

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present ~~invention~~ disclosure to provide a means of effectively encapsulating and storing a range of reaction reagents suitable for use in a wide variety of potential applications as illustrated through the non-limiting list given above. Furthermore, it is an object of ~~this invention~~ to provide with such encapsulating systems a means of rapid release and effective reaction of the reaction reagents at the point/time of use. Specifically this is achieved by the use of multi-component encapsulated powder systems wherein one reaction reagent is maintained in isolation from one or more other reaction reagents up to the point of need when these are brought together by mechanical action.

Thus, an embodiment of the present ~~invention~~ disclosure provides a system for storing and releasing complementary reaction reagents, comprising:

a first part comprising colloidal particles, the colloidal particles coating and encapsulating microdroplets, the microdroplets comprising an aqueous solution including a first reaction reagent to form a first encapsulate containing said first reaction reagent;

at least a second part comprising colloidal particles, the colloidal particles coating and encapsulating microdroplets, the microdroplets comprising an aqueous solution including at least a second reaction reagent to form a second encapsulate containing said at least a second reaction reagent, said first and said at least a second reaction reagent being selected such that upon being mixed the first and at least a second reaction reagent chemically react to form reaction product; and

wherein in use the first and at least second parts, being commingled together, are subjected to mechanical action causing breakage of the first and at least second encapsulates releasing and mixing the first and at least second reaction reagents to form said reaction product.

In an embodiment, the first and second colloidal particles are hydrophobized colloidal particles, which can be fumed silica.

The system can be formulated as a skin sanitization product, in which the first aqueous solution comprises a peroxide, a first acid and water, and wherein the second aqueous solution comprises a salt of a transition metal, a second acid and water; and

The salt can be present in the second part in a range from about 0.001ppm to about 49% by weight. The system can further include a third part the comprises one or combination of surfactant, enzyme, salt, perfume, colourant, and dye transfer inhibition agent.

5 | In an embodiment aspect, the invention is a skin sanitization product, comprising:

a) a first part comprising first hydrophobized colloidal particles, said first hydrophobized colloidal particles containing first microdroplets, said first microdroplets comprising a first aqueous solution of a peroxide, a first acid and water to form a first encapsulate containing a first reaction element;

10 | b) at least a second part comprising second hydrophobized colloidal particles, said second hydrophobized colloidal particles containing second microdroplets, said second microdroplets comprising a second aqueous solution of a salt of a transition metal, a second acid and water to form a second encapsulate containing a second reaction element; and

15 | wherein in use said first and second parts are mixed together on a user's skin to form a mixture and upon being subjected to mechanical action said first and second encapsulates are broken, releasing and mixing said first and second reaction elements.

In a particular embodiment, the skin sanitization product includes a first part
20 | which comprises, by weight:

about 84% water; about 1% phosphoric acid (75%); about 12% hydrogen peroxide 50%; and about 3% fumed silica; and

a second part which comprises, by weight:

25 | about 92.6% water; about 0.4% phosphoric acid (75%); about 4.0% copper sulphate; and about 3.0% fumed silica.

| In another aspect, the invention provides a bleach product, comprising:

30 | a) a first part comprising first hydrophobized colloidal particles, said first hydrophobized colloidal particles containing first microdroplets, said first microdroplets comprising a first aqueous solution of water and one or combination of percarboxylic acid and bleach activator, to form a first encapsulate containing a first reaction element; and

b) at least a second part comprising second hydrophobized colloidal particles, said second hydrophobized colloidal particles containing second

microdroplets, said second microdroplets comprising a second aqueous solution of a salt of a transition metal and water to form a second encapsulate containing a second reaction element; and

wherein in use said first and second parts are mixed together to form a mixture and upon being subjected to mechanical action said first and second encapsulates are broken, releasing and mixing said first and second reaction elements.

In an embodiment, the first part of the bleach product comprises, by weight: about 93% water; about 4.0% sodium percarbonate; about 3% fumed silica; and the second part comprises, by weight: about 96.98% water; about 0.02% Mn(Bcyclam)Cl₂; and about 3.0% fumed silica.

The bleach product can further comprise a third part, wherein the third part comprises, by weight, about 50.0% zeolite; about 25.0% linear alkylbenzene sulphonate; about 15.0% C12-15 EO5 alcohol ethoxylate; and about 10.0% sodium silicate.

~~Another aspect~~ ~~Also provided~~ is a method for producing a system for storing and releasing complementary reaction reagents, comprising the steps:

a) dissolving at least one first reaction reagent in water to form a first aqueous solution;

b) mixing and agitating said first aqueous solution with hydrophobized colloidal particles comprising fumed silica to form first colloidal particles encapsulating droplets of said first aqueous solution to form a first encapsulate wherein said fumed silica is present within said first particles in an amount less than 5% by weight;

c) dissolving at least one second reaction reagent in water to form at least one second solution;

d) mixing and agitating said second solution with ~~said~~ hydrophobized colloidal particles comprising fumed silica to form at least second colloidal particles encapsulating droplets of said second solution to form a second encapsulate wherein said fumed silica is present within said second particles in an amount less than 5% by weight; and

e) mixing said first and second encapsulate without breaking said first and second encapsulates to form an inter-dispersed composition of said first and second encapsulates.

5 Steps b) and d) can be accomplished with one of a high-shear rotary mixer and a blender.

Another aspect provides a method for producing a system for storing and releasing complementary reaction reagents, comprising the steps:

10 a) dissolving at least one first reaction reagent comprising a peroxide and a first acid in water to form a first aqueous solution;

b) mixing and agitating said first aqueous solution with hydrophobized particles comprising metal oxide powders to form first particles encapsulating droplets of said first aqueous solution to form a first encapsulate;

15 c) dissolving at least one second reaction reagent comprising a salt of a transition metal and a second acid in water to form at least one second solution;

20 d) mixing and agitating said second solution with said hydrophobized particles to form at least second particles encapsulating droplets of said second solution to form a second encapsulate; and

e) mixing said first and second encapsulates without breaking said first and second encapsulates to form an inter-dispersed composition of said first and second encapsulates.

Another aspect provides a method for producing a system for storing and releasing complementary reaction reagents, comprising the steps:

a) dissolving at least one first reaction reagent comprising one or combination of percarboxylic acid and bleach activator in water to form a first aqueous solution;

b) mixing and agitating said first aqueous solution with hydrophobized particles comprising metal oxide powders to form first particles encapsulating droplets of said first aqueous solution to form a first encapsulate;

c) dissolving at least one second reaction reagent comprising a salt of a transition metal in water to form at least one second solution;

d) mixing and agitating said second solution with hydrophobized particles to form at least second particles encapsulating droplets of said second solution to form a second encapsulate; and

e) mixing said first and second encapsulates without breaking said first and second encapsulates to form an inter-dispersed composition of said first and second encapsulates.

A system of the invention can be as described above in which the first and second parts are included within a suitable carrier formulation selected from the group consisting of a cream, gel and paste.

~~The invention~~ Another aspect ~~includes~~ relates to a method for delivering a skin sanitizing product, the method comprising:

(i) applying the product to the skin of a user, the product comprising a mixture of:

A) a first part comprising a first encapsulate comprising hydrophobized colloidal particles and microdroplets comprising an aqueous solution of a peroxide, a first acid and water; and

B) at least a second part comprising a second encapsulate comprising hydrophobized colloidal particles and microdroplets comprising an aqueous solution of the salt of a transition metal, a second acid and water; and

(ii) subjecting the product to mechanical force by hand-rubbing the product on the user's skin with sufficient force to break open the first and second

encapsulates to release and mix said components of the first and second parts with each other.

The hydrophobized colloidal particles of the first and second parts can comprise fumed silica.

5 The first acid and said second acid can each include, independently of the other, one or more of phosphoric acid, phosphonic acid, citric acid, sulfonic acid, sulphuric acid, hydrochloric acid, itaconic acid, methanoic acid, alpha-hydroxy acid, maleic acid, gluconic acid, propanoic acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic mono-acid, octanoic di-acid, octanoic tri-acid, beta-
10 hydroxy-acid, sodium tripolyphosphate, ethylenediaminetetraacetic acid, diethylenetriaminepentaacetic acid, N-(hydroxyethyl)-ethylenediami-netriacetic acid, 2-hydroxyethyliminodiacetic acid, benzoic acid, salicylic acid, and aminobenzoic acid.

15 The invention includes a method for cleansing a surface, the method comprising the steps:

(i) applying the product to the surface, the product comprising a mixture of:

(I) a first encapsulate comprising hydrophobized colloidal particles encapsulating an aqueous solution of at least one first reaction reagent comprising a peroxide, a first acid and water; and
(II) a second encapsulate comprising hydrophobized colloidal particles encapsulating an aqueous solution of at least one second reaction reagent comprising a salt fo a transition metal, a second acid and water;

wherein the first and second reagents chemically react when exposed to each other to form a cleansing agent;

(ii) subjecting the product to mechanical force by hand-rubbing the product on the surface with sufficient force to break open the first and second encapsulates to release and mix said first and second reaction reagents and thereby expose the surface to the cleansing agent.

Another aspect provides a method for cleansing a surface, the method comprising the steps:

(I) applying the product to the surface, the product comprising a mixture of:

(i) a first encapsulate comprising hydrophobized colloidal particals encapsulating microdroplets comprising an aqueous solution of at least one first reaction reagent comprising one or combination of percarboxylic acid and bleach activator; and

(ii) a second encapsulate comprising hydrophobized colloidal particles encapsulating microdroplets comprising an aqueous solution of at least one second reaction reagent comprising a salt of a transition metal;

wherein the first and second reagents chemically react when exposed to each other to form a cleansing agent;

(II) subjecting the product to mechanical force by hand-rubbing the product on the surface with sufficient force to break open the first and second encapsulates to release and mix said first and second reagents and thereby expose the surface to the cleansing agent.

An embodiment of the present invention provides a skin sanitization product comprising a mixture of two dry powder components, where each dry powder component is formed from a phase inversion process involving vigorous mixing. The dry powder is stabilized by colloidal fumed silica particles, which assist in generating stable "dry water" microdroplets. One dry powder component comprises encapsulates containing microdroplets comprising an aqueous solution of hydrogen peroxide, and the other dry powder component comprises encapsulates containing microdroplets comprising an aqueous solution of copper sulphate or another suitable source of a transition metal ion. When the hand sanitization product is agitated by rubbing together of ones hands, the encapsulates rupture and the two aqueous solutions undergo a Fenton reaction upon contact. The Fenton reaction is catalyzed to produce hydroxyl free-radicals that generate an effective bactericidal dose.

DETAILED DESCRIPTION OF THE INVENTION

Generally speaking, the embodiments described herein are directed to a system for storing and delivering two or more reaction reagents stored in microdroplets coated and encapsulated by hydrophobic colloidal particles to be released at the point and time of use by mechanical agitation of the stored reaction reagents in the encapsulates which are commingled such that the mechanical action releases the reagents which then react to give a desired reaction product. As required, embodiments of the present invention are disclosed herein. However, the disclosed embodiments are merely exemplary, and it should be understood that the