							Comparative Product	
	1	2	3	4	5	6	7	8	9
Nonionic surface active agent ^{*2)}	20	20	20	20	30	10	35	15	20
Type 4A Zeolite	20	20	20	20	20	20	15	10	20
Oil absorbent carrier ^{*3)}	10	10	10	10	10	5	10	3	20
Sodium carbonate	1	10	5	5	5	0	0	20	20
Potassium carbonate	19	10	15	15	15	20	15	0	0
Ionic active agent ^{*4)}	0	0	0	3	9	0	1	3	0
Polyethylene glycol ^{*5)}	1	1	1	1	1	3	5	1	1
Sodium polyacrylate ^{*6)}	2	2	2	2	2	2	2	2	2
Sodium sulfate	balance	balance	balance	balance	balance	balance	balance	balance	balance
Total	100	100	100	100	100	100	100	100	100
Solubility	1	1	1	1	1	1	1	2	2

Notes; *1): All values indicated in Table 2 except for the solubility are % by weight.

*2): Nonionic surface active agent: a polyoxyethylene dodecyl ether (mean added ethyleneoxide mol number: 8; melting point: 15°C; HLB value: 10.14)

*3): Oil absorbent carrier: Tokusil NR manufactured by Tokuyama Soda Co., ltd. (pore value: 309 cm³/100 g; SiO₂ content: 100%)

*4): Ionic surface active agent: sodium straight-chain alkyl-sulfate having 14.3 carbon atoms on the average

*5): Polyethylene glycol (molecular weight: 6,000)

*6): Average molecular weight: 5,000

While the invention has been described in detail and with reference to specific examples thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

Claims

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1. A tablet detergent composition which comprises a nonionic surface active agent and potassium carbonate, wherein said nonionic surface active agent has an HLB value of from 8.0 to 16.0 and a weight ratio of potassium carbonate to said nonionic surface active agent ranges from 5/1 to 1/5.
- 10
2. A tablet detergent composition according to claim 1, wherein said nonionic surface active agent is used in an amount of from 5 to 40% by weight.
3. A tablet detergent composition of claim 1, wherein said nonionic surface active agent is a polyoxyethylene alkyl ether.
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4. A tablet detergent composition of claim 2, wherein said nonionic surface active agent is a polyoxyethylene alkyl ether.
- 20
5. A tablet detergent composition comprising the following components (1) to (4):
(1) from 5 to 40 % by weight of a nonionic surface active agent having an HLB value of from 8.0 to 16.0;
(2) from 5 to 30 % by weight of potassium carbonate;
(3) from 5 to 25 % by weight of a porous oil absorbent carrier; and
(4) from 10 to 60 % by weight of a crystalline aluminosilicate.
- 25
6. A tablet detergent composition of claim 5, wherein said composition further comprises sodium carbonate in an amount to give a weight ratio of sodium carbonate to potassium carbonate of from 1/100 to 10/1 and a total weight of sodium carbonate and potassium carbonate of from 10 to 40 % by weight.
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7. A tablet detergent composition of claim 5, wherein said composition further comprises from 0.5 to 10 % by weight of polyethylene glycol having a molecular weight of from 2,000 to 30,000.
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8. A tablet detergent composition of claim 6, wherein said composition further comprises from 0.5 to 10 % by weight of polyethylene glycol having a molecular weight of from 2,000 to 30,000.
- 40
9. A tablet detergent composition of claim 5, wherein said composition further comprises an ionic surface active agent in an amount of from 0 to 50 % by weight based on the weight of said nonionic surface active agent.
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10. A tablet detergent composition of claim 6, wherein said composition further comprises an ionic surface active agent in an amount of from 0 to 50 % by weight based on the weight of said nonionic surface active agent.
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11. A tablet detergent composition of claim 8, wherein said composition further comprises an ionic surface active agent in an amount of from 0 to 50 % by weight based on the weight of said nonionic surface active agent.
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DOCUMENTS CONSIDERED TO BE RELEVANT			EP 91118137.8
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	<p><u>EP - A - 0 016 567</u> (UNILEVER NV)</p> <p>* Page 1, lines 1-3; page 3, lines 4-12; page 5, lines 1-2; page 6, line 24 - page 7, line 12 *</p> <p>-----</p>	1, 2, 3, 4	<p>C 11 D 3/10 C 11 D 17/06 C 11 D 1/72</p>
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			C 11 D
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 22-01-1992	Examiner SEIRAFI
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>		<p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>----- & : member of the same patent family, corresponding document</p>	