Abstract: The invention provides cleaning tablets for use in a washing operation. The tablets are characterised in that each tablet has a mass of between 1g and 15g such that it can be used singularly or with one or more other like tablets depending upon a required washing performance. Also provided are cleaning methods which use the tablets and packaged products which comprise the tablets.

Title: ARTICLE AND METHOD
The present invention relates to cleaning tablets, including dishwashing tablets, laundry cleaning tablets and water softening tablets used in cleaning methods. The invention further relates to cleaning methods using such tablets.

It is known to provide cleaning compositions in various forms for use in ware washing machines such as dish and clothes washing machines.

One of the most common forms in which laundry and dish washer detergents are used consists of powder or granules in which the average particle size ranges between 0.1 and 2mm in diameter. In use, such powder or granules are placed in a chamber from which they are washed out during the washing cycle. Because of the hygroscopic nature of the powder or granules lumps occasionally form as a result of which the detergent may not be correctly delivered into the washing chamber of a dishwasher or washing machine. It is known to use additives to alleviate this effect, but these may not always be effective.

Accordingly, as an alternative to powders or granules it is known to use detergents in tablet form. These tablets are usually manufactured from the same ingredients as the known powders or granules, with the addition of tabletting aids. The problems with the formation of lumps which are known with powders and granules are avoided by such tablets. The known detergent tablets also have the advantage that they avoid the need to measure out powder or granules which can sometimes be somewhat complicated and tiresome.
However, such tablets have a disadvantage compared to the use of powder or granules which is that they reduce the flexibility in measuring out the required quantity of detergent. Instead, it is usual for the same amount of detergent to be added to every washing cycle, which is determined by the size of the tablet, irrespective of whether the crockery or laundry to be cleaned is heavily or lightly soiled and/or whether the machine being operated has a full or reduced load.

Known detergent tablets may comprise a detergent composition together with other cleaning aid compositions.

For example, known multi-function automatic dishwasher tablets comprise three major components: a detergent composition, a water softening function ("salt function") and a rinse aid function. These components may be provided in separate conjoined layers of the tablet and arranged to dissolve into the wash water during different stages of the washing operation.

It is typical for such an automatic dishwasher tablet comprising a detergent, dishwasher salt function and rinse aid function to weigh between 20 and 25g. For example, such a tablet may comprise around 10g of detergent composition, around 10g of water softening function composition and around 1g to 2g of rinse aid function. In order to clean crockery using a domestic dishwasher a single tablet will be added regardless of the amount of crockery or extent of the soiling of the crockery which is to be washed in the dishwasher.
The provision of dishwasher detergent in the form of smaller tablets is known from EP 0 318 204 Al. However, this document relates to difficulties associated with incompatible components. In this case it is necessary to use a combination of at least two types of tablet with incompatible components being distributed among the tablet types in such a way that substantially only compatible ingredients are formulated in the same tablet type.

The different types can either be offered separately and mixed in the correct proportions by the user or provided as a pre-mixed product. However, both cases have their own difficulties. In the first case, the difficulty arises of maintaining the correct proportions between the various tablet types when measuring out the amount required. In the second case, problems occur if the tablet types become unevenly distributed in the mixture or if they are separated during transport or storage.

Accordingly, there remains a need to provide a detergent composition in a form which allows for variable dosage in a simple manner which is convenient for the consumer.

Accordingly, the present invention aims to address at least one disadvantage associated with the prior art whether discussed herein or otherwise.

According to a first aspect of the present invention there is provided a cleaning tablet for use in a washing operation, characterised in that the tablet has a mass of between 1g and 15g such that it can be used singularly or with one or more other like tablets depending upon a required washing performance.
Preferably, the tablet has a mass of no more than 14g, more preferably no more than 13g, more preferably no more than 12g, more preferably no more than 10g. The tablet may have a mass of no more than 9g, for example of no more than 8g, 7g, 6g, or 5g.

Preferably, the tablet has a mass of at least 2g, more preferably at least 3g. The tablet may have a mass of at least 4g, for example at least 5g, 6g, 7g, 8g or 9g.

Suitably, the cleaning tablet comprises a detergent composition. Alternatively or in addition, the cleaning tablet may comprise a water-softening tablet which comprises a cleaning composition comprising a water-softening composition.

Suitably, the cleaning tablet comprises a tablet for use in an automatic ware washing machine.

Preferably, the cleaning tablet comprises a tablet for use in an automatic dishwashing machine. Suitably, the detergent tablet may be arranged to be used in combination with a separate supply of dishwasher salt and/or rinse aid. Thus, the tablet may be substantially free from rinse aid and/or dishwasher salt functions.

The term "cleaning composition" is understood in the broad sense in the present application, namely as comprising all those substances and mixtures of substances which can be used in connection with cleaning processes. These include not only the compositions which are actually active in
cleaning, such as detergents, for example dishwasher detergents, and washing substances, but all compositions which support cleaning functions concerned, such as water softeners, or which have the effect of providing protective care, such as fabric treaters or final rinses.

Included in the term "cleaning composition" are mixtures of ingredients selected from: surfactant, builder, filler, bleach (optionally containing also bleach activator and/or a bleach catalyst), water-softening composition and enzymes. The cleaning composition may contain other minor ingredients such as dye, fragrance and optical brighteners.

By use of the term "water-softening composition" we mean a mixture of a water-softening active (s) with other compounds selected from those mentioned in the previous paragraph, or elsewhere in this specification.

Suitably, the cleaning composition comprises a detergent composition. The cleaning composition may comprise a detergent composition together with other components which support a cleaning function. Alternatively, the cleaning composition may consist essentially of a detergent composition.

As used herein the term "detergent composition" is understood to comprise all those substances and mixtures of substances which are active in cleaning, such as detergents and washing substances.

Included in the term "detergent composition" are mixtures of ingredients selected from: surfactant, builder, filler,
bleach (optionally containing also bleach activator and/or a bleach catalyst) and enzymes.

The detergent composition may be substantially free of components which support cleaning functions, such as water-softeners, or which have the effect of providing protective care, such as fabric softeners or final rinses (rinse aids).

Suitably, the tablet comprises a detergent composition in an amount of from 1g to 12g, preferably an amount of from 2g to 8g, for example an amount of from 3g to 6g.

Suitably, the tablet comprises detergent composition in an amount of no more than 12g, preferably no more than 9g, more preferably no more than 10g, for example no more than 9g, 8g, 7g, 6g, 5g, 4g, 3g or 2g.

Suitably, the tablet comprises a detergent composition in an amount of at least 1g, preferably at least 2g, for example at least 3g, 4g, 5g, 6g, 7g or 8g.

The tablet may comprise a "mono-benefit" tablet. The tablet may comprise a single-function tablet for use in an automatic dish washer. Thus, at least 90% by weight of the cleaning composition may comprise detergent composition and the cleaning composition may preferably consist essentially of a detergent composition, which may suitably comprise fillers and/or tabletting aids in addition to the active components.
Suitably the tablet has a mass of between 1g and 7g, preferably between 2g and 6g, more preferably between 3g and 5g, for example around 4g.

Suitably, the tablet has a mass of between 5g and 13g, preferably between 7g and 10g, more preferably between 8g and 10g, for example around 9g.

Suitably, the cleaning composition comprises detergent composition which comprises a substantially complete formulation for its respective use. Accordingly, it is suitably not necessary to employ a number of tablets according to the present invention comprising different compositions. Difficulties associated with a consumer having to count out a selection of different tablets may thus be avoided.

Suitably, the tablet is free from phosphorus-containing compounds.

The cleaning tablets of the present invention may have a number of advantages compared to known larger tablets.

As the tablet is smaller than known tablets it comprises less detergent and thus if a single tablet is used in a wash cycle of an automatic dishwashing machine there will be less release of detergent composition into the waterways. The use of a single tablet in a ware washing machine of the floor standing type may be appropriate to wash a small load or if the load is lightly soiled and thus the use of tablets accordingly to the present invention may provide significant environmental benefits.
Tablets according to the present invention may also be "multi-dosed". For example, for a small load one tablet could be used with the environmental advantage as described above. For a larger load then two tablets may be used. For a particularly heavily soiled load three tablets may be used. Thus, a consumer may be provided with the flexibility to vary the amount of detergent used in an automatic dishwashing machine, particularly in a machine of the floor standing type, without having to expend the time and energy associated with using powder or granular detergents.

The use of two like tablets of the present invention may be more effective than the use of a known tablet having the same formulation as the tablets of the present invention and a weight equal to the combined weight of said two tablets of the present invention.

Accordingly, it may for example be possible to achieve the same cleaning effect provided by a known 20g tablet by using two 9g tablets, each having a similar composition as the known tablet. Accordingly, it may be possible to use around 10% less detergent to achieve the same cleaning effect. The environmental benefits associated with the use of tablets accordingly to the present invention will thus be readily apparent.

Whilst having advantages over known tablets, the tablets according to the present invention may also retain the benefits that those known tablets have over powder or granular detergent compositions.
Tablets according to the present invention may be less susceptible to breakage and may be more easily removed from a machine chamber and distributed in a dish washing machine than known tablets. A problem which occasionally occurs with known dishwasher detergent tablets, namely that the tablets become stuck between pieces of crockery and do not dissolve correctly as a result, may also be substantially avoided.

Suitably, the tablet is such that it need not be used in combination with other tablets of differing type.

The starting material for the cleaning tablets of the invention may be formulated in the same way as conventional powders, granules or tablets. A suitable formulation for a tablet composition may therefore comprise a large number of different ingredients, which may include any of the following: builders, surfactants, enzymes, bleaches, bleach activators, sources of alkalinity, dyes, perfumes, disintegrants, dispersants for lime soaps, organic polymers, including polymers to inhibit colour transfer, crystal growth inhibitors, complexing agents for heavy metal ions, salts, enzyme stabilisers, corrosion inhibitors, solvents, fabric softeners, optical brighteners, hydro-tropic agents, etc.

In addition, the tablet composition may contain suitable fillers, such as sulphates and chlorides, and tabletting aids, such as polyethylene glycol, starch or starch derivatives, etc.

The tablet may be provided with a water soluble coating, the nature of that coating being determined by the purpose
for which it is intended. Any water-soluble polymer may be provided for a coating, for example, if the purpose of the coating is to provide greater stability during storage and handling and/or a certain delay in dissolution in the wash liquor. If the aim of the delay is, for example, for the ingredients to be released in a certain phase of the washing cycle, as is the case with formulations for the final rinse for machine rinsing in the form of the invention, pH-dependent coating materials can be used.

The tablets may also contain a scattering agent or effervescent system, such as a combination of bicarbonate of soda and citric acid, in order to support the rapid dissolution of the tablets, especially when poorly soluble ingredients are included.

If the tablet is for use in laundry washing, it may typically comprise, for example, a bleach, stain remover, water-softener, enzyme or fabric conditioner, in addition to the cleaning composition. The tablet may be designed to release components at different times during the laundry wash. For example, a bleach or fabric conditioner is generally released at the end of a wash, and a water-softener is generally released at the start of a wash. An enzyme may be released at the start or the end of a wash.

If the tablet is for use in dishwashing it may comprise, for example, a water-softener, salt, enzyme, rinse aid, bleach or bleach activator. The tablet may be designed to release the components at different times during the wash cycle. For example, a rinse aid, bleach or bleach activator is generally released at the end of a wash, and a wa-
ter-softener, salt or enzyme is generally released at the start of a wash.

Examples of water-softening particulates which may be used in tablets according to the present invention include:

A) homo or co polymers of the following monomeric units or salts thereof - acrylic acids, maleic acids, sulfonic acids or phosphonics acid; and/or

B) citrate salts, for example alkali metal citrates, and especially sodium citrate.

Preferably a compound of class A) and a compound of class B) are both present in a water-softening composition.

Additional beneficial compounds in a water-softening composition include one or more of:

(1) ion exchange agents, including alkali metal (preferably sodium) aluminosilicates, either crystalline, amorphous or a mixture of the two;

(2) ion capture agents - agents which prevent metal ions from forming insoluble salts or reacting with surfactants, such as polyphosphate, monomeric polycarbonates, such as citric acid or salts thereof, EDTA, algins, alginates; and

(3) anti-nucleating agents - agents which prevent seed crystal growth, such as polycarbonate polymers, such as polyacrylates, acrylic/maleic copolymers, and acrylic phosphonates, and sulfonates.
The components of a cleaning tablet depend on its intended use. Generally, the tablet may contain surface active agents such as an anionic, non-ionic, cationic, amphoteric or zwitterionic surface active agents or mixtures thereof.

Examples of anionic surfactants are straight-chained or branched alkyl sulfates and alkyl polyalkoxylated sulfates, also known as alkyl ether sulfates. Such surfactants may be produced by the reaction of sulfates with higher (e.g. C₈-C₂₀) fatty alcohols.

Examples of primary alkyl sulfate surfactants are those of formula:

\[ \text{ROSO}_3^+ \]

wherein R is a linear C₈-C₂₀ hydrocarbyl group and M is a water-solubilising cation. Preferably R is Ci₀-Ci₆ alkyl, for example Ci₂-Ci₄, and M is alkali metal such as lithium, sodium or potassium.

Examples of secondary alkyl sulfate surfactants are those which have the sulfate moiety on a "backbone" of the molecule, for example those of formula:

\[ \text{CH}_2 (\text{CH}_2)_n (\text{CHOSO}_3^+ \text{M}^+) (\text{CH}_2)_m \text{CH}_3 \]

wherein m and n are independently 2 or more, the sum of m+n typically being 6 to 20, for example 9 to 15, and M is a water-solubilising cation such as lithium, sodium or potassium.
Especially preferred secondary alkyl sulfates are the (2,3) alkyl sulfate surfactants of formulae:

\[ \text{CH}_2(\text{CH}_2)_x(\text{CHOSO}_3\text{M}^+)\text{CH}_3 \text{ and} \]

\[ \text{CH}_3(\text{CH}_2)_x(\text{CHOSO}_3\text{M}^+)\text{CH}_2\text{CH}_3 \]

for the 2-sulfate and 3-sulfate, respectively. In these formulae \( x \) is at least 4, for example 6 to 20, preferably 10 to 16. \( \text{M} \) is cation, such as an alkali metal, for example lithium, sodium or potassium.

Examples of alkoxylated alkyl sulfates are ethoxylated alkyl sulfates of the formula:

\[ \text{RO}(\text{C}_2\text{H}_4\text{O})_n\text{SO}_3\text{M}^+ \]

wherein \( \text{R} \) is a \( \text{C}_8-\text{C}_{20} \) alkyl group, preferably \( \text{C}_{10}-\text{C}_{18} \) such as a \( \text{C}_{12}-\text{C}_{16} \), \( n \) is at least 1, for example from 1 to 20, preferably 1 to 15, especially 1 to 6, and \( \text{M} \) is a salt-forming cation such as lithium, sodium, potassium, ammonium, alkylammonium or alkanolammonium. These compounds can provide especially desirable fabric cleaning performance benefits when used in combination with alkyl sulfates.

The alkyl sulfates and alkyl ether sulfates will generally be used in the form of mixtures comprising varying alkyl chain lengths and, if present, varying degrees of alkoxylation.

Other anionic surfactants which may be employed are salts of fatty acids, for example \( \text{C}_8-\text{C}_{18} \) fatty acids, especially
the sodium or potassium salts, and alkyl, for example C₈-C₁₈, benzene sulfonates.

Examples of non-ionic surfactants are fatty acid alkoxy-
lates, such as fatty acid ethoxylates, especially those of formula:

R(C₂H₄O)ₙOH

wherein R is a straight or branched C₈-C₁₆ alkyl group, preferably a C₉-C₁₅, for example C₁₀-C₁₄, alkyl group and n is at least 1, for example from 1 to 16, preferably 2 to 12, more preferably 3 to 10.

The alkoxyalted fatty alcohol non-ionic surfactant will frequently have a hydrophilic-lipophilic balance (HLB) which ranges from 3 to 17, more preferably from 6 to 15, most preferably from 9 to 15.

Examples of fatty alcohol ethoxylates are those made from alcohols of 12 to 15 carbon atoms and which contain about 7 moles of ethylene oxide. Such materials are commercially marketed under the trademarks NEODOL 25-7 and NEODOL 23-6.5 by Shell Chemical Company. Other useful compounds of this type include NEODOL 1-5, an ethoxylated fatty alcohol averaging 11 carbon atoms in its alkyl chain with about 5 moles of ethylene oxide; NEODOL 23-9, an ethoxyalted primary C₁₂-C₁₃ alcohol having about 9 moles of ethylene oxide; and NEODOL 91-10, an ethoxylated C₉-Cₙ primary alcohol having about 10 moles of ethylene oxide.

Alcohol ethoxylates of this type have also been marketed by Shell Chemical Company under the DOBANOL trademark.
DOBANOL 91-5 is an ethoxylated C₉-C₁₁ fatty alcohol with an average of 5 moles ethylene oxide and DOBANOL 25-7 is an ethoxylated C₁₂-C₁₅ fatty alcohol with an average of 7 moles of ethylene oxide per mole of fatty alcohol.

Other examples of suitable ethoxylated alcohol non-ionic surfactants include TERGITOL 15-S-7 and TERGITOL 15-S-9, both of which are linear secondary alcohol ethoxylates available from Union Carbide Corporation. TERGITOL 15-S-7 is a mixed ethoxylated product of a Cₙ-C₁₅ linear secondary alkanol with 7 moles of ethylene oxide and TERGITOL 15-S-9 is the same but with 9 moles of ethylene oxide.

Other suitable alcohol ethoxylated non-ionic surfactants are NEODOL 45-11, which is a similar ethylene oxide condensation products of a fatty alcohol having 14-15 carbon atoms and the number of ethylene oxide groups per mole being about 11. Such products are also available from Shell Chemical Company.

Further non-ionic surfactants are, for example, C₁₀-C₁₈ alkyl polyglycosides, such as C₁₂-C₁₆ alkyl polyglycosides. These are especially useful when high foaming compositions are desired. Further surfactants are polyhydroxy fatty acid amides, such as C₁₀-C₁₈ N-(3-methoxypropyl) glycamides and ethylene oxide-propylene oxide block polymers of the Pluronic type.

Examples of cationic surfactants are those of the quaternary ammonium type.

The total content of surfactants in the tablet is desirably 60 to 95 wt%, especially 75 to 90 wt%. Desirably an
anionic surfactant is present in an amount of 50 to 75 wt%, the nonionic surfactant is present in an amount of 5 to 50 wt%, and/or the cationic surfactant is present in an amount of from 0 to 20 wt%, by weight of tablet.

The tablets, particularly when used as laundry washing or dishwashing tablets, may also independently comprise enzymes, such as protease, lipase, amylase, cellulase and peroxidase enzymes. Such enzymes are commercially available and sold, for example, under the registered trade marks ESPERASE, ALCALASE and SAVINASE by Nova, Industries A/S and MAXATASE by International Biosynthetics, Inc. Desirably the enzymes are independently present in the tablets in an amount of from 0.5 to 3 wt%, especially 1 to 2 wt%, when added as commercial preparations they are not pure and this represents an equivalent amount of 0.005 to 0.5 wt% of pure enzyme. As mentioned above they can be incorporated after extrusion if wished.

Tablets used in dishwashing independently usually comprise a detergency builder. The builders counteract the effects of calcium, or other ion, water hardness. Examples of such materials are citrate, succinate, malonate, carboxymethyl succinate, carboxylate, polycarboxylate and polycetyl carboxylate salts, for example with alkali metal or alkaline earth metal cations, or the corresponding free acids. Specific examples are sodium, potassium and lithium salts of oxydisuccinic acid, mellitic acid, benzene polycarboxylic acids, \( \text{C}_{10}-\text{C}_{22} \) fatty acids and citric acid. Further examples are organic phosphonate type sequestering agents such as those sold by Monsanto under the trade mark DEQUEST and alkylhydroxy phosphonates. Citrate salts and \( \text{C}_{12}-\text{C}_{18} \) fatty acid soaps are preferred. Further builders
are: phosphates such as sodium, potassium or ammonium salts of mono-, di- or tri-poly or oligo-phosphates; zeolites; silicates, amorphous or structured, such as sodium, potassium or ammonium salts.

Other suitable builders are polymers and copolymers known to have builder properties. For example, such materials include appropriate polyacrylic acid, polymaleic acid, and polyacrylic/polymaleic and copolymers and their salts, such as those sold by BASF under the trade mark SOKALAN. The builder is desirably present in an amount of up to 90 wt%, preferably 15 to 90 wt%, more preferably 15 to 75 wt%, relative to the total weight of the tablet. Further details of suitable components are given in, for example, EP-A-694,059, EP-A-518,720 and WO 99/06522.

The tablets can also optionally comprise one or more additional ingredients. These include conventional cleaning composition components such as further surfactants, bleaches, bleach enhancing agents, builders, suds boosters or suds suppressors, anti-tarnish and anti-corrosion agents, organic solvents, co-solvents, phase stabilisers, emulsifying agents, preservatives, soil suspending agents, soil release agents, germicides, pH adjusting agents or buffers, non-builder alkalinity sources, chelating agents, clays such as smectite clays, enzyme stabilizers, anti-limescale agents, colourants, dyes, hydrotropes, dye transfer inhibiting agents, brighteners, and perfumes. If used, such optional ingredients will generally constitute no more than 10 wt%, for example from 1 to 6 wt%, of the total weight of the tablets.
Tablets which comprise an enzyme may optionally contain materials which maintain the stability of the enzyme. Such enzyme stabilizers include, for example, polyols such as propylene glycol, boric acid and borax. Combinations of these enzyme stabilizers may also be employed. If utilized, the enzyme stabilizers generally constitute from 0.1 to 1 wt% of the tablets.

Preferred dishwashing tablets are adapted to be used in automatic dish washing machines. Due to their specific requirements specialised formulation is required, and these are illustrated below.

Amounts of the ingredients can vary within wide ranges, however preferred automatic dishwashing cleaning composition tablets herein (which typically have a 1% aqueous solution pH of above 8, more preferably from 9.5 to 12, most preferably from 9.5 to 10.5) are those wherein there is present: from 5% to 90%, preferably from 5% to 75%, of builder; from 0.1% to 40%, preferably from 0.5% to 30%, of bleaching agent; from 0.1% to 15%, preferably from 0.2% to 10%, of the surfactant system; from 0.001% to 1%, preferably from 0.001% to 0.05%, of a metal-containing bleach catalyst; and from 0.1% to 40%, preferably from 0.1% to 20% of a water-soluble silicate. Such fully-formulated embodiments typically further comprise from 0.1% to 15% of a polymeric dispersant, from 0.01% to 10% of a chelant, and from 0.0001% to 10% of a detergents enzyme, though further additional or adjunct ingredients may be present.

Non-ionic surfactants useful in ADW (Automatic Dish Washing) tablets of the present invention desirably include surfactant(s) at levels of from 1% to 10% of the composi-
In general, bleach-stable surfactants are preferred. Non-ionic surfactants generally are well known, being described in more detail in Kirk Othmer's Encyclopedia of Chemical Technology, 3rd Ed., Vol. 22, pp. 360-379, "Surfactants and Detersive Systems", incorporated by reference herein.

Preferably an ADW tablet comprises at least one non-ionic surfactant. One class of non-ions are ethoxylated non-ionic surfactants prepared by the reaction of a monohydroxy alkanol or alkylphenol with 6 to 20 carbon atoms with preferably at least 12 moles, particularly preferably at least 16 moles, and still more preferably at least 20 moles of ethylene oxide per mole of alcohol or alkylphenol.

Particularly preferred non-ionic surfactants are formed from a linear chain fatty alcohol with 16-20 carbon atoms and at least 12 moles, particularly preferably at least 16 moles, and still more preferably at least 20 moles, of ethylene oxide, per mole of alcohol.

The non-ionic surfactant may additionally comprise propylene oxide (PO) units in the molecule. Preferably the PO units constitute up to 25% by weight, preferably up to 20% by weight and still more preferably up to 15% by weight of the overall molecular weight of the non-ionic surfactant. Particularly preferred surfactants are ethoxylated monohydroxy alkanols or alkylphenols, which additionally comprises polyoxyethylene-polyoxypropylene block copolymer units. The alcohol or alkylphenol portion of such surfactants constitutes more than 30%, preferably more than 50%,
more preferably more than 70% by weight of the overall molecular weight of the non-ionic surfactant.

Another class of non-ionic surfactants includes reverse block copolymers of polyoxyethylene and polyoxypropylene and block copolymers of polyoxyethylene and polyoxypropylene initiated with trimethylolpropane.

Another preferred non-ionic surfactant can be described by the formula:

$$R^1O\left[CH_2CH(CH_3)O\right]x[CH_2CH_2O]_y[CH_2CH(OH)R^2]$$

wherein $R^1$ represents a linear or branched chain aliphatic hydrocarbon group with 4-18 carbon atoms or mixtures thereof, $R^2$ represents a linear or branched chain aliphatic hydrocarbon rest with 2-26 carbon atoms or mixtures thereof, $x$ has a value between 0.5 and 1.5 and $y$ has a value of at least 15.

Another group of preferred nonionic surfactants are the end-capped polyoxyalkylated non-ions of formula:

$$R^1O\left[CH_2CH\left(R^3\right)O\right]x[CH_2]_kCH(OH)[CH_2]_jOR^2$$

wherein $R^1$ and $R^2$ represent linear or branched chain, saturated or unsaturated, aliphatic or aromatic hydrocarbon groups with 1-30 carbon atoms, $R^3$ represents a hydrogen atom or a methyl, ethyl, n-propyl, iso-propyl, n-butyl, 2-butyl or 2-methyl-2-butyl group, $x$ has a value between 1 and 30 and, $k$ and $j$ have values between 1 and 12, preferably between 1 and 5. When the value of $x$ is $>2$ each $R^3$ in the formula above can be different. $R^1$ and $R^2$
are preferably linear or branched chain, saturated or unsaturated, aliphatic or aromatic hydrocarbon groups with 6-22 carbon atoms, where groups with 8 to 18 carbon atoms are particularly preferred. For the group R_3 H, methyl or ethyl are particularly preferred. Particularly preferred values for x are from 1 and 20, preferably from 6 to 15.

As described above, when x ≥ 2, each R^3 in the formula can be different. For example, when x=3, the group R^3 could be chosen to build ethylene oxide (R^3=H) or propylene oxide (R^3=methyl) units which can be used in every single order for example (PO) (EO) (EO), (EO) (PO) (EO), (EO) (EO) (EO), (PO) (EO) (PO), (PO) (EO) (PO), (PO) (PO) (EO) and (PO) (PO) (PO).

The value 3 for x is only an example and bigger values can be chosen whereby a higher number of variations of (EO) or (PO) units would arise.

Particularly preferred end-capped polyoxyalkylated alcohols of the above formula are those where k=l and j=l originating molecules of simplified formula:

\[
R^1 O \left[ CH_2 CH (R^3) O \right]_x CH_2 CH (OH) CH_2 OR^2
\]

The use of mixtures of different non-ionic surfactants is particularly preferred in ADW formulations for example mixtures of alkoxyalcohol and hydroxy group containing alkoxyalcohol.

A tablet disintegrant could be present in the tablets, for example a water-swellable cellulosic compound.

The cleaning tablets of the present invention can suitably be manufactured using a variety of processes; for example
by pressing under pressure. Depending on the demands placed on the dissolution behaviour and stability in storage and transport, and depending on the nature of the ingredients, the appropriate pressing pressure can be set accordingly.

A further preferred manufacturing process is compacting, which is understood in this application to mean pressing agglomeration without the use of binders, which is usually performed by rollers rotating in opposite directions and possessing grooves of the appropriate dimensions. With this production process, it is also possible to use other ingredients, which are usually not suitable for pressing, because the pressures during compacting are considerably lower.

Tablets accordingly to the invention may be manufactured using procedures other than compacting (such as extrusion / injection moulding), and non-compacting methods may provide greater flexibility with regard to the manufacturing process.

A cleaning tablet of the invention may be used in a variety of ways. By way of example, we may refer to use as a dishwasher detergent, as a final rinse in dishwashers, as a detergent in a washing machine or for a hand wash, as a water softener or fabric softening rinse in a washing machine, or as a descaling agent. Other fields of use in the detergent sector are conceivable and possible, such as use as a detergent composition for dissolution in water, for cleaning hard surfaces, such as floors.
Suitably, the tablet is arranged such that N tablets can be employed in a washing method to wash a load which substantially corresponds to a full load of a ware washing machine, and which load has a normal level of soiling, wherein N is 1, 2, 3 or 4. Preferably N is 2 for an automatic dishwasher of the floor standing type. Suitably the tablet is arranged such that the number of tablets employed in the washing method can be adjusted as detailed in the second aspect which follows.

According to a second aspect of the present invention there is provided a method of performing a washing operation characterised in that the method employs one or more tablets according to the first aspect and a quantity of water.

Here it has been found that as the tablets of the present invention are much smaller than conventional commercial detergent tablets they can be accommodated much more easily in a tablet dispenser. This has been found to be of particular significance when a high amount of cleaning agent (i.e. a high number of cleaning tablets is required). A suggested reason for this effect is that a large number of small tablet may be accommodated much more easily in a tablet dispenser than one larger tablet due to flexibility in positioning. For example it has been found to be easier to accommodate three tablets of weight 9g than one large tablet of weight 27g.

This benefit may seem insignificant as the larger tablet could simply be placed in side the operating part of the machine. However, some automatic washing machines (such as dishwashers) operate a pre-wash cycle in which it is
not advantageous to dispense any cleaning formulation. The accommodation of the tablets in the dispenser (which typically does not operate until a main wash cycle) overcomes this disadvantage.

Suitably, the tablets comprise a detergent composition.

Suitably, where the method employs a plurality of tablets the tablets are substantially identical.

Suitably, the method only employs substantially identical tablets according to the first aspect. It may thus not be necessary to use a combination of tablets having distinct formulations.

Preferably, the method comprises washing articles in an automatic ware washing machine. More preferably the method comprises washing articles, for example crockery, within an automatic dishwashing machine.

Preferably, the method comprises the step of determining whether one or more tablets are required depending on the level of soiling and the quantity of articles to be washed.

Suitably, for a load having a normal level of soiling and which load substantially corresponds to a full load of a ware washing machine, the method will use N tablets.

Suitably, N = 1 to 4. Suitably for a domestic dish washer of the floor standing type, N = 2, 3 or 4, preferably 2.
Suitably, for a load having a heavy level of soiling and which load substantially corresponds to a full load of the ware washing machine the method will use \( N + A \) tablets.

Suitably, \( A = 0 \) to 2. Suitably, \( A > 0 \) and \( \leq (N - 1) \).
Suitably, for a domestic dish washer of the floor standing type \( A = 1 \) or 2, preferably 1.

Suitably, for a load having a light level of soiling and which load substantially corresponds to a full load of the ware washing machine the method will use \( N - B \) tablets.

Suitably, \( B = 0 \) to 2. Suitably, \( B > 0 \) and \( \leq (N - 1) \).
Suitably, for a domestic dish washer of the floor standing type \( B = 1 \) or 2, preferably 1.

Suitably, for a load having a normal level of soiling and which load substantially corresponds to a half load of the ware washing machine the method will use \( N - C \) tablets.

Suitably, \( C = 0 \) to 2. Suitably, \( C > 0 \) and \( \leq (N - 1) \).
Suitably, for a domestic dish washer of the floor standing type \( C = 1 \) or 2, preferably 1.

Suitably, for a given ware washing machine and tablet combination \( N, A, B \) and \( C \) have fixed values. Suitably, for a domestic dishwasher of the floor standing type \( A, B \) and \( C \) have the same value. Thus variation of the "dose" of tablets may thus be simple for a user to perform.

For a domestic dish washer of the table top type \( N \) may be 1 or 2, suitably 1. In this case suitably \( B \) and \( C \) are 0. In this case \( A \) may also be 0. Whilst it may thus not be
possible to vary the "dose" in the same manner this may not be problematic since such a dishwasher is, for example, less likely to be operated part loaded.

The terms "normal level of soiling", "heavy level of soiling" and "light level of soiling" as well as "full load" and "half load" are somewhat subjective and will, to a degree, be a matter of judgement for a user. Their judgement may depend in part on the efficiency of their machine and on the water characteristics. However, it will be apparent to a user which situation is most likely to apply in any given case and a user can thus make the determination outlined above and calculate the number of tablets to use according to the basic criteria given above.

Suitably, the determination step comprises a user noting the extent of soiling of the articles to be washed, noting the extent to which a machine is loaded and determining whether N tablets should be used or if an adjustment needs to be made. Suitably, a value for N will be provided with the tablets. Suitably, if an adjustment is required a user will use a value for A, B or C provided with the tablets.

According to a third aspect of the present invention there is provided a packaged product comprising a packet containing one or more tablets according to the first aspect; preferably at least two tablets, more preferably at least three tablets, and most preferably at least four tablets. Suitably the packet contains up to ten tablets, preferably up to eight tablets, and most preferably up to six tablets.
Suitably, the tablets are substantially identical.

Suitably, the packet comprises a plastics wrapper providing a water tight container for one or more tablets.

Suitably, the packaged product comprises instructions for varying the "dose" of tablets employed to perform a washing operation.

Suitably, the instructions comprise instructions for performing a method according to the second aspect.

Suitably, the instructions include values for N, A, B and C as described in the second aspect.

Suitably, the packet comprises N tablets. Suitably, N is 2.

The present invention will now be illustrated by way of example.

Example 1

Cleaning tablets of cuboid shape having a length of 24mm, a width of 16mm and a thickness of 14mm were produced by tabletting a tablet composition to provide a tablet having a mass of around 9g.
The tablets had the following formulation:

<table>
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<tr>
<th>Ingredient</th>
<th>Total (%w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na$_2$CO$_3$·H$_2$O$_2$</td>
<td>10-15</td>
</tr>
<tr>
<td>Na$_3$P$_3$O$_10$</td>
<td>15-40</td>
</tr>
<tr>
<td>Na$_3$C$_2$H$_5$O$_7$</td>
<td>0-20</td>
</tr>
<tr>
<td>NaHCO$_3$</td>
<td>0-5</td>
</tr>
<tr>
<td>Na$_2$CO$_3$</td>
<td>10-40</td>
</tr>
<tr>
<td>Polyethylene glycol</td>
<td>2-6</td>
</tr>
<tr>
<td>Phosphonate</td>
<td>0-1.5</td>
</tr>
<tr>
<td>Polymer</td>
<td>0-5</td>
</tr>
<tr>
<td>TAED</td>
<td>0-5</td>
</tr>
<tr>
<td>Amylase</td>
<td>0-2</td>
</tr>
<tr>
<td>Protease</td>
<td>0-2</td>
</tr>
<tr>
<td>Dye</td>
<td>0-0.5</td>
</tr>
<tr>
<td>Nonionic</td>
<td>1-5</td>
</tr>
<tr>
<td>Anti-Corrosion Agent</td>
<td>0-1</td>
</tr>
<tr>
<td>Perfume</td>
<td>0-0.5</td>
</tr>
<tr>
<td>Water</td>
<td>Balance</td>
</tr>
<tr>
<td>Total (%w/w)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The tablets were produced according to the following method. Solid raw materials are weighed separately into the mixing vessel. Liquids are weighed and added to the mixture. Raw materials are combined in a commercial mixer for 10 minutes. Mixtures are then emptied into drums and transferred to the storage vessel of a rotary press. A rotary press is used to press the tablets, the final compression forces are on average 34 kN.
APPLICATION EXAMPLES

Application Example 1

The bleach capability (and other cleaning capabilities) was tested in a Miele G651SC Plus dishwashing machine using a 50°C cycle, according to the method IKW. The formulation was added at the start of the dishwasher main wash cycle. The water hardness was 9°gH. The results (given in Table 1) are expressed in percentages with 100% being the best score for a particular property.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Formulation</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Ex. 1</td>
</tr>
<tr>
<td>Stain</td>
<td></td>
</tr>
<tr>
<td>Bleachable (Tea)</td>
<td>32</td>
</tr>
<tr>
<td>Starch</td>
<td>96</td>
</tr>
<tr>
<td>Protein</td>
<td>59</td>
</tr>
<tr>
<td>Burnt-on (milk)</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Av. 70</td>
</tr>
</tbody>
</table>

Comp 1 is a commercially available dishwashing tablet weighing 19g having a similar formulation to Example 1.

The results show a small tablet in accordance with the present invention is able to active comparable performance to a much larger commercially available tablet for the majority of the washing criteria measured. Further with the use of two small tablets in accordance with the present
invention much improved performance over all of the washing criteria measured is achieved.

It is to be understood that the invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification, or to any novel one, or any novel combination, of the steps of any method or process so disclosed.
Claims

1. A cleaning tablet for use in a washing operation, characterised in that the tablet has a mass of between 1g and 15g such that it can be used singularly or with one or more other like tablets depending upon a required washing performance.

2. A tablet according to claim 1, comprising a detergent composition.

3. A tablet according to Claim 1 or 2, comprising a water-softening composition.

4. A tablet according to any preceding claim, wherein the tablet is for a ware washing machine.

5. A tablet according to claim 4, wherein the tablet is for an automatic dish washing machine.

6. A tablet according to claim 5, except when dependent on claim 3, wherein the tablet comprises a single function detergent tablet which comprises a detergent composition and is substantially free from dishwasher salt function or rinse aid function.

7. A tablet according to Claim 6, wherein the tablet has a mass of between 1g and 7g.

8. A tablet according to claim 7, wherein the tablet has a mass of between 5g and 13g.
9. A method of performing a washing operation characterised in that the method employs one or more tablets according to any of the preceding claims and a quantity of water.

10. A method according to Claim 9, wherein, where the method employs a plurality of tablets the tablets are substantially identical.

11. A method according to Claim 9 or 10, wherein the method comprises the step of determining whether one or more tablets are required depending on the level of soiling and the quantity of articles to be washed.

12. A method according to any of Claims 9 to 11, wherein the method comprises the step of determining whether one or more tablets are required depending on the level of water hardness.

13. A method according to any of Claims 9 to 12, wherein the method comprises washing articles in an automatic ware washing machine.

14. A method according to Claim 13, wherein the tablets comprise detergent composition and the method comprises washing articles in an automatic dishwashing machine.

15. A method according to Claim 14, wherein the dishwashing machine comprises a domestic dishwasher of the floor standing type, and for a load having a normal level of soiling and which load substan-
16. A method according to Claim 14 or 15, wherein the dishwashing machine comprises a domestic dishwasher of the floor standing type, and for a load having a heavy level of soiling and which load substantially corresponds to a full load of the dishwashing machine the method uses $N + A$ tablets where $N = 2$, 3, or 4 and $A > 0$ and $≤ (N - 1)$.

17. A method according to any of Claims 14 to 16, wherein the dishwashing machine comprises a domestic dishwasher of the floor standing type, and for a load having a light level of soiling and which load substantially corresponds to a full load of the dishwashing machine the method uses $N - B$ tablets where $N = 2$, 3, or 4 and $B > 0$ and $≤ (N - 1)$.

18. A method according to any of Claims 14 to 17, wherein the dishwashing machine comprises a domestic dishwasher of the floor standing type, and for a load having a normal level of soiling and which load substantially corresponds to a half load of the dishwashing machine the method uses $N - C$ tablets where $N = 2$, 3, or 4 and $C > 0$ and $≤ (N - D)$.

19. A packaged product comprising one or more tablets according to any of Claims 1 to 8.
20. A packaged product according to Claim 19 and further comprising instructions for varying the dose of tablets to perform a method according to any of claims 9 to 16.

21. A packaged product according to Claim 19 or 20, wherein the tablets are substantially identical.
INTERNATIONAL SEARCH REPORT

International application No PCT/GB2006/002397

A. CLASSIFICATION OF SUBJECT MATTER

INV. C11D17/00

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)

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents

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'O' document referring to an oral disclosure, use, exhibition or other means

'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Y' document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

'Z' document member of the same patent family

Date of the actual completion of the international search: 18 September 2006

Date of mailing of the international search report: 26/09/2006

Name and mailing address of the ISA:
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Tel (+31-70) 340-2040, Tx 31651 epo nl
Fax (+31-70) 340-3016

Authorized officer:
Pfannenstein, Heide
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