

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
1 April 2004 (01.04.2004)

PCT

(10) International Publication Number
WO 2004/027005 A1

(51) International Patent Classification⁷: **C11D 3/10**,
3/20, 17/06

(21) International Application Number:
PCT/EP2003/009863

(22) International Filing Date:
4 September 2003 (04.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0221740.4 19 September 2002 (19.09.2002) GB

(71) Applicant (*for AE, AG, AU, BB, BZ, CA, CY, GB, GD, GH, GM, IE, IL, KE, LC, LK, LS, MN, MW, NZ, OM, PG, SC, SD, SG, SL, SZ, TT, TZ, UG, VC, ZA, ZM, ZW only*): **UNILEVER PLC** [GB/GB]; Unilever House, Blackfriars, London EC4P 4BQ (GB).

(71) Applicant (*for AL, AM, AT, AZ, BA, BE, BF, BG, BJ, BR, BY, CF, CG, CH, CI, CM, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, FR, GA, GE, GN, GQ, GR, GW, HR, HU, ID, IS, IT, JP, KG, KP, KR, KZ, LR, LT, LU, LV, MA, MC, MD, MG, MK, ML, MR, MX, MZ, NE, NI, NL, NO, PH, PL, PT, RO, RU, SE, SI, SK, SN, SY, TD, TG, TJ, TM, TN, TR, UA, UZ, VN, YU only*): **UNILEVER NV** [NL/NL]; Weena 455, NL-3013 AL Rotterdam (NL).

(71) Applicant (*for IN only*): **HINDUSTAN LEVER LIMITED** [IN/IN]; Hindustan Lever House, 165/166 Backbay Reclamation, Maharashtra, 400 020 Mumbai (IN).

(72) Inventors: **NUNZIO, del, Mario, Jovelino**; Rua Simon Bolivar, 318, Condominio Jd. Coleginho, 12310-670 Jacarei, Sao Paulo (BR). **PUELLE ANDRADE, Paulo**,

Cesar; Unilever Brazil Ltda, Av. Manoel Domingos Pinto 481, Parque Anhanguera, CEP 05120-000 Sao Paulo SP (BR). **STEEL, Andrew, Thomas**; Unilever Brazil Ltda, Av. Manoel Domingos Pinto 481, Parque Anhanguera, CEP 05120-000 Sao Paulo SP (BR).

(74) Agents: **ELLIOTT, Peter, William** et al.; Unilever PLC, Patent Department, Colworth House, Sharnbrook, Bedford, Bedfordshire MK44 1LQ (GB).

(81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT (utility model), PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DETERGENT COMPOSITIONS

(57) Abstract: An effervescent granule for use in particulate detergent compositions which comprises (a) a particulate acid source; and (b) a particulate carbonate source characterised in that the ratio of the d50 particle size of the acid source to the carbonate source is from less than 2:1 to greater than 1:1 is provided. The granules are surprisingly more effective if the particle sizes of the reacting constituents are similar.



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DETERGENT COMPOSITIONS

TECHNICAL FIELD

- 5 The present invention relates to effervescent granules for use in particulate detergent compositions.

BACKGROUND AND PRIOR ART

- 10 Particulate laundry detergent compositions must satisfy a wide range of practical constraints. As well as providing excellent cleaning and care, they must also satisfy numerous physical constraints which go beyond this basic requirement. For example it is known that the effervescence properties of
15 certain added ingredients can provide improved dispensing qualities to the detergent composition. This can be achieved by adding two ingredients which react together in the presence of water to produce a gas, for example by using sodium carbonate and citric acid. It is also known to place
20 the two reacting components together in a single granule. Such a single granule is often referred to in the art as an effervescent granule.

US 4 252 664 (Colgate-Palmolive) discloses the use of an effervescent granule comprising a gas-producing agent (preferably a carbonate) and an acid (preferably a solid acid). The effervescent granule is present in the full formulation at a level of from 5 to 10 wt%.

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A series of patent applications have published which disclose effervescent granules which also contain detergent ingredients such as surfactant and builder:

5 WO 98 42811 (Procter & Gamble) discloses a detergent granule of size 1.0 to 4.5 mm which comprises an acid source and an alkali source.

WO 98 46714 (Procter & Gamble) discloses a substantially
10 anhydrous effervescent particle of size 0.075 to 20 mm.

WO 98 46715 (Procter & Gamble) discloses a substantially anhydrous foaming component comprising an anhydrous surface active component (e.g. surfactant) and an effervescence
15 component (e.g. acid or alkali source).

WO 98 46716 (Procter & Gamble) discloses a dry effervescent granule comprising an acid, a carbonate source and a binder, wherein the acid and carbonate source are in close physical
20 proximity.

More recently, it has been discovered that effervescent granules may be improved by controlling the particle sizes of its constituents:

25

WO 00 34422 (Procter & Gamble) discloses an effervescence component which comprises an acid source and a carbonate source wherein at least 75% of the acid source has a particle size of from 0.1 to 150 microns. Preferably the
30 carbonate source also has a defined particle size and the granule is preferably coated in a nonionic surfactant.

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WO 01 30949 (Procter & Gamble) discloses a reactive particle comprising two particulate reactants in which the particle number ratio of the first reactant to the second is at least 50:1. Preferably the median particle size of the second to
5 the first reactant is at least 2:1.

The present inventors have surprisingly found that an effervescent granule which comprises a particulate acid source and a particulate carbonate source, wherein the d_{50}
10 particle size of the citric acid is greater than, but less than twice as great as, the d_{50} particle size of the carbonate source, provides a particularly effective effervescent granule. It is believed that this is due to the inherently greater solubility of the acid source as
15 compared to the carbonate source. The present invention therefore provides an effervescent granule whose constituents are sized such that they dissolve in water at a comparable rate; the inherently more rapid solubility of the acid source being compensated by its increased particle
20 size.

STATEMENT OF INVENTION

In a first aspect, the present invention provides an
25 effervescent granule for use in particulate detergent compositions which comprises a first reactant and a second reactant

- (a) a particulate acid source; and
- 30 (b) a particulate carbonate source;

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wherein the ratio of the d₅₀ particle size of the acid source to the carbonate source is from less than 2:1 to greater than 1:1.

- 5 In a second aspect, the present invention provides a laundry detergent composition which comprises from 0.1 to less than 10 wt%, preferably from 0.5 to less than 4 wt%, more preferably from 0.5 to less than 2 wt% of an effervescent granule as defined above.

10

DETAILED DESCRIPTION OF THE INVENTION

The Effervescent Granule

- 15 The effervescent granule of the present invention comprises a particulate acid source and a particulate carbonate source wherein the d₅₀ particle size of the citric acid is greater than, but less than twice as great as, the d₅₀ particle size of the carbonate source. Without wishing to be bound by
20 theory, it is believed that this may be because the acid source is inherently more rapidly dissolving than the carbonate source. This means that when particles of the same size are added to water under the same conditions, the particles of acid dissolve more rapidly. Hence the
25 increased particle size of the acid source slows down its solubility such that the solubility of the carbonate source becomes more comparable and an enhanced effervescent action results.

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Preferably, the ratio of the d₅₀ particle size of the acid source to the carbonate source is from 1.9:1 to 1.1:1, more preferably from 1.8:1 to 1.2:1.

5 The granule preferably comprises from 20 to 80 wt%, preferably from 30 to 60 wt%, more preferably from 40 to 50 wt% of the carbonate source. The granule preferably comprises from 10 wt% to 60 wt%, preferably from 20 wt% to 50 wt%, more preferably from 30 wt% to 40 wt% of the acid
10 source.

It is preferred that the majority of the granule is comprised of the carbonate and the acid source and that more preferably the carbonate source and the acid source make up
15 from 50 to 100 wt%, preferably from 60 to 99 wt%, more preferably from 70 to 95 wt%, most preferably from 80 to 90 wt% of the granule.

The granules preferably have a particle size of from 0.2 to
20 10 mm, preferably from 0.5 to 5 mm, more preferably 0.8 to 4 mm, most preferably from 1 to 2 mm. This helps to provide a highly effective localised fizzing action.

The granule may also comprise a drying agent such as a
25 silica gel to ensure that the granule remains dry during storage.

The granule may also comprise a binder to help hold it together and it is preferred that such a binder is a
30 polyethylene glycol or a polypropylene glycol.

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The granules preferably also comprises a colourant in order to contrast their appearance from that of the detergent compositions to which they are added.

5 The Acid Source

The acid source reacts with the carbonate source in the presence of water to produce carbon dioxide gas.

10 Preferably the acid source is a particulate material and has a narrow particle size distribution such that at least 50 wt%, preferably at least 60 wt%, more preferably at least 70 wt%, most preferably at least 80 wt% of particles have a particle size of from 150 to 350 microns.

15

Preferably the acid source is an organic acid. Preferably the acids are mono-, bi- or tri-protonic acids. Such preferred acids include mono- or polycarboxylic acids preferably citric acid, adipic acid, glutaric acid,
20 citramalic acid, tartaric acid, maleic acid, malic acid, succinic acid, malonic acid. Such acids are preferably used in their acidic forms, and it may be preferred that their anhydrous forms are used, or mixtures thereof. Citric acid is the most highly preferred.

25

The Carbonate Source

The carbonate source reacts with the acid source in the presence of water to produce carbon dioxide gas.

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The carbonate source is preferably selected from carbonate, bicarbonate, sesquicarbonate and mixtures thereof.

5 The carbonate source may advantageously be a combination of sodium bicarbonate and sodium carbonate in a weight ratio of greater than 1:1, preferably from greater than 1:1 to 100:1, preferably from greater than 3:2 to 75:1, more preferably from 2:1 to 50:1, most preferably from 3:1 to 25:1.

10 The Optional Solid Surfactant Particles

In order to enhance the fizzing action and to provide a positive cue for the end user, the effervescent granules of the present invention preferably comprise solid surfactant
15 particles. It is preferred that in its isolated state the surfactant is sufficiently solid such that it is pourable.

As desired, the granule may comprises from 1 to 15 wt%, preferably from 2 to 10 wt%, more preferably from 3 to 8 wt%
20 of solid surfactant particles.

Preferably the surfactant has a melting point of at least 30°C, preferably at least 40°C, more preferably at least 50°C.

25

Surfactants suitable for the present invention meet the criteria of being solid and particulate. Highly preferred surfactants are the alkyl sulphate type surfactants, preferably a C₈-C₁₅ primary alkyl sulphate, more preferably a

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C₁₀-C₁₄ primary alkyl sulphate. Also preferred are the C₈-C₁₅ olefin sulphonates.

Preferably the granules are substantially free of alkyl benzene sulphonate surfactants, because of their hygroscopicity. In this context, 'substantially free' means less than 5 wt% of the effervescent granule, preferably less than 3 wt%, more preferably less than 1 wt%, most preferably completely absent.

Preferably the surfactant particles have a d₅₀ particle size of greater than 100 microns, more preferably from 150 to 800 microns.

In a particularly preferred embodiment, the ratio of the particle size of the effervescent granule to the d₅₀ particle size of the surfactant is greater than 5:1, preferably from 6:1 to 1000:1.

The Method of Manufacture

The effervescent granules according to the present invention may be made by any suitable process, such as for example by granulation, roll-compaction, extrusion or a combination thereof.

The Detergent Composition

The effervescent granules of the present invention are intended to be added to a conventional particulate laundry

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detergent composition. When added to a detergent composition they are present at a level of from 0.1 to less than 10 wt%, preferably from 0.5 to less than 4 wt%, more preferably from 0.5 to less than 2 wt%. The benefit of the effervescent granules is surprisingly not diminished at reduced levels of inclusion.

Detergent compositions of the invention contain detergent-active compounds and detergency builders, and may optionally contain bleaching components and other active ingredients to enhance performance and properties.

Detergent-active compounds (surfactants) may be chosen from soap and non-soap anionic, cationic, nonionic, amphoteric and zwitterionic detergent-active compounds, and mixtures thereof. Many suitable detergent-active compounds are available and are fully described in the literature, for example, in "Surface-Active Agents and Detergents", Volumes I and II, by Schwartz, Perry and Berch. The preferred detergent-active compounds that can be used are soaps and synthetic non-soap anionic and nonionic compounds. The total amount of surfactant present is suitably within the range of from 5 to 40 wt%.

Anionic surfactants are well-known to those skilled in the art. Examples include alkylbenzene sulphonates, particularly linear alkylbenzene sulphonates having an alkyl chain length of C₈-C₁₅; primary and secondary alkylsulphates, particularly C₈-C₁₅ primary alkyl sulphates; alkyl ether sulphates; olefin sulphonates; alkyl xylene

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sulphonates; dialkyl sulphosuccinates; and fatty acid ester sulphonates. Sodium salts are generally preferred.

Nonionic surfactants that may be used include the primary
5 and secondary alcohol ethoxylates, especially the C₈-C₂₀ aliphatic alcohols ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C₁₀-C₁₅ primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles
10 of ethylene oxide per mole of alcohol. Non-ethoxylated nonionic surfactants include alkylpolyglycosides, glycerol monoethers, and polyhydroxyamides (glucamide).

Cationic surfactants that may be used include quaternary
15 ammonium salts of the general formula $R_1R_2R_3R_4N^+ X^-$ wherein the R groups are long or short hydrocarbyl chains, typically alkyl, hydroxyalkyl or ethoxylated alkyl groups, and X is a solubilising anion (for example, compounds in which R₁ is a C₈-C₂₂ alkyl group, preferably a C₈-C₁₀ or C₁₂-C₁₄ alkyl
20 group, R₂ is a methyl group, and R₃ and R₄, which may be the same or different, are methyl or hydroxyethyl groups); and cationic esters (for example, choline esters).

Detergent compositions suitable for use in most automatic
25 fabric washing machines generally contain anionic non-soap surfactant, or nonionic surfactant, or combinations of the two in any ratio, optionally together with cationic, amphoteric or zwitterionic surfactants, optionally together with soap.

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The detergent compositions of the invention also contain one or more detergency builders. The total amount of detergency builder in the compositions will suitably range from 5 to 80 wt%, preferably from 10 to 60 wt%.

5

Suitable inorganic non-phosphorus containing builders include crystalline and amorphous aluminosilicates, for example zeolites as disclosed in GB 1 473 201 (Henkel); amorphous aluminosilicates as disclosed in GB 1 473 202
10 (Henkel); and mixed crystalline/amorphous aluminosilicates as disclosed in GB 1 470 250 (Henkel); and layered silicates as disclosed in EP 164 514B. Inorganic phosphate builders, for example, sodium orthophosphate, pyrophosphate and tripolyphosphate, may also be present.

15

Aluminosilicates, include the zeolite used in most commercial particulate detergent compositions, namely zeolite A. Advantageously, however, maximum aluminium zeolite P (zeolite MAP) described and claimed in EP 384 070B
20 (Unilever) may be used. Zeolite MAP is an alkali metal aluminosilicate of the P type having a silicon to aluminium ratio not exceeding 1.33, preferably not exceeding 1.15, and more preferably not exceeding 1.07.

25

Suitably the builder system comprises a zeolite (for example zeolite A) and optionally an alkali metal citrate and/or a crystalline layered silicate (for example SKS-6 ex Hoechst).

30

Examples of phosphorus-containing inorganic detergency builders include the water-soluble salts, especially the

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alkali metal salts of pyrophosphates, orthophosphates, polyphosphates and phosphonates.

The phosphorus containing inorganic builder is preferably
5 pyrophosphate or polyphosphate. Specific examples of inorganic phosphate builders include sodium and potassium tripolyphosphates, orthophosphates and hexametaphosphates.

Organic builders that may be present include polycarboxylate
10 polymers such as polyacrylates and acrylic/maleic copolymers; monomeric polycarboxylates such as citrates, gluconates, oxydisuccinates, glycerol mono-, di- and trisuccinates, carboxymethyloxysuccinates, carboxymethyloxymalonates, dipicolinates,
15 hydroxyethyliminodiacetates, alkyl- and alkenylmalonates and succinates; and sulphonated fatty acid salts. These materials are preferably present in alkali metal salt, especially sodium salt, form. This list is not intended to be exhaustive.

20

Especially preferred organic builders are citrates, suitably used in amounts of from 5 to 30 wt%, preferably from 10 to 25 wt%; and acrylic polymers, more especially acrylic/maleic copolymers, suitably used in amounts of from
25 0.5 to 15 wt%, preferably from 1 to 10 wt%. Builders, both inorganic and organic, are preferably present in alkali metal salt, especially sodium salt, form.

Detergent compositions according to the invention may also
30 suitably contain a bleach system. Preferably this will include a peroxy bleach compound, for example, an inorganic

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persalt or an organic peroxyacid, capable of yielding hydrogen peroxide in aqueous solution. Preferred inorganic persalts are sodium perborate monohydrate and tetrahydrate, and sodium percarbonate. The sodium percarbonate may have a protective coating against destabilisation by moisture. The peroxy bleach compound is suitably present in an amount of from 5 to 35 wt%, preferably from 10 to 25 wt%.

The peroxy bleach compound may be used in conjunction with a bleach activator (bleach precursor) to improve bleaching action at low wash temperatures. The bleach precursor is suitably present in an amount of from 1 to 8 wt%, preferably from 2 to 5 wt%. Preferred bleach precursors are peroxycarboxylic acid precursors, more especially peracetic acid precursors and peroxybenzoic acid precursors; and peroxycarbonic acid precursors. An especially preferred bleach precursor suitable for use in the present invention is N,N,N',N'-tetracetyl ethylenediamine (TAED).

A bleach stabiliser (heavy metal sequestrant) may also be present. Suitable bleach stabilisers include ethylenediamine tetraacetate (EDTA), diethylenetriamine pentaacetate (DTPA), ethylenediamine disuccinate (EDDS), and the polyphosphonates such as the Dequests (Trade Mark), ethylenediamine tetramethylene phosphonate (EDTMP) and diethylenetriamine pentamethylene phosphate (DETPMP).

Bleach ingredients are postdosed.

The compositions of the invention may contain alkali metal, preferably sodium, carbonate, in order to increase

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detergency and ease processing. Sodium carbonate may suitably be present in amounts ranging from 1 to 60 wt%, preferably from 2 to 40 wt%. Sodium carbonate may be included in either or both base granule, and/or may be
5 postdosed.

As previously indicated, sodium silicate may also be present. The amount of sodium silicate may suitably range from 0.1 to 5 wt%. Sodium silicate may be postdosed, for
10 example, as granular sodium disilicate, or as sodium carbonate/sodium silicate cogramules, for example, Nabion (Trade Mark) 15 ex Rhodia Chimie.

Powder flow may be improved by the incorporation of a small
15 amount of a powder structurant. Examples of powder structurants, some of which may play other roles in the formulation as previously indicated, include, for example, fatty acids (or fatty acid soaps), sugars, acrylate or acrylate/maleate polymers, sodium silicate, and dicarboxylic
20 acids (for example, Sokalan (Trade Mark) DCS ex BASF). One preferred powder structurant is fatty acid soap, suitably present in an amount of from 1 to 5 wt%.

Other materials that may be present in detergent
25 compositions of the invention include antiredeposition agents such as cellulosic polymers; soil release agents; anti-dye-transfer agents; fluorescers; inorganic salts such as sodium sulphate; enzymes (proteases, lipases, amylases, cellulases); dyes; coloured speckles; perfumes;
30 and fabric conditioning compounds. This list is not intended to be exhaustive.

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EXAMPLES

An effervescent granule was made with the following composition:

5

Ingredient	Wt%
Citric acid	38
Sodium bicarbonate	42
Sodium carbonate	10
Sodium C ₁₂₋₁₄ alkyl sulphate	5
Polypropyleneglycol	4.5
Silica Gel	0.5
Total	100

The sodium carbonate had a d₅₀ particle size of about 150 microns. The sodium bicarbonate had a d₅₀ particle size of about 120 microns. The citric acid had a d₅₀ particle size of about 250 microns. The sodium C₁₂-C₁₄ alkyl sulphate was in particulate form (with a melting point in excess of 60°C) and had a d₅₀ particle size of about 200 microns.

15 The sodium carbonate, sodium bicarbonate, silica gel, sodium lauryl sulphate and citric acid were mixed together to provide a dry-mix. Polypropylene glycol was then added to produce a wetted mixture. The resultant mixture was then granulated in a sieve-type granulator with 2 mm holes. The extrudates were then sliced into cylinders with a length of approximately 2 mm.

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1 parts of the effervescent granule was mixed with 99 parts of a phosphate detergent powder with a formulation given below:

Ingredient	Wt%
Base Powder	
Sodium C ₁₂ alkyl benzene sulphonate	18.0
Sodium tripolyphosphate	12.0
Sodium silicate	7.5
Sodium sulphate	26.9
SCMC	0.50
Optical brightener	0.18
Photobleach	0.03
Silicone	0.02
Salts + moisture	0.5
Post Dosed	
Sodium carbonate	15.0
Sodium sulphate	10.0
Protease	0.24
Amylase	0.10
Sodium perborate monohydrate	1.50
TAED	0.50
Perfume	0.24
Moisture	6.8
Total	100.00

5

The resultant detergent powder gave an attractive effervescent action when added to wash water despite the very low level of effervescent granule.

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CLAIMS

1. An effervescent granule for use in particulate detergent compositions which comprises

5

- (c) a particulate acid source; and
(d) a particulate carbonate source;

characterised in that the ratio of the d_{50} particle size of the acid source to the carbonate source is from less than 2:1 to greater than 1:1.

10

2. An effervescent granule as claimed in claim 1, characterised in that the ratio of the d_{50} particle size of the acid source to the carbonate source is from 1.9:1 to 1.1:1, preferably from 1.8:1 to 1.2:1.

15

3. An effervescent granule as claimed in any preceding claim, characterised in that the effervescent granules comprise from 10 wt% to 60 wt%, preferably from 20 wt% to 50 wt%, more preferably from 30 wt% to 40 wt% of the acid source.

20

4. An effervescent granule as claimed in any preceding claim, characterised in that the effervescent granules comprise from 20 to 80 wt%, preferably from 30 to 60 wt%, more preferably from 40 to 50 wt% of the carbonate source.

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5. An effervescent granule as claimed in any preceding claim, characterised in that the effervescent granule comprises at from 50 to 100 wt%, preferably from 60 to 99 wt%, more preferably from 70 to 95 wt%, most preferably from 80 to 90 wt%, of the total of the acid source and carbonate source.
6. An effervescent granule as claimed in any preceding claim, characterised in that it is substantially free of alkyl benzene sulphonate surfactant.
7. An effervescent granule as claimed in any preceding claim, characterised in that the acid source is citric acid.
8. A laundry detergent composition which comprises from 0.1 to less than 10 wt%, preferably from 0.5 to less than 4 wt%, more preferably from 0.5 to less than 2 wt% of an effervescent granule as claimed in any one of claims 1 to 7.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/09863

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C11D3/10 C11D3/20 C11D17/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01 30949 A (PROCTER & GAMBLE (US)) 3 May 2001 (2001-05-03) cited in the application claims 1-15 examples page 3, line 27 -page 10, line 20 ---	1-8
A	WO 00 34422 A (PROCTER & GAMBLE) 15 June 2000 (2000-06-15) cited in the application claims 1-11,14-18 examples page 5, line 12 -page 13, line 31 -----	1-8

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

3 March 2004

Date of mailing of the international search report

11/03/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Neys, P

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 03/09863

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