FORM 1

COMMONWEALTH OF AUSTRALIA 611541

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

I\We,

UNILEVER PLC

of UNILEVER HOUSE
BLACKFRIARS
LONDON EC4
ENGLAND

hereby apply for the grant of a standard patent for an invention entitled:

LIQUID DETERGENT COMPOSITION

which is described in the accompanying complete specification

Details of basic application(s):

| Number of basic application | Name of Convention country in which basic application was filed | Date of basic application |
|---|---|---|
| 8806701 | GB | 21 MAR 88 |
| 8823803 | GB | 11 OCT 88 |

My/our address for service is care of GRIFFITH HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 17th day of March 1989

UNILEVER PLC

GRIFFITH HACK & CO.

TO: The Commissioner of Patents.

Australia Patent Declaration Form

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of applicant(s)

In support of the application made by UNILEVER PLC

Title

for a patent for an invention entitled LIQUID DETERGENT COMPOSITION

Name(s) and address(es) of person(s) making declaration

I/~~we~~, DILSHAD RAJAN of unilever House, Blackfriars, London EC4P 4BQ, England

do solemnly and sincerely declare as follows:-

1. I am/~~we are the applicant(s) for the patent, or any/are~~ authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in Great Britain on 21 March 1988
by Unilever Plc
in Great Britain on 11 October 1988
by Unilever plc

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are

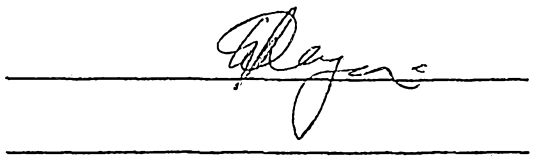
David Alan REED, 41 Heathbank Avenue, Irby, Wirral, Merseyside L61 4XD, England

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

The said applicant is the assignee of the said actual inventors.

DECLARED at London, England this 3rd day of March 1989



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(71) Applicant(s)

UNILEVER PLC

(72) Inventor(s)

DAVID ALAN REED

(74) Attorney or Agent
GRIFFITH HACK & CO, GPO Box 1285K, MELBOURNE VIC 3001

(57) In our search for an alternative abrasive having water solubility and abrasive properties similar to sodium bicarbonate, but without the undesirable properties associated with such products, a large number of materials were examined.

Eventually it was discovered that potassium sulphate possessed the requisite abrasive properties and water solubility, and also it could be formulated into stable products having a neutral or slightly acid pH, which surprisingly possessed none of the unpleasant and unacceptable feel characteristics associated with similar product containing sodium bicarbonate.

CLAIM

1. A pourable, homogeneous, abrasive, aqueous detergent composition comprising, in addition to water:

i) 1 to 40% by weight of a detergent active agent;

.../2

ii) 2 to 65% by weight of potassium sulphate present in both a dissolved and an undissolved state, the undissolved part of the potassium sulphate having a mean particle diameter of from 10 - 500 $\mu$m;

iii) optionally 0.5 to 10% by weight of at least one elctrolyte capable of lowering the solubility of the potassium sulphate

the composition having a pH of less than 8, and having an apparent viscosity at 20°C of at least 6500 Pas at a shear rate of $3 \times 10^{-5}$ $sec^{-1}$, and not more than 10 Pas at a shear rate of 21 $sec^{-1}$.

AUSTRALIA

PATENTS ACT 1952

611541

Form 10

COMPLETE SPECIFICATION

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TO BE COMPLETED BY APPLICANT

Name of Applicant:
UNILEVER PLC

Address of Applicant: UNILEVER HOUSE
BLACKFRIARS
LONDON EC4
ENGLAND

Actual Inventor:

Address for Service: GRIFFITH HACK & CO.,
601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:
LIQUID DETERGENT COMPOSITION

The following statement is a full description of this invention including the best method of performing it known to me:-

# LIQUID DETERGENT COMPOSITION

## TECHNICAL FIELD

The invention relates to pourable, homogenous, aqueous liquid detergent compositions, especially compositions containing a water soluble particulate abrasive, which are suitable for the hand washing of dishes, crockery, cutlery and saucepans and also for the cleaning of other hard surfaces such as plastic laminate working surfaces, glass and ceramic tiles.

## BACKGROUND

Liquid detergent compositions for cleaning hard surfaces are generally classified into two types. The first are aqueous suspensions containing water-insoluble palpable abrasive particles: sometimes difficulty can be experienced when rinsing with water a hard surface that has been cleaned with such a composition, because insoluble particles of the abrasive can be difficult to remove completely from the surface. The second are liquid detergent compositions, usually containing soap, nonionics and alkyl benzene sulphonate, but with no palpable abrasive particles.

Liquid detergent compositions of the latter type, although free from the possible problem of scratching in use, nevertheless suffer from a number of drawbacks which can limit their consumer acceptability. They can, for example, have poor cleaning performance on stubborn soil, especially in areas where the water is hard, due to the absence of an abrasive constituent. Also, they can suffer from poor homogeneity and can possess viscosity characteristics which are not ideal for use by the consumer. Moreover, the higher surfactant concentration necessary for in-use removal of grease and fatty soils can lead to excessive suds formation, which requires rinsing and wiping by the user. Although excessive suds production can be controlled to some extent by incorporation of a suds-regulating material such as solvents, hydrophobic silica and/or silicone or soap, this

in itself can raise problems of poor product stability and homogeneity, and problems associated with deposition of insoluble residues on the items or surfaces being cleaned, leading to residual streaks and spots when dried.

It has been proposed in US Patent No. 4 057 506 (Colgate Palmolive Company) to employ in a heavy-duty liquid detergent composition a builder salt such as a water-soluble phosphate, silicate, borate, carbonate, bicarbonate or citrate in a manner such that the composition is substantially devoid of any builder salt in the form of solid particles, the composition being otherwise smooth and creamy. It is however an essential feature of the Colgate Palmolive's composition that any of the builder salt that is present in solid form is of colloidal-size particles having a particle size of <1μ, usually <0.1μ.

It would appear that builder salt particles of this dimension, while possibly functioning as a builder, are too small to function as an abrasive. Such compositions are accordingly ineffective in cleaning heavily soiled hard surfaces as they lack scouring ability.

It has been proposed in GB-A-1370377 to incorporate water-soluble salt in an essentially non-aqueous liquid composition, so that the salt remains undissolved and can act as an abrasive.

It has also been proposed in EP-A-0 193 375 (Unilever) to employ a water-soluble salt such as sodium bicarbonate in the form of undissolved particles having a mean particle diameter of from 10 to 500μm suspended in an aqueous detergent composition which is then suitable for cleaning hard surfaces. The sodium bicarbonate is intended to be of a suitable size to act as an abrasive, yet the composition is characterised by low soil redeposition and little or no propensity to causing streaking or spotting on surfaces washed therewith. This is apparently due to the ability of

residual particles of sodium bicarbonate to dissolve in excess water used to rinse the cleaned surface.

Experience has however shown that although sodium bicarbonate when employed as described in EP-A-O 193 375 performs as an excellent cleaner, the composition usually feels slimy to the touch and accordingly when used in the hand washing of hard surfaces, such as dishes, cutlery and saucepans and the like without the use of gloves, it produces an unpleasant skin feel sensation sufficient to persuade the user to seek an alternative product.

Investigations have now shown that this undesirable property is due to the alkaline pH of the composition of 8.5 or higher, which is unavoidable when sodium bicarbonate is used in an amount sufficient to act as the sole water-soluble abrasive.

In our search for an alternative abrasive having water solubility and abrasive properties similar to sodium bicarbonate, but without the undesirable properties associated with such products, a large number of materials were examined.

Eventually it was discovered that potassium sulphate possessed the requisite abrasive properties and water solubility, and also it could be formulated into stable products having a neutral or slightly acid pH, which surprisingly possessed none of the unpleasant and unacceptable feel characteristics associated with similar product containing sodium bicarbonate.

DEFINITION OF THE INVENTION

Accordingly, the invention provides a pourable, homogeneous, abrasive, aqueous detergent composition,

comprising, in addition to water:

i) 1 to 40% by weight of a detergent active agent;

ii) 2 to 65% by weight of potassium sulphate present in both a dissolved and an undissolved state, the undissolved part of the potassium sulphate having a mean particle diameter of from 10 - 500 $\mu$m;

iii) optionally, 0.5 to 10% by weight of at least one electrolyte capable of lowering the solubility of potassium sulphate,

the composition having a pH value not in excess of pH 8, and an apparent viscosity of 20°C of at least 6500 Pas at a shear rate of $3 \times 10^{-5}$ $sec^{-1}$ and not more than 10 Pas at a shear rate of 21 $sec^{-1}$.

Compositions of this invention possess suitability for hand dishwashing and/or cleaning other hard surfaces. Generally the compositions will be applicable in both ways and are thus dual purpose although not usually optimum for both applications. A composition can be formulated to be principally a hand dishwashing product, in which case it would have a fairly high level of detergent active agent with a low level of abrasive. Alternatively a composition can be formulated to be principally suitable for cleaning fixed hard surfaces and removing stubborn soils, in which case it would have a fairly high level of abrasive with a low level of detergent active agent.

## DISCLOSURE OF THE INVENTION AND EMBODIMENTS THEREOF

### Detergent Active Agent

The composition according to the invention will comprise

detergent active agent. Suitably this is chosen from synthetic anionic detergent active agents, and optionally also nonionic detergent active agents.

Suitable synthetic anionic detergent active agents are water-soluble salts of organic sulphuric reaction products having in the molecular structure an alkyl radical containing from 8 to 22 carbon atoms, and a radical chosen from sulphonic acid or sulphuric acid ester radicals and mixtures thereof. Examples of synthetic anionic detergents are sodium and potassium alkyl sulphates, especially those obtained by sulphating the higher alcohols produced by reducing the glycerides of tallow or coconut oil; sodium and

potassium alkyl benzene sulphonates such as those in which the alkyl group contains from 9 to 15 carbon atoms; sodium alkyl glyceryl ether sulphates, especially those ethers of the higher alcohols derived from tallow and coconut oil; sodium coconut oil fatty acid monoglyceride sulphates; sodium and potassium salts of sulphuric acid esters of the reaction product of one mole of a higher fatty alcohol and from 1 to 6 moles of ethylene oxide; sodium and potassium salts of alkyl phenol ethylene oxide ether sulphate with from 1 to 8 units of ethylene oxide molecule and in which the alkyl radicals contain from 4 to 14 carbon atoms; the reaction product of fatty acids esterified with isethionic acid and neutralised with sodium hydroxide where, for example, the fatty acids are derived from coconut oil and mixtures thereof.

The preferred water-soluble synthetic anionic detergent active agents are the ammonium and substituted ammonium (such as mono, di and triethanolamine), alkaline metal (such as sodium and potassium) and alkaline earth metal (such as calcium and magnesium) salts of higher alkyl benzene sulphonates, higher alkyl sulphonates, higher alkyl alpha-olefin sulphonates, higher alkyl sulphates, higher alkyl ether sulphates and mixtures thereof. Higher alkyl aromatic sulphonates may in particular be higher alkyl benzene sulphonates containing from 6 or 8 to 20 or 22 carbon atoms in the alkyl group in a straight or branched chain.

Particularly preferred mixtures of anionic detergent active agents comprise (i) sodium alkyl benzene sulphonate and sodium lauryl ether sulphate (2EO to 8EO) and (ii) sodium secondary alkyl sulphonate with sodium lauryl ether sulphate.

The amount of synthetic anionic detergent active agent to be employed in the detergent composition of this invention will generally be from 1 to 40%, preferably from 2 to 25%, and most preferably from 2 to 20% by weight.

Suitable nonionic detergent active agents can be broadly described as compounds produced by the condensation of alkylene oxide groups, which are hydrophilic in nature, with an organic hydrophobic compound which may be aliphatic or alkyl aromatic in nature. The length of the hydrophilic or polyoxyalkylene radical which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements.

Particular examples include the condensation product of aliphatic alcohols having from 8 to 22 carbon atoms in either straight or branched chain configuration with ethylene oxide, such as a coconut oil ethylene oxide condensate having from 2 to 15 moles of ethylene oxide per mole of coconut alcohol; condensates of alkylphenols whose alkyl group contains from 6 to 12 carbon atoms with 5 to 25 moles of ethylene oxide per mole of alkylphenol; condensates of the reaction product of ethylenediamine and propylene oxide with ethylene oxide, the condensates containing from 40 to 80% of polyoxyethylene radicals by weight and having a molecular weight of from 5,000 to 11,000; tertiary amine oxides of structure $R_3NO$, where one group R is an alkyl group of 8 to 18 carbon atoms and the others are each methyl, ethyl or hydroxyethyl groups, for instance dimethyldodecylamine oxide; tertiary phosphine oxides of structure $R_3PO$, where one group R is an alkyl group of from 10 to 18 carbon atoms, and the others are each alkyl or hydroxyalkyl groups of 1 to 3 carbon atoms, for instance dimethyldodecylphosphine oxide; and dialkyl sulphoxides of structure $R_2SO$ where the group R is an alkyl group of from 10 to 18 carbon atoms and ther other is methyl or ethyl, for instance methyltetradecyl sulphoxide; fatty acid alkylolamides; alkylene oxide condensates of fatty acid alkylolamides and alkyl mercaptans.

Mixtures of two or more of nonionic detergent active agents can be employed in the detergent composition of the invention.

The amount of nonionic detergent active agents that can optionally be employed in the detergent composition of the invention will generally be from 0.5 to 15%, preferably from 1 to 10%, and most preferably from 1 to 8% by weight.

When both anionic and nonionic detergent active agents are employed, the weight ratio of anionic detergent to nonionic detergent active agents can vary but is preferably in the range of from 1:9 to 9:1, ideally from 1:4 to 4:1.

Preferably, the compositions contain an amount of both the anionic and the nonionic detergent active agents which is chosen so as to provide a structured liquid detergent composition, i.e. one which is 'self' thickened without necessarily employing any thickening agent per se.

According to an embodiment illustrating this aspect of the invention, the detergent compositions will comprise from 2 to 16% by weight of a water-soluble, synthetic anionic sulphated or sulphonated detergent salt containing an alkyl radical having from 8 to 22 carbon atoms in the molecule, and from 0.5 to 4% by weight of an alkyleneoxylated nonionic detergent derived from the condensation of an aliphatic alcohol having from 8 to 22 carbon atoms in the molecule with ethylene oxide, such that the condensate has from 2 to 15 moles of ethylene oxide per mole of aliphatic alcohol.

It is also possible optionally to include amphoteric , cationic or zwitterionic detergent actives in the compositions according to the invention.

Suitable amphoteric detergent-active compounds that optionally can be employed are derivatives of aliphatic secondary and tertiary amines containing an alkyl group of 8 to 18 carbon atoms and an aliphatic radical substituted by an anionic water-solubilising group, for

instance sodium 3-dodecylamineopropionate, sodium 3-dodecylaminopropane sulphonate and sodium N-2-hydroxydodecyl-N-methyltaurate.

Suitable cationic detergent-active agents ~~compounds~~ are quaternary ammonium salts having an aliphatic radical of from 8 to 18 carbon atoms, for instance cetyltrimethyl ammonium bromide.

Suitable zwitterionic detergent-active agents ~~compounds~~ that optionally can be employed are derivatives of aliphatic quaternary ammonium, sulphonium and phosphonium compounds having an aliphatic radical of from 8 to 18 carbon atoms and an aliphatic radical substituted by an anionic water-solubilising group, for instance 3-(N,N-dimethyl-N-hexadecylammonium)propane-1-sulphonate betaine, 3-(dodecylmethyl sulphonium) propane-1-sulphonate betaine and 3-(cetylmethylphosphonium) ethane sulphonate betaine.

Further examples of suitable detergent-active agents ~~compounds~~ are compounds commonly used as surface-active agents given in the well-known textbooks "Surface Active Agents", Volume I by Schwartz and Perry and "Surface Active Agents and Detergents", Volume II by Schwartz, Perry and Berch.

The total amount of detergent active agent ~~compound~~ to be employed in the detergent composition of the invention will generally be from 1 to 40%, preferably from 1.5 to 30%, more preferably 2 to 20 or 25% by weight.

The Water-soluble Salt

The composition according to the invention will also comprise ~~at least one water-soluble salt, namely~~ potassium sulphate, which can function as an abrasive. This water-soluble salt will be present in the composition in an amount in excess of its saturation solubility, and will accordingly be present in both a dissolved and an

undissolved state. The composition will therefore comprise a saturated aqueous solution of potassium sulphate together with from 0.5 to 60% more preferred from 1-50% by weight of the composition at 20°C in the form of a solid phase comprising particles of the salt having a mean particle diameter of from 10 to 500μm preferably from 20 to 300μm, to provide the necessary abrasive properties.

The water-soluble salt potassium sulphate is anhydrous and does not change into any hydrated species when present as a crystalline solid in water at a temperature of from 10°C to 40°C in an amount in excess of that required to form a saturated solution. The saturation solubility of the salt in water at 40°C is less than twice that at 10°C. These properties help to ensure that the characteristics of the product, in particular the size, shape and amount of crystalline abrasive particles, do not change significantly over the normal temperature range of use. Uniformity of performance is accordingly ensured. These properties of potassium sulphate also help to ensure that when the composition is self structured - that is to say the structure which provides the desired viscosity characteristics is derived from an appropriate choice of anionic detergent active(s) or anionic and nonionic detergent actives - it will remain stable without substantial change in viscosity.

The water-soluble salt potassium sulphate has a Mohs hardness of about 3, which provides useful abrasive properties. It has a saturation solubility in water which at 10°C does not exceed 15% by weight, so allowing the presence of undissolved particles at reasonable total inclusion levels.

The salt also has a solubility in water of more than 5 g/l at 10°C, which ensures that any surplus salt can readily be rinsed from a hard surface after cleaning with the composition. In this way, the surface can be free from

residual spots or streaks.

The total amount of the potassium sulphate present in the detergent composition, both in dissolved and undissolved form, will preferably be from 2 to 65%, more preferably from 4 to 55%, and ideally 7 to 50% by weight. Dependent on the specific abrasive level required, from 0.5 to 60%, more preferably from 1-50% by weight of the water-soluble salt should be present in the composition, at normal storage or use temperatures of from 10° to 40°C, in a solid, particulate form, having an average particulate size, and other characteristics, as herein defined.

In addition to potassium sulphate, the composition according to the invention can also optionally comprise electrolytes which are capable of slightly reducing the solubility of potassium sulphate in water, provided that the pH value of the composition does not exceed pH 8. Especially suitable in this respect is the incorporation of alkali metal chlorides, preferably sodium chloride at a level of from 0.5 to 5%, or higher, up to 10%, of the composition. This effects a small reduction of the solubility of potassium sulphate in water, thereby reducing the required amount of potassium sulphate for obtaining an adequate level of undissolved particles, but at the same time does not reduce the solubility of potassium sulphate to below a level of 5 g/litre, thereby ensuring that any surplus salt can readily be removed from a hard surface after cleaning.

The presence of electrolytes, especially sodium chloride, is also advantageous in that the freeze-thaw stability of the product is improved.

Especially advantageous is the incorporation of another electrolyte additionally to the alkali metal chlorides,

this additional electrolyte is preferably an alkali metal citrate such as sodium citrate, which provides the additional benefit of pH regulation.

Water

The composition according to the invention will also comprise water which will generally form from 30 to 89.5% preferably from 40 to 80%, and ideally 45 to 70% by weight of the composition.

Optional Ingredients

The composition according to the invention can contain other ingredients which aid in their cleaning performance, provided that due to the presence of these other ingredients the pH value of the composition does not exceed pH 8. For example, the composition can contain detergent builders such as nitrilotriacetates, polycarboxylates, citrates, dicarboxylic acids, water-soluble phosphates especially polyphosphates, mixtures of ortho- and pyrophosphate and mixtures thereof. Such builders can additionally function as abrasives if present in an amount in excess of their solubility in the overall composition as explained herein. In general, the builder, when employed, preferably will form from 0.1 to 25% by weight of the composition.

Metal ion sequestrants such as ethylenediaminetetraacetates, amino-polyphosphonates (DEQUEST) and phosphates and a wide variety of other poly-functional organic acids and salts, can also optionally be employed.

A further optional ingredient for compositions according to the invention is a suds regulating material, which can be employed in compositions according to the invention which have a tendency to produce excessive suds in use. One example of a suds regulating material is soap. Soaps are salts of fatty acids and include alkali metal soaps such as the sodium, potassium, ammonium and alkanol ammonium salts of higher fatty acids containing from about 8 to about 24 carbon atoms, and preferably from about 10 to about 20 carbon atoms. Particularly useful are the sodium and potassium and mono-, di- and triethanolamine salts of the mixtures of fatty acids derived from coconut oil and ground nut oil. When employed, the amount of soap can from at least 0.005%, preferably 0.5% to 2% by weight of the composition. A further example of a suds regulating material is an organic solvent, hydrophobic silica and a silicone oil or hydrocarbons.

The compositions according to the invention may optionally contain structuring agents to aid in providing appropriate rheological properties to maintain the undissolved salt or salts uniformly distributed in the composition and in enhancing their distribution and adherence of the composition to the hard surface to be cleaned. Preferred structuring agents include polysaccharides, such as sodium carboxymethyl cellulose and other chemically modified cellulose materials, xanthan gum and other non-flocculating structuring agents such as Biopolymer PS87 referred to in US Patent No. 4 329 448. Certain polymers such as a polymer of acrylic acid cross-linked with a poly functional agent,

for example CARBOPOL, can also be used as structuring agents. The amount of such structuring agents, when employed, to be used in compositions according to the invention can be as little as 0.001%, preferably at least 0.01% by weight of the composition.

The compositions according to the invention can also comprise at least partially esterified resin such as an at least partially esterified adduct of rosin and an unsaturated dicarboxylic acid or anhydride, or an at least partially esterified derivatives of co-polymerisation products of mono-unsaturated aliphatic, cycloaliphatic or aromatic monomers having no carboxy groups and unsaturated dicarboxylic acids or anhydrides thereof.

Typical examples of suitable copolymers of the latter type are copolymers of ethylene, styrene, and vinylmethylether with maleic acid, fumaric acid, itaconic acid, citraconic acid and the like and the anhydrides thereof. Preferred are the styrene/maleic anydride copolymers.

In general, the compositions of the invention can optionally comprise from 0.005 to 20%, usually from 0.1 to 15% and preferably from 0.5 to 10% by weight of the at least partially esterified resin.

Compositions according to the invention can also contain, in addition to the ingredients already mentioned, various other optional ingredients such as pH regulants, perfumes, colourants, optical brighteners, soil suspending agents, detersive enzymes, compatible bleaching agents, gel-control agents, freeze-thaw stabilisers, bactericides, preservatives, detergent hydrotropes, opacifiers and solvents.

The compositions according to the invention will not contain more than 10%, preferably not more than 5% by

weight of a water-insoluble abrasive, such as felspar and quartz, in view of the tendency of such abrasives to leave a deposit on hard surfaces after cleaning, even when rinsed with water.

Ideally, compositions according to the invention are substantially free from water-insoluble abrasives.

Generally, the water and optional ingredients comprising other detergent adjuncts will form the balance of the composition, after accounting for the detergent active compound and the water-soluble salt ingredients. Accordingly, the water and optional ingredients can form from 89.5 to 25% by weight of the composition.

pH

It is an important feature of the invention that the compositions are formulated so as to have a pH value which does not exceed 8. Preferably the composition have a pH value of from 5 to 8, ideally about pH 6-7, although pH values of as low as 3 are acceptable.

Suspending Properties

It is an important feature of the invention that the composition will be capable of suspending the undissolved particles of salt abrasive, so that the consumer does not need to agitate the composition, for example by shaking it, in order to re-suspend and re-distribute sedimented particles prior to use. For this purpose, the composition should preferably have an apparent viscosity at 20°C of at least 6500 Pas at a shear rate of $3 \times 10^{-5}$ sec. $^{-1}$ to ensure that the particles of salt abrasive do not sediment on standing at 20°C by more than 1 cm in one month. Ideally, the apparent viscosity at 20°C is at least 25,000 Pas at a shear rate of $3 \times 10^{-5}$ sec. $^{-1}$.

This viscosity value can be determined by application of Stokes Law, with the assumption that the particles of salt abrasive are spherical, and that the above sedimentation rate applies.

While it is necessary to ensure that the composition according to the invention has an apparent viscosity which is high enough to prevent any substantial settlement of the undissolved particles of salt abrasive during storage, it should remain fluid, so that it can readily be poured from a bottle or other container when required for use. For this purpose, the composition should have an apparent viscosity at 20°C, measured using a rotational viscometer which does not exceed 10 Pas at a shear rate of 21 sec. $^{-1}$. Preferably, the apparent viscosity at 20°C is no greater than 5 Pas at a shear rate of 21 $sec^{-1}$.

Suitable rheological conditions to suit these criteria can be provided by judicial choice of anionic and nonionic detergent to provide a structured liquid having the requisite suspending properties, and/or by use of an appropriate amount of an alternative structuring agent such as is described herein.

A preferred method for adapting the viscosity of the composition is by the inclusion of water-soluble polymers into the system, such as for instance described in our co-pending application EP, ~~88-307-007.0~~ -A-301883

Process for Preparation of Compositions

Since the compositions according to the invention are in liquid form, they can be prepared simply by blending the essential and optional ingredients in water.

Packaging and Use of the Compositions

The compositions according to the invention are pourable liquids that are preferably contained in a closable

container for convenience of storage, transport and sale, without spillage.

The compositions are particularly suited to the hand washing of dishes, cutlery, saucepans and other utensils and for cleaning of soiled hard surfaces, such as those to be found in the domestic kitchen and bathrooms. The compositions can be used neat, that is without dilution, or they can first be diluted as required with water before application to a soiled surface using, for example, a cloth, brush or sponge for ease of application. Following use, any surplus undissolved water-soluble salt abrasive remaining on the surface can readily be removed by rinsing with clean water in which it dissolves.

Surfaces cleaned in this way with compositions of the invention show less of a tendency to residual streaking or spotting than surfaces cleaned with corresponding products containing water-insoluble abrasives such as calcite.

EXAMPLES

The invention is illustrated by the following Examples of formulations. Percentages are by weight unless otherwise stated. The undissolved potassium sulphate in each Example had a mean particle size of approximately 150μm. The formulations all possessed satisfactory suspending properties with a viscosity in excess of 6500 Pas at a shear rate of $3 \times 10^{-5}$ $sec^{-1}$. Adjustment of pH was carried out using sodium hydroxide solution or sulphuric acid as required.

Example 1

This Example illustrates the formulation of a concentrated hand dishwashing composition according to the invention.

The formulation of this detergent concentrate was as follows:

| | %w/w |
|---|---|
| sodium alkylbenzene sulphonate | 3.0 |
| sodium lauryl ether sulphate (3EO) | 4.5 |
| coconut diethanolamide | 7.5 |
| potassium sulphate | 20.0 |
| perfume | 0.25 |
| water | --- balance to 100% --- |

Viscosity at 20°C was 0.8 Pas at a shear rate of 21 $sec^{-1}$ and > 6500 Pas at a shear rate of $3 \times 10^{-5}$ $sec^{-1}$.

pH is adjusted to 7 with sodium hydroxide or sulphuric acid. The undissolved potassium sulphate particles are present at a level of about 10%.

Example 2

A hand dishwashing formulation was formulated as follows:

| | %w/w |
|---|---|
| Sodium linear alkyl benzene sulphonate | 2.7 |
| Sodium lauryl ether sulphate (3EO) | 10.8 |
| Coconut diethanolamide | 4.5 |
| Potassium sulphate | 8.0 |
| Sodium chloride | 2.0 |
| Trisodium citrate $2H_2O$ | 0.5 |
| Perfume | 0.25 |
| Water | --- balance to 100% --- |

Viscosity at 20°C: 0.6 Pas at a shear rate of 21 $sec^{-1}$.
Undissolved potassium sulphate particles: 2%.
pH is adjusted to 6 with sodium hydroxide or sulphuric acid.

Example 3

A hand dishwashing product was formulated as follows:

| | %w/w |
|---|---|
| Sodium linear alkyl benzene sulphonate | 2.7 |
| Sodium lauryl ether sulphate (3EO) | 10.8 |
| Coconut diethanolamide | 4.5 |
| Potassium sulphate | 12.0 |
| Sodium chloride | 2.0 |
| Trisodium citrate $2H_2O$ | 0.5 |
| Sodium polyacrylate (mol. wt. ~4000) | 0.2 |
| Perfume | 0.2 |
| Water | --- balance to 100% --- |

Viscosity at 25°C: 0.35 Pas at 21 $sec^{-1}$.
Undissolved potassium sulphate: about 6%.

The pH of the composition is adjusted to 6 with sodium hydroxide or sulphuric acid.

Example 4

A hand dishwashing product was formulated as follows:

| | %w/w |
|---|---|
| Sodium secondary alkyl sulphonate | 3.6 |
| Sodium lauryl ether sulphate | 14.4 |
| Potassium sulphate | 12.0 |
| Sodium chloride | 6.0 |
| Perfume | 0.2 |
| Water | --- balance to 100% --- |

pH = 6. Viscosity at 25°C: 0.71 Pas at 21 $sec^{-1}$.
Undissolved potassium sulphate: approx 8%.

Example 5

A hard surface cleaning product was formulated as follows:

| | %w/w |
|---|---|
| Sodium linear alkyl benzene sulphonate | 1.8 |
| Sodium lauryl ether sulphate (3EO) | 10.4 |
| Potassium sulphate | 40.0 |
| Sodium chloride | 2.0 |
| Trisodium citrate $2H_2O$ | 0.3 |
| Perfume | 0.2 |
| Water | --- balance to 100% --- |

pH = 6.5. Visosity at 25°C: 0.96 Pas at 21 $sec^{-1}$.
Undissolved potassium sulphate: 35%.

Example 6

A concentrated hand dishwashing product was formulated as follows:

| | %w/w |
|---|---|
| Sodium linear alkyl benzene sulphonate | 3.8 |
| Sodium lauryl ether sulphate (3EO) | 15.0 |
| Coconut diethanolamide | 6.2 |
| Potassium sulphate | 12.0 |
| Sodium chloride | 1.7 |
| Trisodium citrate $2H_2O$ | 0.4 |
| Perfume | 0.2 |
| Water | --- balance to 100% --- |

pH = 7. Viscosity at 25°C: 2.1 Pas at 21 $sec^{-1}$ at 25°C.
Undissolved potassium sulphate: 5%.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A pourable, homogeneous, abrasive, aqueous detergent composition comprising, in addition to water:

i) 1 to 40% by weight of a detergent active agent;

ii) 2 to 65% by weight of potassium sulphate present in both a dissolved and an undissolved state, the undissolved part of the potassium sulphate having a mean particle diameter of from 10 - 500 $\mu$m;

iii) optionally 0.5 to 10% by weight of at least one elctrolyte capable of lowering the solubility of the potassium sulphate

the composition having a pH of less than 8, and having an apparent viscosity at 20°C of at least 6500 Pas at a shear rate of $3 \times 10^{-5}$ $sec^{-1}$, and not more than 10 Pas at a shear rate of 21 $sec^{-1}$.

2. A composition according to claim 1 wherein the amount of detergent active agent is 1.5 to 30% by weight of the composition, and the amount of potassium sulphate is 4 to 55% of the composition.

3. A composition according to claim 2 wherein the amount of detergent active agent is 2 to 25% by weight of the composition and the amount of potassium sulphate is 7 to 50% by weight of the composition.

4. A composition according to any one of the preceding claims wherein the undissolved part of the potassium sulphate, constitutes from 0.5 to 60% by weight of the composition.

5. A composition according to claim 1 wherein che electrolyte comprises alkali metal chloride.

6. A composition according to claim 5 wherein the electrolyte additionally comprises sodium citrate.

7. A composition according to any one of the preceding claims wherein anionic detergent active agent forms from 1 to 25% by weight of the composition.

8. A composition according to claim 7 wherein the detergent active agent comprises from 2 to 20% by weight of the composition of a water soluble synthetic anionic sulphated or sulphonated detergent salt containing an alkyl radical having from 8 to 22 carbon atoms in the molecule.

9. A composition according to claim 7 or claim 8 wherein nonionic detergent active agent forms from 0.5 to 15% by weight of the composition.

10. A composition according to claim 9 wherein the weight ratio of anionic to nonionic detergent active agent is from 1:9 to 9:1.

11. A composition according to any preceding claim wherein the undissolved potassium sulphate has a mean particle diameter of from 20 to 300 $\mu$m.

12. A composition according to any preceding claim wherein water comprises from 30 to 89.5% by weight of the composition.

13. A composition according to any preceding claim wherein water comprises from 40 to 80% by weight of the composition.

14. A composition according to any preceding claim which has an apparent viscosity at 20°C of at least 25,000 Pas at a shear rate of $3 \times 10^{-5}$ $sec^{-1}$.

15. A composition according to any preceding claim which has an apparent viscosity at 20°C of not more than 5 Pas at a shear rate of 21 $sec^{-1}$.

DATED THIS 19TH DAY OF MARCH 1991

UNILEVER PLC

By its Patent Attorneys:

GRIFFITH HACK & CO.

Fellows Institute of Patent Attorneys of Australia.