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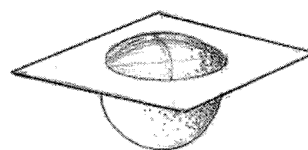
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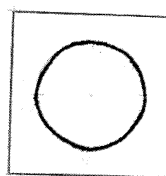
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(54) **Unit dose detergent for cleaning a coffee machine**

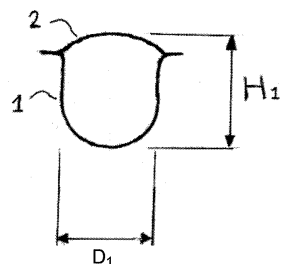
(57) The present invention relates to a unit dose detergent for cleaning a hot and cold drink vending machine comprising a water-soluble capsule filled with a detergent composition, wherein the capsule has a substantially spherical shape with a largest cross-sectional dimension of 1-2.5 cm, and to a method of cleaning a hot and cold drink vending machine by dissolving said unit dose detergent in water in the water tank of the machine, and discharging the tank after dissolution.



A



B



C

Figure 1

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Description

[0001] The invention relates to a unit dose detergent for cleaning a hot and cold drink vending machine and to a method of cleaning such machine by dissolving the unit dose detergent in the water tank thereof.

[0002] Unit dose detergents enclosed by a water-soluble membrane are well known for various types of cleaning applications. WO 97/35955 discloses a cleaning concentrate packed in measured doses in water-soluble capsules. The dry detergent is pressed in tablet form. US 6,514,429 also discloses cleaning compositions in the form of tablets. However, tablets possess the disadvantage that they generally show a slow dissolution behaviour.

[0003] Certain cleaning applications, for instance the cleaning of coffee machines, require an extremely short dissolution time that typically is not possible to achieve using tablets.

[0004] To decrease dissolution time, EP 1 591 515 discloses powder unit doses in a flat sachet form. However, this form also possesses some disadvantages. In coffee cleaning application, a square and flat sachet tends to get stuck upon dosing due to the complex and narrow funnel arrangement within the machine and can easily stick to surfaces in the machine. In addition, dispensing of a flat PVA sachet from a jar is difficult. Finally, due to the nature of the PVA material and environmental conditions the sachets tend to attract moisture and to stick together during storage.

[0005] It is therefore an objective of the present invention to provide a unit dose detergent that does not display the above problems and disadvantages.

[0006] The present invention provides a unit dose detergent comprising a water-soluble capsule filled with a detergent composition, wherein the capsule has a substantially spherical shape, with a largest cross-sectional dimension of 1-2.5 cm, preferably of 1-2 cm, more preferably of about 1.5 cm.

[0007] Figure 1 shows a schematic drawing of the capsule according to the invention, in perspective view (A), top view (B) and side view (C). Figure 1C depicts the capsule having a length H_1 of the middle axis and a diameter D_1 as measured perpendicular to the middle axis H_1 , and a bottom film 1 and a top film 2.

[0008] Within the context of the invention, the term "substantially spherical" is used to define a shape of the capsule wherein the ratio between the length of the middle axis H_1 and the diameter D_1 as measured perpendicular to the middle axis is between 0.5 and 1.6, preferably between 0.8 and 1.5, more preferably between 0.9 and 1.4, most preferably between 0.9 and 1.3. The substantially spherical shape may be somewhat flattened at one side, typically the side where the capsule is closed.

[0009] Due to its substantially spherical shape, the capsule may advantageously be packed in a jar provided with a dispensing opening sufficient to release one capsule at a time. Even when stored for a longer time the capsule still can be dispensed easily from the jar. As dispensing from a jar is easy, there is no need for manually picking capsules out of the jar, thus avoiding the risk of moisture contamination of the capsules. Moisture contamination would destroy the total content of the container.

[0010] The capsule according to the invention is suitable for quick cleaning cycles of food and beverage service applications where manual dosing of cleaning chemicals is desired. Cleaning cycles used in this area normally use very small quantities of water and the level of both pressure and agitation applied on this water is very low. For this reason superior dissolution is crucial.

[0011] Thus, the capsule of the invention is able to dissolve quickly during the cleaning cycle, thereby increasing the efficiency of the cleaning operation significantly, and further eliminating the disintegration and food/detergent contact risks. It does not dissolve during handling but dissolves quickly during the cleaning cycle.

[0012] Within the context of the invention, "quickly" means that the capsule dissolves within 2 min, preferably within 1 min, more preferably within 45 sec, most preferably (almost) instantly when bringing it in contact with water.

[0013] The term "hot and cold drink vending machine" within the context of the present inventions includes machines for food and beverage service applications like hot and cold drink vending machines, particularly such as machines for making coffee, espresso, cappuccino, tea, chocolate, and the like.

[0014] The capsule may be of any substance capable of quickly dissolving, disintegrating or dispersing in the wash liquor to deliver the contained unit dose detergent composition. As used herein, the term "capsule" means any rigid or non rigid enclosure, whether seamless or made of two or more portions, of sheet or other material bonded or sealed to make the closed capsule containing the detergent composition. Optionally, it may comprise two or more compartments, e.g. to keep separate mutually incompatible components.

[0015] The substance capable of dissolving, disintegrating or dispersing in the wash liquor preferably is a water-soluble polymer as defined below. The term "water-soluble polymer" refers to a polymer that dissolves completely in water within at the most a few minutes after dispensing in water. The water-soluble polymer further exists in the form of a film or sheet having proper strength and heat-sealability, to permit machine handling during the method of making the water-soluble capsule. There further should be a proper balance between shelf life of the capsule and thickness of the capsule material. Process conditions for preparing the capsules may be accommodated to take into account this balance.

[0016] Any water-soluble polymer possessing the above features is suitable for use in the capsule of the invention.

[0017] Preferred water-soluble resins include polyvinyl alcohol, cellulose ethers, polyethylene oxide, starch, polyvi-

nylpyrrolidone, polyacrylamide, polyvinyl methyl ethermaleic anhydride, polymaleic anhydride, styrene maleic anhydride, hydroxyethylcellulose, methylcellulose, polyethylene glycols, carboxymethylcellulose, polyacrylic acid salts, alginates, acrylamide copolymers, guar gum, casein, ethylene-maleic anhydride resin series, polyethyleneimine, ethyl hydroxyethylcellulose, ethyl methylcellulose, hydroxyethyl methylcellulose. Lower molecular weight water-soluble, polyvinyl alcohol film-forming resins are preferred.

[0018] The water-soluble polymer is preferably a cold water-soluble PVA (polyvinyl alcohol). Such polymers are known in the art. For instance in US patent No. 4,844,828 a detergent dispenser which comprises a powder detergent and a pouch or bag containing the powder detergent has been disclosed, wherein the pouch is made of a cold water-soluble polyvinyl alcohol derivative. These polyvinyl alcohols can be applied as a water-soluble polymer for water-soluble films and in other fields. PVA which has a degree of saponification ranging from 80 to 95 mole % exhibits rapid water solubility. PVA which has a degree of saponification of at least 98 mole % is less suitable since it dissolves in water when it is allowed to stand in the water for a long period of time or if it is placed into hot water.

[0019] The detergent composition comprises the usual detergent components, including sequestering agents, persalts, scale inhibitors, alkaline components and, optionally, auxiliary agents.

[0020] Preferred sequestering agents are compounds that have a strong complexation with or bonding to calcium and magnesium. Most preferred are sodium or potassium salts of NTA (nitrilotriacetic acid), MGDA (methylglycinediacetic acid), EDTA (ethylenediamine tetraacetic acid), and (S,S)-EDDS (ethylenediamine-N,N'-disuccinic acid), or mixtures thereof. Preferred concentrations of the sequestering agent amount to 20-30 wt. %.

[0021] Preferred persalts are percarbonate and perborate. Preferably, the counter ion is an alkali metal such as sodium or potassium. Preferred peracids are sodium or potassium salts of phthalimidoperhexanoic acid (PAP) and peracetic acid (PAA). Preferred concentrations of the peroxy compound amount to 22-35 wt. %.

[0022] Preferred scale inhibitors are phosphonates such as sodium or potassium salts of ethanehydroxydiphosphonic acid and aminotrimethylenephosphonic acid, and carboxyl-functional polymers such as poly(meth)acrylic acid, and copolymers of (meth)acrylic acid and maleic acid or anhydride. Preferred concentrations of the phosphonate or carboxyl-functional polymer amount to 3-7 wt. %.

[0023] The alkaline compound may be any compound that is able to bring the pH to at least 10. Suitable alkaline compounds include metasilicate, granulated or powder-like silicate, disilicate, sodium hydroxide, sodium carbonate, sodium hydrogencarbonate, and the like.

[0024] The composition may further comprise auxiliary compounds to complete the composition to 100 wt. %. Suitable auxiliary compounds include phosphates (such as sodium tri(polyphosphate), sodium pyrophosphate, and sodium orthophosphate), sequestering agents other than those of a), perfumes, colorants, fillers, emulsifiers and the like. These additional compounds may be used as granules or powders, or mixtures thereof.

[0025] The ingredients in the composition are at least partly granular and may be partly powder. The granular components are preferably NTA, sodium percarbonate and sodium metasilicate, but the other component may also be used in granular form. The amount of granular material should be in the range of 30 to 100 wt. %, preferably 40-90 wt. %, more preferably 60-80 wt. %. The granular material is material with a particle size ranging from 250-800 μm , preferably be about 300-750 μm , most preferably 350-500 μm . The BET specific surface area is less than 100 m^2/g , preferably less than 90 m^2/g , most preferably less than 80 m^2/g .

[0026] The detergent composition comprising granules, or optionally a mixture of granules and powder, preferably includes a persalt or peracid as ingredient which creates some degree of agitation of the cleaning solution by gas release without neutralization of the cleaning solution, thereby increasing the dissolution rate.

[0027] Due to the presence of granular material in the composition, the active ingredients in the capsule are made available in the cleaning solution almost as quickly as when a liquid detergent would have been used. It also provides complete cleaning in the same time as a liquid detergent without encountering all the problems that are associated with the use of liquid detergents.

[0028] A preferred composition for the unit dose capsule comprises:

- a) 10-40 wt. % of a sequestering agent;
- b) 15-50 wt. % of a persalt or peracid;
- c) 0.1-10 wt. % of a scale inhibitor selected from phosphonate and a carboxyl-functional polymer;
- d) a sufficient amount of an alkaline compound to obtain a pH of at least 10 when the composition is dissolved in water; and
- e) optionally, to a total of 100 wt. % of ingredients a) to e) of at least one auxiliary agent;

wherein 30-100 wt. % of the total of a) to e) is in the form of granules having a mean particle size 250-800 μm , a BET specific surface area of less than 100 m^2/g , and a dissolution rate of less than 1 min in 100 ml of water of 90° C. It is preferred to obtain as much as possible granules in the composition, but practically the amount is restricted because of the commercial availability of the ingredients in the form of granules. Practically, therefore a total amount of 40-60 wt.

% granules is preferred.

[0029] An example of a suitable detergent has a composition as follows:

5	sodium tri(polyphosphate)	10 wt.% powder
	sodium NTA	24 wt.% granules
	sodium percarbonate	30 wt.% granules
	sodium metasilicate	14 wt.% granules
	sodium carbonate	17 wt.% powder
10	tetrasodium acetodiphosphonate	5 wt.% powder

All granular constituents have a particle size within the range 250-500 μm .

[0030] The present invention surprisingly shows the feasibility of preparing the unit dose surrounded by a water-soluble material in the shape according to the invention by a simple and cheap thermoforming method. The method comprises thermoforming a first sheet of water-soluble material (1 in Figure 1) to form recesses in the sheet using a forming die with cavities corresponding generally to the dimensions of the capsules to be produced, adding detergent composition to the thus-formed recesses, covering the recesses with a second sheet (2 in Figure 1) and heat-sealing the first and second sheet.

[0031] Successful manufacture of the capsule requires conical cavities with rounded edges for optimal film material distribution in the cavities leading to optimal wall thickness. Each cavity further includes a raised surrounding flange. Further, a single heating plate is used for thermoforming the film for all the cavities, and in the same way a single sealing plate is used.

[0032] A first sheet of polyvinyl alcohol film is drawn over a forming die so that the film is placed over the plurality of forming cavities in the die. In order to maximise capsule strength the film is delivered to the forming die in a crease free form and with minimum tension. In the forming step, the film is heated to 100 to 120° C., preferably approximately 110° C., for up to 5 seconds, preferably approximately 700 micro seconds. A heating plate is used to heat the film, which plate is positioned to superpose the forming die. During this preheating step, a vacuum of 0.5 bar is pulled through the pre-heating plate to ensure intimate contact between the film and the pre-heating plate, this intimate contact ensuring that the film is heated evenly and uniformly (the extent of the vacuum is dependant of the thermoforming conditions and the type of film used, however in the present context a vacuum of less than 0.6 bar was found to be suitable). Non-uniform heating results in a formed capsule having weak spots. In addition to the vacuum, it is possible to blow air against the film to force it into intimate contact with the preheating plate.

[0033] The thermoformed film is moulded into the cavities blowing the film off the heating plate and/or by sucking the film into the cavities thus forming a plurality of recesses in the film that, once formed, are retained in their thermoformed orientation by the application of a vacuum through the walls of the cavities. This vacuum is maintained at least until the capsules are sealed. Once the recesses are formed and held in position by the vacuum, a granular detergent composition according to the invention is added to each of the recesses. A second sheet of polyvinyl alcohol film (top sheet) is then superposed onto the first sheet (bottom sheet) across the filled recesses and heat-sealed thereto using a sealing plate. In this case the heat-sealing plate, which is generally flat, operates at a temperature of about 140 to 160° C., and contacts the films for 1 to 2 seconds and with a force of 8 to 30 kg/cm², preferably 10 to 20 kg/cm². The raised flanges surrounding each cavity ensure that the films are sealed together along the flange to form a continuous seal.

[0034] Once sealed, the capsules formed are separated from the web of sheet film using cutting means. At this stage it is possible to release the vacuum on the die, and eject the formed capsules from the forming die. In this way the capsules are formed, filled and sealed while nested in the forming die. In addition they may be cut while in the forming die as well.

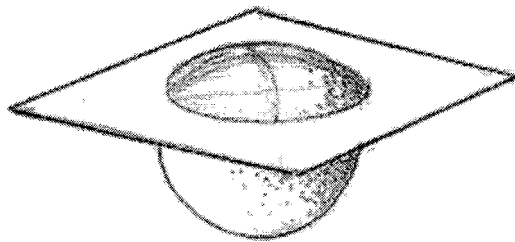
[0035] During the forming, filling and sealing steps of the process, the relative humidity of the atmosphere is controlled to ca. 50% humidity. This is done to maintain the heat-sealing characteristics of the film. When handling thinner films, it may be necessary to reduce the relative humidity to ensure that the films have a relatively low degree of plasticization and are therefore stiffer and easier to handle.

[0036] In the finalized capsules, the tension existing in the bottom film 1 due to the thermoforming advantageously is partially released into the top film 2 used for covering, causing bulging of the top film (see Figure 1 C).

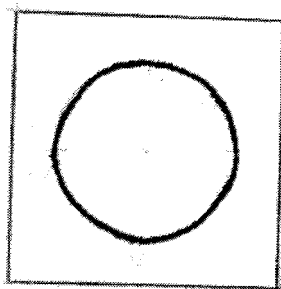
[0037] A suitable method for cleaning coffee machines is to dose the capsule containing the detergent composition to the water tank (also known as brewer) and to add water. For instance, the brewer is charged with the sachet and 20 ml of water having a temperature of 90° C to 95° C. After a delay time of about 10 seconds to allow the capsule to dissolve at least partially, the brewer is filled by charging an additional amount of 80 ml of water of 90° C to 95° C. The capsule and granule/powder mixture quickly dissolve. The brewer stays filled with the cleaning solution for 40 seconds, which allows complete dissolution and gives excellent brewer cleaning. The brewer is then discharged and flushed to remove all traces of detergent.

Claims

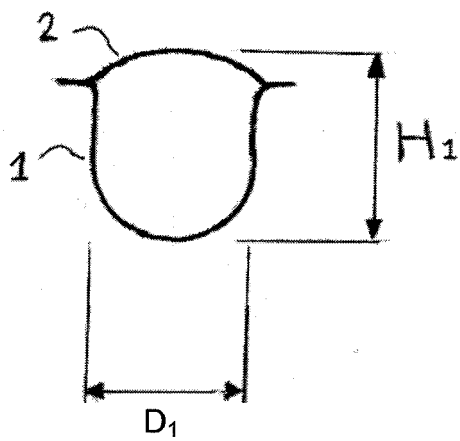
1. A unit dose detergent for cleaning a hot and cold drink vending machine comprising a water-soluble capsule filled with a detergent composition, wherein the capsule has a substantially spherical shape with a largest cross-sectional dimension of 1-2.5 cm.
2. The unit dose detergent of claim 1 wherein the capsule has a middle axis (H_1) and a diameter (D_1) as measured perpendicular to the middle axis and the ratio between the length of the middle axis (H_1) and the diameter (D_1) is between 0.5 and 1.6.
3. The unit dose detergent of claim 1 or 2 comprising:
 - a) 10-40 wt.% of a sequestering agent;
 - b) 15-50 wt.% of a persalt or peracid;
 - c) 0.1-10 wt.% of a scale inhibitor selected from phosphonate and a carboxyl-functional polymer;
 - d) a sufficient amount of an alkaline compound to obtain a pH of at least 10 when the composition is dissolved in water; and
 - e) optionally, to a total of 100 wt.% of ingredients a) to e) of at least one auxiliary agent;
 wherein 30-100 wt.% of the total of a) to e) is in the form of granules having a mean particle size 250-800 μm , a BET specific surface area of less than 100 m^2/g , and a dissolution rate of less than 1 min in 100 ml of water of 90° C.
4. The unit dose detergent of any one of the preceding claims wherein the capsule is made of polyvinylalcohol.
5. The unit dose detergent of any one of the preceding claims wherein the composition comprises:
 - a) 20-30 wt.% of the sequestering agent;
 - b) 25-35 wt.% of the persalt or peracid; and
 - c) 3-7 wt.% of the scale inhibitor;
 wherein 60-80 wt.% of the total of a) to d) is in the form of granules having a particle size of 300-750 μm .
6. The unit dose detergent of claim 5 wherein the composition further comprises a phosphate and optionally other auxiliary agents.
7. The unit dose detergent of claim 5 or 6 wherein the sequestering agent is NTA, MGDA, EDTA, (S,S)-EDDS, or a mixture thereof.
8. The unit dose detergent of any one of claims 5-7 wherein b) is alkali metal percarbonate or perborate.
9. The unit dose detergent of any one of claims 5-8 wherein the scale inhibitor is a phosphonate.
10. A storage container with a dispensing opening containing the unit dose detergent of any one of the preceding claims.
11. A method of cleaning a hot and cold drink vending machine by dissolving the unit dose detergent of any one of claims 1-9 in water in the water tank of the machine, and discharging the tank after dissolution.



A



B



C

Figure 1



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 0656

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Place of search The Hague		Date of completion of the search 15 August 2006	Examiner Bertran Nadal, J
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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