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(54) **UNIT-DOSE ARTICLE WITH PRINTED INDICIUM**

(57) A unit-dose article comprising a water-soluble film which encompasses an inner volume enclosed by the water-soluble film; a composition, wherein the composition is contained within the inner volume; and a

printed indicium on a surface of the film, wherein the printed indicium comprises a black pigment, characterised in that the black pigment comprises less than 10% by weight of carbon black.

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Description

FIELD OF THE INVENTION

- 5 **[0001]** The present invention is in the field of unit-dose articles. In particular it relates to a unit-dose article comprising a printed indicium and a method of making the unit-dose article.

BACKGROUND OF THE INVENTION

- 10 **[0002]** Often it is desirable to print on water-soluble films. For some applications, such as water-soluble unit dose articles, the water-soluble films used can be quite thin, the thickness is usually in the micron range. The films can be subjected to heat, followed by stretching during manufacturing of water-soluble unit dose articles made from those films. It has been found that some inks can promote the formation of defects on the films during such heating-stretching transformation that can have a negative impact on the mechanical properties of the film, including premature rupture
 15 upon exposure to water. Some inks have also been found to cause the film becoming over-stretched in the printed area, leading to distorted printed images. These effects seem to be more acute when the printing ink comprises black pigments.
[0003] The objective of the present invention is to provide a unit-dose article made from a water-soluble film that maintains its mechanical properties even after a black printed indicium has been applied to it.

20 SUMMARY OF THE INVENTION

- [0004]** According to the first aspect of the invention there is provided a unit-dose article. The unit-dose article comprises a water-soluble film. The water-soluble film creates an inner volume that houses a composition, preferably a detergent composition. Preferably, the water-soluble film comprises polyvinyl alcohol. Preferably the water-soluble film has a
 25 thickness of from 10 to 200 microns, more preferably from 20 to 100 microns. The water-soluble film has a printed indicium on its surface. The printed indicium comprises a black pigment. The black pigment comprises less than 10% by weight of carbon black.
[0005] According to the second aspect of the invention there is provided a process for making the unit-dose article of the invention.
 30 **[0006]** The elements of the unit-dose article described in relation to the first aspect of the invention apply *mutatis mutandis* to the second aspect of the invention.

DETAILED DESCRIPTION OF THE INVENTION

- 35 **[0007]** As used herein, the articles including "the," "a" and "an" when used in a claim or in the specification, are understood to mean one or more of what is claimed or described.
[0008] As used herein, the terms "include," "includes" and "including" are meant to be non-limiting.
[0009] The term "substantially free of" or "substantially free from" as used herein refers to either the complete absence of an ingredient or a minimal amount thereof merely as impurity or unintended byproduct of another ingredient. A composition
 40 that is "substantially free" of/from a component means that the composition comprises less than about 0.5%, 0.25%, 0.1%, 0.05%, or 0.01%, or even 0%, by weight of the composition, of the component.
[0010] All percentages, ratios and proportions used herein are by weight percent of the composition, unless otherwise specified. All average values are calculated "by weight" of the composition, unless otherwise expressly indicated. All measurements are performed at 25°C unless otherwise specified.
 45 **[0011]** Unless otherwise noted, all component or composition levels are in reference to the active portion of that component or composition, and are exclusive of impurities, for example, residual solvents or by-products, which may be present in commercially available sources of such components or compositions.

Unit-dose article

- 50 **[0012]** The present invention relates to a unit-dose article. The unit-dose article comprises a water-soluble film which encompasses an inner volume enclosed by the water-soluble film. The inner volume houses a composition. The unit-dose article comprises a printed indicium on a surface of the film.
[0013] The unit-dose article can have a single compartment or more than one compartment. Multiple compartments, also referred to herein as multi-compartment, unit-dose articles comprise two or more compartments.
 55 **[0014]** Preferably, the unit-dose article comprises a liquid composition. Preferably, the unit-dose article comprises a detergent composition. Preferably, the unit-dose article comprises a liquid detergent composition.
[0015] The water-soluble film is sealed such that the composition does not leak out of the compartments during storage.

However, upon addition of the water-soluble unit-dose article to water, the water-soluble film dissolves and releases the contents of the internal compartment into water.

[0016] Each compartment should be understood as meaning a closed internal space within the unit-dose article, which holds the composition, preferably a detergent composition. The unit-dose article is manufactured such that the water-soluble films completely surround the composition and in doing so defines the compartment in which the composition resides. The film is described in more detail below.

[0017] The unit-dose article can comprise one or more compartments, two or even at least three compartments, or even at least four compartments, in which preferably at least two compartments are present in a superposed position, i.e. one positioned on top of the other. The unit-dose article may further comprise compartments positioned in a side-by-side orientation, i.e. one orientated next to the other, or even be orientated in a 'tyre and rim' arrangement, i.e. a first compartment is positioned next to a second compartment, but the first compartment at least partially surrounds the second compartment, but does not completely enclose the second compartment, or alternatively, one compartment may be completely enclosed within another compartment.

[0018] One of the compartments may be smaller than the other compartment. Wherein the unit-dose article comprises at least three compartments, two of the compartments may be smaller than the third compartment, and preferably the smaller compartments are superposed on the larger compartment. Wherein the unit-dose article comprises at least four compartments, three of the compartments may be smaller than the fourth compartment, and preferably the smaller compartments are superposed on the larger compartment. The superposed compartments preferably are orientated side-by-side.

[0019] Each compartment may comprise the same or different compositions. The different compositions could all be in the same form, or they may be in different forms, for example liquid or powder.

[0020] The water-soluble film comprises an inner surface which is in contact with the composition and an outer surface which is oriented away from the composition, towards the outside environment, the printed indicium can be printed on to the inner or outer surface of the water-soluble film. Preferably, the printed indicium is printed on the inner surface of the water-soluble film, more preferably, the printed indicium is printed on the inner surface of the water-soluble film and the composition is a liquid composition, more preferably a liquid detergent composition.

[0021] Preferably the water-soluble unit-dose article comprises one larger compartment with at least one, preferably at least two, or even at least three smaller compartments superposed thereon. In this case, the printed indicium is preferably found in the inner surface of the outer film of the larger compartment. In the process for making the water-soluble unit-dose article the outer film, on which the indicium is printed, is usually heated and then stretched to form an open cavity that is filled with the detergent composition and then closed with a second film. The second film is usually neither stretched or heated.

[0022] The outer contouring seal area includes or preferably consists of a flange area. A flange area is arranged around the perimeter of the unit-dose article, and the flange comprises sealed film from two, three, or more water-soluble films. In other words, the flange area protrudes out from the unit-dose article and comprises sealed film. By 'seal area' we herein mean both the inner seal area as defined as the areas of film sealed together to define the individual compartments without the presence of a flange as well as the outer seal area defining a flange of the water-soluble unit-dose article. Herein the flange excludes the inner seal areas. Preferably, the flange comprises sealed film from at least a first water-soluble film and a second water-soluble film and a third water-soluble film if present. The inner seal area can be created by sealing two water-soluble films together to create physically separated individual compartments or can be created by sealing at least three films together to create physically separated individual compartments. Preferably the inner seal is created by sealing solely two water-soluble films together.

Water-soluble film

[0023] The film of the present invention is soluble or dispersible in water. The water-soluble film preferably has a thickness prior to deformation of from 20 to 150 micron, preferably 35 to 125 micron, even more preferably 50 to 110 micron, most preferably about 76 micron.

[0024] Preferably, the film has a water-solubility of at least 50%, preferably at least 75% or even at least 95%, as measured by the method set out here after using a glass-filter with a maximum pore size of 20 microns:

5 grams $\pm$ 0.1 gram of film material is added in a pre-weighed 3L beaker and 2L * 5ml of distilled water is added. This is stirred vigorously on a magnetic stirrer, Labline model No. 1250 or equivalent and 5 cm magnetic stirrer, set at 600 rpm, for 30 minutes at 30°C. Then, the mixture is filtered through a folded qualitative sintered-glass filter with a pore size as defined above (max. 20 micron). The water is dried off from the collected filtrate by any conventional method, and the weight of the remaining material is determined (which is the dissolved or dispersed fraction). Then, the percentage solubility or dispersability can be calculated.

[0025] Preferred film materials are preferably polymeric materials. The film material can, for example, be obtained by casting, blow-moulding, extrusion or blown extrusion of the polymeric material, as known in the art.

[0026] The water-soluble film comprises polyvinyl alcohol polymer wherein the polyvinyl alcohol polymer comprises a polyvinyl alcohol homopolymer, an anionic polyvinyl alcohol copolymer, or a blend thereof, preferably wherein the anionic polyvinylalcohol copolymers are selected from sulphonated and carboxylated anionic polyvinylalcohol copolymers especially carboxylated anionic polyvinylalcohol copolymers. Most preferably the water-soluble film comprises a blend of polyvinyl alcohol homopolymers, a blend of a polyvinylalcohol homopolymer and a carboxylated anionic polyvinylalcohol copolymer, or alternatively, the polyvinylalcohol consists of an anionic polyvinyl alcohol copolymer, most preferably a carboxylated anionic polyvinylalcohol copolymer. When the polyvinylalcohol in the water-soluble film is a blend of a polyvinylalcohol homopolymer and a carboxylated anionic polyvinylalcohol copolymer, the homopolymer and the anionic copolymer are present in a relative weight ratio of 90/10 to 10/90, preferably 80/20 to 20/80, more preferably 70/30 to 50/50. General classes of anionic monomer units which can be used for the anionic polyvinyl alcohol co-polymer include the vinyl polymerization units corresponding to monocarboxylic acid vinyl monomers, their esters and anhydrides, dicarboxylic monomers having a polymerizable double bond, their esters and anhydrides, vinyl sulfonic acid monomers, and alkali metal salts of any of the foregoing. Examples of suitable anionic monomer units include the vinyl polymerization units corresponding to vinyl anionic monomers including vinyl acetic acid, maleic acid, monoalkyl maleate, dialkyl maleate, monomethyl maleate, dimethyl maleate, maleic anhydride, fumaric acid, monoalkyl fumarate, dialkyl fumarate, monomethyl fumarate, dimethyl fumarate, fumaric anhydride, itaconic acid, monomethyl itaconate, dimethyl itaconate, itaconic anhydride, vinyl sulfonic acid, allyl sulfonic acid, ethylene sulfonic acid, 2-acrylamido-1-methylpropanesulfonic acid, 2-acrylamido-2-methylpropanesulfonic acid, 2-methylacrylamido-2-methylpropanesulfonic acid, 2-sulfoethyl acrylate, alkali metal salts of the foregoing (e.g., sodium, potassium, or other alkali metal salts), esters of the foregoing (e.g., methyl, ethyl, or other C1-C4 or C6 alkyl esters), and combinations thereof (e.g., multiple types of anionic monomers or equivalent forms of the same anionic monomer). The anionic monomer may be one or more acrylamido methylpropanesulfonic acids (e.g., 2-acrylamido-1-methylpropanesulfonic acid, 2-acrylamido-2-methylpropanesulfonic acid, 2-methylacrylamido-2-methylpropanesulfonic acid), alkali metal salts thereof (e.g., sodium salts), and combinations thereof. Preferably, the anionic moiety of the first anionic monomer unit is selected from a sulphonate, a carboxylate, or a mixture thereof, more preferably a carboxylate, most preferably an acrylate, a methacrylate, a maleate, or a mixture thereof. Preferably, the anionic monomer unit is present in the anionic polyvinyl alcohol copolymer in an average amount in a range of between 1 mol.% and 5 mol.% or between 2 mol.% and 5 mol.%.

[0027] The polyvinyl alcohol polymer may be present between 50% and 95%, preferably between 55% and 90%, more preferably between 60% and 80% by weight of the water-soluble film.

[0028] Without wishing to be bound by theory, the term "homopolymer" generally includes polymers having a single type of monomeric repeating unit (e.g., a polymeric chain comprising or consisting of a single monomeric repeating unit). For the particular case of polyvinyl alcohol, the term "homopolymer" further includes copolymers having a distribution of vinyl alcohol monomer units and optionally vinyl acetate monomer units, depending on the degree of hydrolysis (e.g., a polymeric chain comprising or consisting of vinyl alcohol and vinyl acetate monomer units). In the case of 100% hydrolysis, a polyvinyl alcohol homopolymer can include only vinyl alcohol units. Without wishing to be bound by theory, the term "copolymer" generally includes polymers having two or more types of monomeric repeating units (e.g., a polymeric chain comprising or consisting of two or more different monomeric repeating units, whether as random copolymers, block copolymers, etc.). For the particular case of polyvinyl alcohol, the term "copolymer" (or "polyvinyl alcohol copolymer") further includes copolymers having a distribution of vinyl alcohol monomer units and vinyl acetate monomer units, depending on the degree of hydrolysis, as well as at least one other type of monomeric repeating unit (e.g., a ter- (or higher) polymeric chain comprising or consisting of vinyl alcohol monomer units, vinyl acetate monomer units, and one or more other monomer units, for example anionic monomer units). In the case of 100% hydrolysis, a polyvinyl alcohol copolymer can include a copolymer having vinyl alcohol units and one or more other monomer units, but no vinyl acetate units. Without wishing to be bound by theory, the term "anionic copolymer" includes copolymers having an anionic monomer unit comprising an anionic moiety.

[0029] Preferably, the polyvinyl alcohol, and/or in case of polyvinyl alcohol blends the individual polyvinyl alcohol polymers and/or the combined polyvinyl alcohol polymers, have an average viscosity (μ 1) in a range of between 4 mPa.s and 30 mPa.s, preferably between 10mPa.s and 25 mPa.s, measured as a 4% polyvinyl alcohol polymer solution in demineralized water at 20 degrees C. The viscosity of a polyvinyl alcohol polymer is determined by measuring a freshly made solution using a Brookfield LV type viscometer with UL adapter as described in British Standard EN ISO 15023-2:2006 Annex E Brookfield Test method. It is international practice to state the viscosity of 4% aqueous polyvinyl alcohol solutions at 20 °C. It is well known in the art that the viscosity of an aqueous water-soluble polymer solution (polyvinylalcohol or otherwise) is correlated with the weight-average molecular weight of the same polymer, and often the viscosity is used as a proxy for weight-average molecular weight. Thus, the weight-average molecular weight of the polyvinylalcohol can be in a range of 30,000 to 175,000, or 30,000 to 100,000, or 55,000 to 80,000. Preferably, the polyvinyl alcohol, and/or in case of polyvinylalcohol blends the individual polyvinylalcohol polymers, have an average degree of hydrolysis in a range of between 75% and 99%, preferably between 80% and 95%, most preferably between 85% and 95%. A suitable test method to measure the degree of hydrolysis is as according to standard method JIS K6726.

[0030] Preferably, the water-soluble film comprises a non-aqueous plasticizer. Preferably, the non-aqueous plasticizer is selected from polyols, sugar alcohols, and mixtures thereof. Suitable polyols include polyols selected from the group consisting of glycerol, diglycerin, ethylene glycol, diethylene glycol, triethyleneglycol, tetraethylene glycol, polyethylene glycols up to 400 molecular weight, neopentyl glycol, 1,2-propylene glycol, 1,3-propanediol, dipropylene glycol, polypropylene glycol, 2-methyl-1,3-propanediol, trimethylolpropane and polyether polyols, or a mixture thereof. Suitable sugar alcohols include sugar alcohols selected from the group consisting of isomalt, maltitol, sorbitol, xylitol, erythritol, adonitol, dulcitol, pentaerythritol and mannitol, or a mixture thereof. More preferably the non-aqueous plasticizer is selected from glycerol, 1,2-propanediol, dipropylene glycol, 2-methyl-1,3-propanediol, trimethylolpropane, triethyleneglycol, polyethyleneglycol, sorbitol, or a mixture thereof, most preferably selected from glycerol, sorbitol, trimethylolpropane, dipropylene glycol, and mixtures thereof. One particularly suitable plasticizer system includes a blend of glycerol, sorbitol and trimethylol propane. Another particularly suitable plasticizer system includes a blend of glycerin, dipropylene glycol, and sorbitol. Preferably, the film comprises between 5% and 50%, preferably between 10% and 40%, more preferably between 20% and 30% by weight of the film of the non-aqueous plasticizer.

[0031] Preferably, the water-soluble film comprises a surfactant. Preferably, the water-soluble film comprises a surfactant in an amount between 0.1% and 2.5%, preferably between 1% and 2% by weight of the water-soluble film. Suitable surfactants can include the nonionic, cationic, anionic and zwitterionic classes. Suitable surfactants include, but are not limited to, polyoxyethylenated polyoxypropylene glycols, alcohol ethoxylates, alkylphenol ethoxylates, tertiary acetylenic glycols and alkanolamides (nonionics), polyoxyethylenated amines, quaternary ammonium salts and quaternized polyoxyethylenated amines (cationics), and amine oxides, N-alkylbetaines and sulfobetaines (zwitterionics). Other suitable surfactants include dioctyl sodium sulfosuccinate, lactylated fatty acid esters of glycerol and propylene glycol, lactic esters of fatty acids, sodium alkyl sulfates, polysorbate 20, polysorbate 60, polysorbate 65, polysorbate 80, lecithin, acetylated fatty acid esters of glycerol and propylene glycol, and acetylated esters of fatty acids, and combinations thereof.

[0032] Preferably the water-soluble film according to the invention comprises lubricants / release agents. Suitable lubricants/release agents can include, but are not limited to, fatty acids and their salts, fatty alcohols, fatty esters, fatty amines, fatty amine acetates and fatty amides. Preferred lubricants/release agents are fatty acids, fatty acid salts, and fatty amine acetates. The amount of lubricant/release agent in the water-soluble film is in a range of from 0.02% to 1.5%, preferably from 0.1% to 1% by weight of the water-soluble film.

[0033] Preferably, the water-soluble film comprises fillers, extenders, antiblocking agents, detackifying agents or a mixture thereof. Suitable fillers, extenders, antiblocking agents, detackifying agents or a mixture thereof include, but are not limited to, starches, modified starches, crosslinked polyvinylpyrrolidone, crosslinked cellulose, microcrystalline cellulose, silica, metallic oxides, calcium carbonate, talc and mica. Preferred materials are starches, modified starches and silica. Preferably, the amount of filler, extender, antiblocking agent, detackifying agent or mixture thereof in the water-soluble film is in a range of from 0.1% to 25%, preferably from 1% to 10%, more preferably from 2% to 8%, most preferably from 3% to 5% by weight of the water-soluble film. In the absence of starch, one preferred range for a suitable filler, extender, antiblocking agent, detackifying agent or mixture thereof is from 0.1% to 1%, preferably 4%, more preferably 6%, even more preferably from 1% to 4%, most preferably from 1% to 2.5%, by weight of the water-soluble film.

[0034] Preferably the water-soluble film according to the invention has a residual moisture content of at least 4%, more preferably in a range of from 4% to 15%, even more preferably of from 5% to 10% by weight of the water-soluble film as measured by Karl Fischer titration.

[0035] Preferred films exhibit good dissolution in cold water, meaning unheated distilled water. Preferably such films exhibit good dissolution at temperatures of 24°C, even more preferably at 10°C. By good dissolution it is meant that the film exhibits water-solubility of at least 50%, preferably at least 75% or even at least 95%, as measured by the method set out here after using a glass-filter with a maximum pore size of 20 microns, described above.

[0036] The film may be opaque, transparent or translucent. Preferably, the film is transparent. The film may comprise a printed area.

[0037] The area of print may be achieved using standard techniques, such as flexographic printing or inkjet printing.

[0038] The film may comprise an aversive agent, for example a bittering agent. Suitable bittering agents include, but are not limited to, naringin, sucrose octaacetate, quinine hydrochloride, denatonium benzoate, or mixtures thereof. Any suitable level of aversive agent may be used in the film. Suitable levels include, but are not limited to, 1 to 5000ppm, or even 100 to 2500ppm, or even 250 to 2000rpm.

[0039] The water-soluble film or water-soluble unit-dose article or both may be further coated in a lubricating agent, preferably, wherein the lubricating agent is selected from talc, zinc oxide, silicas, siloxanes, zeolites, silicic acid, alumina, sodium sulphate, potassium sulphate, calcium carbonate, magnesium carbonate, sodium citrate, sodium tripolyphosphate, potassium citrate, potassium tripolyphosphate, calcium stearate, zinc stearate, magnesium stearate, starch, modified starches, clay, kaolin, gypsum, cyclodextrins or mixtures thereof.

[0040] Preferably, the water-soluble film, and each individual component thereof, independently comprises between Oppm and 20ppm, preferably between Oppm and 15ppm, more preferably between Oppm and 10ppm, even more

preferably between Oppm and 5ppm, even more preferably between Oppm and 1ppm, even more preferably between 0ppb and 100ppb, most preferably 0ppb dioxane. Those skilled in the art will be aware of known methods and techniques to determine the dioxane level within water-soluble films and ingredients thereof.

Printed indicium

[0041] The printed indicium comprises a black pigment. The black pigment is described in more detail below. The printed indicium may comprise further pigments. Especially the printed indicium may comprise further red and white pigments in addition to the black pigment.

Black pigment

[0042] The black pigment of the invention comprises less than 10% of carbon black. Preferably, the black pigment comprises less than 5%, more preferably less than 1% by weight of carbon black. Most preferably, the black pigment is essentially free or free of carbon black.

[0043] By "essentially free of carbon black" is herein meant that the black pigment comprises less than 0.5%, more preferably less than 0.1% by weight of carbon black.

Carbon black (subtypes are acetylene black, channel black, furnace black, lamp black and thermal black) is a material produced by the incomplete combustion of coal and coal tar, vegetable matter, or petroleum products, including fuel oil, fluid catalytic cracking tar, and ethylene cracking in a limited supply of air. Carbon black is a form of paracrystalline carbon that has a high surface-area-to-volume ratio, although lower than that of activated carbon.

[0044] It has been observed that printed indicium with pigment comprising carbon black give rise to water-soluble film deformations and defects, in particular when the printed film is heated followed by stretching during the process of making the water-soluble unit-dose article. Such defects are found to negatively impact mechanical properties of the film, including deformation and risk of pre-mature rupture upon exposure to water or moisture. Local overstretching of the film in the printed area has been observed when using inks comprising certain black based pigments, e.g. black pigments comprising carbon black, resulting in distorted printed images.

[0045] The black pigment is selected from the group consisting of perylene black (PBk32), tri-chromatic black, chrome iron brown hematite (PBr29), iron manganese black oxide (PBk33), black 6301 (bismuth manganese perovskite), black 6350 (iron and chromium oxide), MPT-370 (calcium, manganese, and titanium oxide), calcium manganese oxide black pigments (CaMnO₃, Ca₂MnO₄, Ca₃Mn₂O₇ and Ca₄Mn₃O₁₀) and mixtures thereof, preferably the black pigment is selected from the group consisting of perylene black (PBk32), tri-chromatic black, chrome iron brown hematite (PBr29) and mixtures thereof. More preferably, the black pigment comprises, preferably consists of perylene black (PBk32).

Composition

[0046] The composition may be a powder, a liquid or a mixture thereof, preferably a liquid. The composition is preferably a detergent composition. More preferably an automatic or laundry detergent composition. More preferably a liquid laundry detergent composition.

The term 'liquid laundry detergent composition' refers to any laundry detergent composition comprising a liquid capable of wetting and treating a fabric, and includes, but is not limited to, liquids, gels, pastes, dispersions and the like. The liquid composition can include solids or gases in suitably subdivided form, but the liquid composition excludes forms which are non-fluid overall, such as tablets or granules.

[0047] By powder we herein mean the laundry detergent composition may comprise solid particulates or may be a single homogenous solid. Preferably, the powder laundry detergent composition comprises particles. This means the powder laundry detergent composition comprises individual solid particles as opposed to the solid being a single homogenous solid. The particles may be free-flowing or may be compacted, preferably free-flowing.

[0048] The laundry detergent composition can be used in a fabric hand wash operation or may be used in an automatic machine fabric wash operation.

[0049] Preferably, the laundry detergent composition comprises a non-soap surfactant. The non-soap surfactant is preferably selected from non-soap anionic surfactant, non-ionic surfactant or a mixture thereof. Preferably, the laundry detergent composition comprises between 10% and 60%, more preferably between 20% and 55% by weight of the laundry detergent composition of the non-soap surfactant. Example weight ratio of non-soap anionic surfactant to nonionic surfactant are from 1:1 to 20:1, from 1.25:1 to 17.5:1, from 1.5:1 to 15:1, or from 1.75:1 to 13:1. Preferably, the anionic non-soap surfactant comprises linear alkylbenzene sulphonate, alkyl sulphate, alkoxyated alkyl sulphate or a mixture thereof. Preferably, the alkoxyated alkyl sulphate is an ethoxyated alkyl sulphate.

[0050] Preferably, the laundry detergent composition comprises between 5% and 60%, preferably between 15% and 55%, more preferably between 25% and 50%, most preferably between 30% and 45% by weight of the detergent

composition of the non-soap anionic surfactant.

[0051] Preferably, the non-soap anionic surfactant comprises linear alkylbenzene sulphonate and alkoxylated alkyl sulphate, wherein the ratio of linear alkylbenzene sulphonate to alkoxylated alkyl sulphate preferably the weight ratio of linear alkylbenzene sulphonate to ethoxylated alkyl sulphate is from 1:2 to 9:1, preferably from 1:1 to 7:1, more preferably from 1:1 to 5:1, even more preferably from 1:1 to 4:1. Alternatively the non-soap anionic surfactant can consist of linear alkylbenzene sulphonate. Alternatively the non-soap anionic surfactant can comprise unalkoxylated alkyl sulphate and linear alkylbenzen sulphonate. The alkoxylated or unalkoxylated alkyl sulphate can be derived from a synthetic alcohol or a natural alcohol, or from a blend thereof, pending the desired average alkyl carbon chain length and average degree of branching. Preferably, the synthetic alcohol is made following the Ziegler process, OXO-process, modified OXO-process, the Fischer Tropsch process, Guerbet process or a mixture thereof. Preferably, the naturally derived alcohol is derived from natural oils, preferably coconut oil, palm kernel oil or a mixture thereof.

[0052] Preferably, the laundry detergent composition comprises between 1% and 30%, preferably between 2% and 25%, most preferably between 3% and 20% by weight of the laundry detergent composition of a non-ionic surfactant. The non-ionic surfactant is preferably selected from alcohol alkoxylate, Ziegler-synthesized alcohol alkoxylate, an oxo-synthesized alcohol alkoxylate, Guerbet alcohol alkoxylates, alkyl phenol alcohol alkoxylates or a mixture thereof. Preferably, the laundry preferably liquid laundry detergent composition comprises between 1.5% and 20%, more preferably between 2% and 15%, even more preferably between 3% and 10%, most preferably between 4% and 8% by weight of the laundry detergent composition of soap, preferably a fatty acid salt, more preferably an amine neutralized fatty acid salt, wherein preferably the amine is an alkanolamine more preferably selected from monoethanolamine, diethanolamine, triethanolamine or a mixture thereof, more preferably monoethanolamine. Preferably, the laundry detergent composition comprises a non-aqueous solvent, preferably wherein the non-aqueous solvent is selected from 1,2-propanediol, dipropylene glycol, tripropyleneglycol, glycerol, sorbitol, polyethyleneglyceol, polypropylene glycol, or a mixture thereof, preferably wherein the polypropyleneglycol has a molecular weight of 400. Preferably the liquid laundry detergent composition comprises between 10% and 40%, preferably between 15% and 30% by weight of the liquid laundry detergent composition of the non-aqueous solvent. Without wishing to be bound by theory the non-aqueous solvents ensure appropriate levels of film plasticization so the film is not too brittle and not too 'floppy'. Without wishing to be bound by theory, having the correct degree of plasticization will also facilitate film dissolution when exposed to water during the wash process.

[0053] Preferably, the liquid laundry detergent composition comprises between 0.5% and 15%, preferably between 5% and 13% by weight of the liquid laundry detergent composition of water. Preferably, the laundry detergent composition comprises an ingredient selected from the list comprising cationic polymers, polyester terephthalates, amphiphilic graft co-polymers, carboxymethylcellulose, enzymes, perfumes, encapsulated perfumes, bleach or a mixture thereof. The laundry detergent composition may comprise an adjunct ingredient, wherein the adjunct ingredient is selected from ethanol, hueing dyes, aesthetic dyes, enzymes, builders preferably citric acid, chelants, cleaning polymers, dispersants, dye transfer inhibitor polymers, fluorescent whitening agent, opacifier, antifoam, preservatives, anti-oxidants, or a mixture thereof. Preferably the chelant is selected from aminocarboxylate chelants, aminophosphonate chelants, or a mixture thereof.

[0054] Preferably, the laundry detergent composition has a pH between 6 and 10, more preferably between 6.5 and 8.9, most preferably between 7 and 8, wherein the pH of the laundry detergent composition is measured as a 10% dilution in demineralized water at 20°C.

[0055] The liquid laundry detergent composition may be Newtonian or non-Newtonian. Preferably, the liquid laundry detergent composition is non-Newtonian. Without wishing to be bound by theory, a non-Newtonian liquid has properties that differ from those of a Newtonian liquid, more specifically, the viscosity of non-Newtonian liquids is dependent on shear rate, while a Newtonian liquid has a constant viscosity independent of the applied shear rate. The decreased viscosity upon shear application for non-Newtonian liquids is thought to further facilitate liquid detergent dissolution. The liquid laundry detergent composition described herein can have any suitable viscosity depending on factors such as formulated ingredients and purpose of the composition. When Newtonian the composition may have a viscosity value, at a shear rate of 20s⁻¹ and a temperature of 20°C, of 100 to 3,000 cP, alternatively 200 to 2,000 cP, alternatively 300 to 1,000 cP, following the method described herein. When non-Newtonian, the composition may have a high shear viscosity value, at a shear rate of 20s⁻¹ and a temperature of 20°C, of 100 to 3,000 cP, alternatively 300 to 2,000 cP, alternatively 500 to 1,000 cP, and a low shear viscosity value, at a shear rate of 1 s⁻¹ and a temperature of 20°C, of 500 to 100,000 cP, alternatively 1000 to 10,000 cP, alternatively 1,300 to 5,000 cP, following the method described herein. Methods to measure viscosity are known in the art. According to the present disclosure, viscosity measurements are carried out using a rotational rheometer e.g. TA instruments AR550. The instrument includes a 40mm 2° or 1° cone fixture with a gap of around 50-60µm for isotropic liquids, or a 40mm flat steel plate with a gap of 1000 µm for particles containing liquids. The measurement is carried out using a flow procedure that contains a conditioning step, a peak hold and a continuous ramp step. The conditioning step involves the setting of the measurement temperature at 20°C, a pre-shear of 10 seconds at a shear rate of 10s⁻¹, and an equilibration of 60 seconds at the selected temperature. The peak hold involves applying a shear rate of 0.05s⁻¹ at 20°C for

3min with sampling every 10s. The continuous ramp step is performed at a shear rate from 0.1 to 1200s⁻¹ for 3min at 20°C to obtain the full flow profile.

Process for making a unit-dose article

[0056] The process of the invention comprises the steps of:

providing a water-soluble film;
 printing an indicium onto a surface of the water-soluble film using at least one ink composition, wherein the at least one ink composition comprises a black pigment;
 heating the printed water-soluble film;
 optionally but preferably stretching the heated, printed water-soluble film;
 forming a structure having an inner volume enclosed by the water-soluble film;
 providing a composition wherein the composition is contained within the inner volume, characterised in that the black pigment comprises less than 10% by weight of carbon black, preferably the black pigment comprises less than 5%, preferably less than 1% by weight of carbon black and most preferably the black pigment is substantially free of carbon black.

[0057] The water-soluble film can be optionally preheated prior to printing to provide for improved print quality. Printing can be selected from the group consisting of contact printing techniques such as flexographic printing, gravure; printing, lithographic printing, and pad printing, or non-contact printing techniques such as inkjet printing, or a combination thereof. Preferably the inks are applied through flexographic printing. Optionally further inks can be applied to the water-soluble film following the same technique or combination of techniques. Especially printed indicium comprising red pigments, white pigments and black pigments are targeted, preferably wherein the red, white and black pigments are printed through a series of flexographic printing units. After the ink is applied to the water-soluble film, the film can travel on a forming surface. The film can be printed on-line or off-line. The forming surface can be a rotating drum or a flat surface such as a horizontal belt system. The printed water-soluble film is heated prior to entering the forming surface or heated on the forming surface prior to the step where the film is being deformed. The forming surface can comprise a plurality of pockets into which the heated water-soluble film can be drawn. A dispenser can be located above the forming surface so that the water-soluble film passes beneath the dispenser. The water-soluble film can be formed into a shape that can contain a composition that is dispensed from the dispenser. Another water-soluble film can be contacted and sealed with the water-soluble film that is on the forming surface to form a unit-dose article containing the composition. The unit-dose article can be conveyed further downstream in the process. If a plurality of unit-dose articles are formed from a continuous web of water-soluble film, the web of finished unit-dose articles can be conveyed further downstream and cut into individual unit-dose articles. A dryer can be provided downstream of the apparatus that applies the ink to the water-soluble film. After the ink is applied to the water-soluble film to form a printed water-soluble film, the printed water-soluble film can be actively dried. Active drying can be beneficial for helping the ink to set in and on the water-soluble film so that the ink printed in and on the water-soluble film is less susceptible to marring or degradation. Actively drying, in contrast to passive drying, is performed by purposefully locally applying drying energy to the printed water-soluble film. Local energy can be applied by exposing the printed water-soluble film to heat, air, dry air, and the like.

[0058] The ink can be applied to the water-soluble film in an environment having a relative humidity between about 0% and about 100%. The ink can be applied to the water-soluble film in an environment having a relative humidity between about 0% and about 60%. Such environment may be dry enough such that the ink can dry sufficiently fast enough so that the freshly applied ink can be sufficiently dry so that water-soluble film can be handled by automated equipment without marring of the ink printed thereon. At a relative humidity greater than about 60%, the ink may dry too slowly and water-soluble film having freshly applied ink thereon may be difficult to handle without marring of the ink printed thereon.

[0059] In the processes of the invention, it is possible to invert the water-soluble film that has ink applied thereto so that the ink ends up on an inside surface of the unit-dose article. Providing the ink on an inside surface of the unit-dose article can be beneficial in that the ink is not exposed to being contacted when the finished unit-dose articles are handled, stored, or used. This can reduce the incidence of marring of the ink.

[0060] When flexographic printing or gravure printing is employed in the process of applying the ink, it can be practical that the ink is retained on the print cylinder, flexographic print cylinder or gravure print cylinder as applicable, for between about 0.5 seconds and about 8 seconds before being printed on the water-soluble film. The time period can be suitable because it is short enough such that the ink remains wet enough to be transferred from the flexographic print cylinder to the water-soluble film. Further, the ink remains wet enough so as to be solubilized into the film after being applied to the water-soluble film.

[0061] In the process for applying ink onto water-soluble film, the water-soluble film can be provided as a continuous web moving at a speed between about 2 m/min to about 50 m/min. Such web speed can be suitable when a flexographic print

cylinder or gravure print cylinder is employed. Such a range of speeds can be practical because at or below the higher end of the range for speed, the ink applied to the water-soluble film may have sufficient time to dry and or solubilize into the water-soluble film before the water-soluble film contacts another appurtenance, such as a roller, downstream of the print cylinder. Below the lower range of speeds, the ink may completely dry on the print cylinder, which may impair quality printing.

[0062] As described herein, the ink can be applied to the water-soluble film. The ink preferably is a water-soluble ink. The ink can be applied as a coating that coats the entire surface of the water-soluble film that makes up a unit-dose article. Such a coating might be practical for providing a film that has a desired color. A coating can also be provided to be the background over which additional ink is printed. For instance, more than one printing apparatus to apply different colors of ink to the water-soluble film can be provided. The ink applied result on printing indicium, for example characters, symbols, and other discrete patterns of ink. The ink can comprise a black pigment, water, binder, bactericide, and solvent. The ink comprises a black pigment. An example of ink compositions is provided in the table below.

Ingredient	Weight %
Water	50-80
Black pigment	10-25
Water soluble binder	5-25
Other solvents	1-10

A specific example of an ink is provided in the table below.

Ingredient	Weight %
Water	68.5
Black pigment (perylene black (PBk32))	14.1
Acetic acid ethenyl ester, polymer with ethanol	10.3
Methanol	0.1
Propanol	2.1
Ammonia salt of modified styrene acrylic polymer	4.8
Ethanol	0.1

The ink can comprise from 1% to 50% by weight of a pigment or from 3% to about 40% by weight of a pigment or from 5% to 35% by weight of a pigment. The ink can comprise from 7% to 25% by weight of a pigment. The ink can comprise from 9% to 20% by weight of a pigment. The ink can comprise a polyvinyl alcohol binder. The ink can comprise 1% to 30% by weight of a water-soluble binder. The ink can comprise 3% to 25% by weight of a water-soluble binder.

[0063] The ink can comprise 12% to 2% by weight of a water-soluble binder. The water-soluble binder can be polyvinyl alcohol.

[0064] The ink can comprise an organic solvent. The ink can comprise from 1% to 20% by weight of organic solvent. The ink can comprise 1% to 10% by weight of organic solvent. The ink can comprise from 1% to 5% by weight of organic solvent. Preferably the organic solvent is an alcohol, more preferably a C1 to C5 alcohol, or mixtures thereof, most preferably a C1 to C3 alcohol, or mixtures thereof.

[0065] The ink can partially absorb into the film upon which it is printed and partially dry on the surface. The absorption and drying can take between about 0.1 and about 5 seconds, or even from about 1 to about 3 seconds. The amount of ink printed onto the water-soluble film can affect the absorption and drying rate. The ink can be applied at a weight from about 0.1 to about 30 g/m² of sheet, or even from about 0.5 to about 18 g/m² of sheet, or even from about 1 to about 10 g/m² of sheet to obtain good printing quality. From about 1 % to about 100 %, or even about 10% to about 40%, of one or both of the interior surface and exterior surface can be printed upon. When printed upon the sheet, the ink can partially dissolve the sheet and be absorbed into the sheet.

[0066] Multiple colors of ink can be applied to water-soluble film. This can be done by providing a plurality of printing apparatuses in series with one another. A more integrated system can be provided by employing a single impression roller and a plurality of print cylinders, or blanket cylinders if lithographic printing is employed, that print different colors about the impression roller. The print cylinder can apply a first color. The first color might provide a background for other colors that

are subsequently applied to the water-soluble film. The first color can be applied through a white ink. The print cylinder can apply a second color. The second color can be applied through a black ink. The second color can be applied to form characters, symbols, and other discrete patterns of ink. The print cylinder can apply a third color. The third color can be applied through a red ink. The third color can be applied to form characters, symbols, and other discrete patterns of ink. If the printed indicium is applied to the film before the film is heated and stretched, the original indicium can be distorted but it will become undistorted once the film is heated and stretched. The black pigment of the invention prevents overstretching of the film and/or the formation of defects that otherwise could take place during the heating and deformation of the film. As stated such overstretching of the film could result in a distorted printed image, while formation of defects in the film could lead to premature rupture of the film upon accidental or initial exposure to water or moisture.

[0067] A unit-dose article forming apparatus can comprise a first web feed roll that feeds water-soluble film, a printing apparatus, a conveyor system, a plurality of molds movably mounted on the conveyor system, a heater, a film deformation unit, a dispenser, and a second web feed roll that feeds water-soluble film to close the water-soluble unit dose article. The water-soluble film can be fed through the printing apparatus. The printing apparatus can print the ink onto the water-soluble film. The printed water-soluble film can then be fed onto the conveyor system.

[0068] The printing apparatus can be located between the first web feed roll and the conveyor system. Optionally the printing unit can be located between the second web feed roll and the conveyor system. Optionally a plurality of printing units can be located between the first web feed roll and the conveyor system. Optionally a plurality of printing units can be located between the second web feed roll and the conveyor system. One or more printing apparatuses can be located between both of first web feed roll and the conveyor system and the second web feed roll and the conveyor system. Optionally, the first web feed roll can be a pre-printed web feed roll and the printing apparatus can be eliminated.

[0069] Once on the conveyor system, the water-soluble film can be plastically deformed in cups in the mold. The plastic deformation can be provided by thermoforming, thermoforming being considered to be a subset of plastic deformation. The water-soluble film can be heated by a heating unit and drawn in to cups in the mold.

The heating unit may comprise an infrared lamp which is preferably capable of heating the first water-soluble film to temperatures of 50°C to 150°C, or even 80°C to 120°C. Preferably, the infrared lamp is capable of heating the water-soluble film after the water-soluble film is fed on the conveyer. Compared to heating prior to feeding the water-soluble film, the above arrangement may allow the coordination between the heating and the application of vacuum, and allow heating/vacuum in multiple steps, resulting in a lower failure rate. More preferably, the infrared lamp comprises at least two sections (for example, two or three sections) which are capable of independently working. Most preferably, the plurality of sections is capable of heating the water-soluble film to same or different temperatures, e.g. room temperature, 50°C, 70°C, 90°C, 110°C, or 120°C, 150°C. The infrared lamp may comprise two sections. The heating unit may further comprise a protection mechanism which is configured to be inserted beyond the infrared lamp when the system stops so as to protect the system from heat damage.

The water-soluble film, heated above ambient temperature, can be drawn in by a vacuum applied to the face of the cups via a vacuum transmission system. The compartment formed by water-soluble film can then be filled or partially filled with the composition by the dispenser. A second water-soluble film is then brought into facing relationship with the plastically deformed water-soluble film and sealed to the plastically deformed water-soluble film to form a unit-dose article. With the addition of heat, the plastic deformation described herein can be thermoforming. The water-soluble film can be preheated prior to being plastically deformed. When the first water-soluble film is printed an indexing system may be present to ensure proper positioning of the printed section versus the cups to ensure proper image deformation.

[0070] Any suitable process of sealing the water-soluble films may be used. The sealing may occur in the landing areas between individual cups of the molds. Non-limiting examples of such means include heat sealing, solvent welding, solvent or wet sealing, and combinations thereof. Preferably solvent sealing is applied. Solvent application can be done through contact, such as through use of a felt role, or through non-contact, such as through use of a sprayer, solvent application techniques. Heat and or solvent can be applied to the entire surface of the water-soluble film or only the area which is to form the seal is treated with heat or solvent. The heat or solvent can be applied by any process, typically on the closing material, and typically only on the areas which are to form the seal. If solvent or wet sealing or welding is used, heat can also be applied. Wet or solvent sealing/welding processes include selectively applying solvent onto the area between the molds, or on the closing material, by for example, spraying or printing this onto these areas, and then applying pressure onto these areas, to form the seal. Sealing rolls and belts as described above that optionally also provide heat can be used, for example. The water-soluble films can be sealed in unprinted regions. Heat and or solvent can be applied to the entire surface of the water-soluble film, unprinted regions of the water-soluble film, or only the area which is to form the seal is treated with heat or solvent. The sealing solvent preferably comprises water, more preferably the sealing solvent comprises at least 90%, more preferably at least 95% by weight of the sealing solvent of water.

[0071] A cutting operation can be integral with or located down-stream of the unit-dose article apparatus to separate the unit-dose articles from the water-soluble web into individual unit-dose articles. The formed unit-dose articles may then be cut from the web by a cutting device. Cutting can be accomplished using any known process. The cutting can be done in continuous manner, optionally with constant speed and in a horizontal position. Separate cutting devices may be used to

cut articles from the web in a machine versus a cross-machine direction. For example a cutting roller could be used in the machine direction, while a roller with spaced cutting blades could be used to cut the articles in a cross-machine direction. The cutting device can, for example, be a sharp item or a hot item, whereby in the latter case, the hot item 'burns' through the sheet/sealing area.

Method to assess Ink Deformation under InfraRed Radiation

[0072] A grid of a known size is printed on PVA film. The grid will have an undeformed line width of l_0 . The grid can be printed for instance by means of a hand-proofer, delivering a coating of ink approximately of 0.5 to 4g/m^2 . The printed film is clamped by the sides in a fixed position on a mold with perforated vacuum holes in the base. A manifold below the mold connected to a vacuum pump delivers a homogeneous vacuum to pull the film to reach contact with the bottom surface. The printed film is heated by means of Infrared Lamps with temperature of the emitting body of 1200°C , and emitting wavelength spectrum equivalent to black body. IR Emitters can be placed at a distance of $2\text{-}4$ cm from the printed film surface. The mold depth is such to result in an average film deformation by stretching of 150% .

[0073] The method execution follows the following steps:

- 1) Film printed is clamped in place on the mold under mild tension, within its elastic deformation region.
- 2) Heating elements are heated up for approximately $1\text{-}2$ seconds
- 3) Vacuum of approximately 300 mbar is applied immediately after the heating step is complete deforming the film to contact the bottom of the mold
- 4) Linear Stretch is measured according to equation below.

$$\Delta l = \frac{l_d - l_0}{l_0}$$

[0074] Deformed Stretched ink,

EXAMPLE :

[0075] Example used printing ink which included perylene black (PBK32), a black pigment free of carbon black.

[0076] Comparative example used printing ink which included carbon black (PBK7). From the test results below, it can be seen that the example ink lacking carbon black provides significantly less distortion of the printed image when compared to a comparative ink comprising carbon black.

	Line thickness (before stretching)	Line thickness (after stretching)
Example	1.5	2.1
Comparative Example	1.5	7.8

[0077] Values are a mean of 5 measured values. All values are in mm.

[0078] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as " 40 mm" is intended to mean "about 40 mm".

Claims

1. A unit-dose article comprising:

water-soluble film which encompasses an inner volume enclosed by the water-soluble film;
a composition, wherein the composition is contained within the inner volume; and
a printed indicium on a surface of the film,
wherein the printed indicium comprises a black pigment,
characterised in that the black pigment comprises less than 10% by weight of carbon black.

2. The unit-dose article according to Claim 1 wherein the black pigment comprises less than 5% , preferably less than 1% by weight of carbon black and most preferably the black pigment is substantially free of carbon black.

3. The unit-dose article according to either of claims 1 or 2 wherein the water-soluble film comprises an inner surface which is in contact with the composition and an outer surface which is oriented away from the composition, towards the outside environment, and wherein the printed indicium is printed on to the inner surface of the water-soluble film.
- 5 4. The unit-dose article according to any of the previous claims wherein the black pigment is selected from the group consisting of perylene black (PBk32), tri-chromatic black, chrome iron brown hematite (PBr29), iron manganese black oxide (PBk33), black 6301 (bismuth manganese perovskite), black 6350 (iron and chromium oxide), MPT-370 (calcium, manganese, and titanium oxide), calcium manganese oxide black pigments (CaMnO₃, Ca₂MnO₄, Ca₃Mn₂O₇ and Ca₄Mn₃O₁₀) and mixtures thereof.
- 10 5. The unit-dose article according to any of the previous claims wherein the black pigment is selected from the group consisting of perylene black (PBk32), tri-chromatic black, chrome iron brown hematite (PBr29) and mixtures thereof.
- 15 6. The unit-dose article according to any of the previous claims wherein the black pigment is perylene black (PBk32).
7. The unit-dose article according to any of the previous claims wherein the film comprises polyvinylalcohol.
8. The unit-dose article according to any of the previous claims wherein the composition is a detergent composition.
- 20 9. A process for making a unit-dose article comprising the steps of:
providing a water-soluble film;
printing an indicium onto a surface of the water-soluble film using at least one ink composition, wherein the at least one ink composition comprises a black pigment;
25 heating the printed water-soluble film;
optionally but preferably stretching the heated, printed water-soluble film;
forming a structure having an inner volume enclosed by the water-soluble film;
providing a composition wherein the composition is contained within the inner volume,
characterised in that the black pigment comprises less than 10% by weight of carbon black.
- 30 10. The process according to claim 9 wherein the step of printing an indicium onto the surface of the water-soluble film is performed by a contact printing technique, preferably by flexographic printing.
- 35 11. The process according to either of claims 9 or 10 wherein the step of heating the printed water-soluble film is carried out using an infra-red radiation from an infra-red radiation source heated to a temperature of between 300°C and 1200°C, preferably between 400°C and 1000°C.
- 40 12. process according to any of claims 9 to 11 wherein the step of stretching the heated, printed water-soluble film is provided by drawing the heated, printed water-soluble film into a mold cavity, preferably by applying a vacuum to the mold cavity.
- 45 13. The process according to any of claims 9 to 12 wherein the black pigment comprises less than 5%, preferably less than 1% by weight of carbon black and most preferably the black pigment is substantially free of carbon black.
- 50 14. The process according to any of claims 9 to 13 wherein the water-soluble film comprises an inner surface which is in contact with the composition and an outer surface which is oriented away from the composition, towards the outside environment, and wherein the printed indicium is printed on to the inner surface of the water-soluble film.
- 55 15. The process according to any of claims 9 to 14 wherein the black pigment is selected from the group consisting of perylene black (PBk32), tri-chromatic black, chrome iron brown hematite (PBr29), iron manganese black oxide (PBk33), black 6301 (bismuth manganese perovskite), black 6350 (iron and chromium oxide), MPT-370 (calcium, manganese, and titanium oxide), calcium manganese oxide black pigments (CaMnO₃, Ca₂MnO₄, Ca₃Mn₂O₇ and Ca₄Mn₃O₁₀) and mixtures thereof.
16. The process according to any of claims 9 to 15 wherein the composition is a detergent composition.



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Application Number

EP 23 21 0829

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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