

IMPROVED DELIVERY OF BENEFIT AGENTSTECHNICAL FIELD

The present invention relates to substantially encapsulated functional ingredients, especially encapsulated food functional ingredients, and to a process for making the same.

BACKGROUND OF THE INVENTION

Functional ingredients are often known in the prior art to be coated or encapsulated. This is usually done to reduce adverse interaction between the ingredient and the product during incorporation, or, during processing or storage of the product.

It may also be done to provide heat, pH and/or moisture resistance. Encapsulation or coating is also done to provide controlled or targeted release of the ingredient. Examples of such functional ingredients are perfumes, pigments, dyes, flavours, vitamins and food functional ingredients.

Several methods of coating or encapsulation are known in the art. These include physico-chemical processes such as interfacial polymerisation, coacervation, phase separation from aqueous or organic solvents, forming meltable dispersions followed by coating and solidification and mechanical processes that include spray drying and vacuum coating. It is required that the coating be strong enough to withstand chemical and physical abuse and yet break down under appropriate conditions to release the functional ingredient contained within the coating.

An extensive description of coating and encapsulation methods is provided in Microcapsule Processing and Technology, A. Kondo, ed. and revised J.W van Valkenburg, Marcel Dekker, New York and Basel, 1979.

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Coating materials may be water-soluble or water-insoluble. Examples of water-soluble coatings include cellulose, hydroxyethyl cellulose, gelatin, casein, dextrin and carboxymethyl starch. Water-insoluble coating materials include
10 silicates, clays and alkaline earth metal salts of fatty acids.

However, it is often preferable to disperse the functional ingredient in a core material, followed by coating or encapsulation of the core. A common core material is a gel in
15 which the functional ingredient is dispersed. Examples of such core materials are methyl cellulose and gelatin. Porous, inorganic materials, e.g. silica and zeolites, have also been disclosed in the prior art as core materials. In particular, volatile organic compounds like flavours and perfumes and
20 reactive compounds like bleaches, can be dispersed inside the pores of the inorganic material and only become available during use.

Functional food ingredients such as iodine-containing compounds
25 and vitamins are often added to food articles or preparations. However, these functional food ingredients can be unstable under certain cooking conditions as well as during storage. For example, iodine-containing compounds, such as potassium iodate, reduce to elemental iodine in acidic pH and also in the
30 presence of reducing agents (e.g. spices used during cooking).

Thus they are not readily available to the body in the necessary form to be utilised.

Other functional food ingredients, such as iron compounds and oligopeptides, when incorporated into food preparations often impart an undesirable colour or undesirable sensory properties
5 either during storage or during use. It is therefore advantageous if they are encapsulated prior to incorporation in order that they do not interact with other components and adversely affect the organoleptic properties of the food preparation or other ingredients.

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US 4 671 963 discloses foodstuffs coated with alkaline earth metal salts of stearic acid. The water-insoluble coating helps to retain the original texture of the coated food in the presence of moisture. Preferred examples of such food stuffs
15 are crunchy foodstuffs such as cereal bars. The zinc, calcium or magnesium stearate is dissolved in hard fat and then applied to the cereal. The stearates may also be dusted on an oil-containing cereal to provide a moisture resistant coating.

20 In Indian patents IN 182558 and IN 182559 there are disclosed methods to encapsulate iodine-containing compounds. It is disclosed that a number of materials can be used to provide a protective coating to the iodine-containing compound and that such encapsulated particles can be incorporated in common salt.

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US 6 030 645 discloses particles comprising an oleophilic substance dispersed in a matrix of at least one core material and a coating. The oleophilic material is vitamin A or E. The core material is a gel and maybe chosen from cellulose and its
30 derivatives, alginic acid and its derivatives, sugar and sugar alcohols and glycerol. The coating material is water insoluble and comprises calcium silicate. Magnesium silicate, silicon

dioxide, calcium or magnesium stearate may also be added to the coating.

EP-A-675 194 discloses liquid detergent compositions comprising
5 encapsulated particles. The detergent active is adsorbed on a porous, hydrophobic material such as hydrophobic silica which is then further coated with a hydrophobic compound such as silicone oil.

10 WO98/42818 discloses laundry functional ingredient particles for perfume delivery and comprising a zeolite porous carrier core intermixed with a glassy encapsulating material which is a partially water-soluble or water-dispersible compound which can be selected from water-soluble polymers, carbohydrates,
15 cellulose and waxes amongst others.

WO 97/48386 discloses a compressed core tablet comprising a therapeutic dose of diltiazem (the active ingredient), colloidal silica and magnesium stearate.

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It is also well known that heat, moisture and pH sensitive functional ingredients (such as potassium iodate and vitamins) when incorporated into food preparations are substantially reduced in concentration, or even lost, during storage and/or
25 cooking. Such functional ingredients are therefore not readily or reliably available to the body following consumption of food articles containing them.

Known encapsulation methods used in connection with food
30 preparations do not ensure that the coating is heat, moisture and pH resistant and that the encapsulated functional ingredients are readily available to the body to a satisfactory extent.

Accordingly, there is a need to provide functional ingredients which can be incorporated into food preparations and which are sufficiently stable so that they can be readily utilised by the
5 body to a satisfactory extent after consumption.

Additionally, certain functional ingredients such as iron-containing compounds and oligopeptides are known to adversely affect the organoleptic properties of foods. This can be
10 attributed to interaction of the functional ingredients with other components present in the food. Hence, there is a need to provide such ingredients which do not impart an undesirable colour or undesirable sensory properties to the food preparation either during preparation, storage or during use.

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The present invention seeks to address one or more of the aforementioned problems.

SUMMARY OF THE INVENTION

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We have surprisingly found that the above problems can be addressed, according to the present invention, by free-flowing particles comprising i) an inorganic, porous core material in which a water soluble functional ingredient is impregnated and
25 ii) a water insoluble, heat stable outer coating which comprises one or more multivalent metal salts of fatty acids. The outer coating breaks down during the digestion process to release the functional ingredient and make it bio-available to the body. The particles prepared by this process can be
30 incorporated in food articles or preparations.

Thus the present invention provides novel encapsulated particles comprising functional ingredients, especially for use in food preparations.

5 We have also found that these particles can be made by the process described herein to make stable, encapsulated particles that break down only at a low pH.

Functional ingredients that are unstable during storage and
10 use, or those that interact unfavourably with other food components, can be suitably encapsulated using the process of the invention.

Thus according to the first aspect of the invention there is
15 provided a substantially encapsulated food additive particle comprising:

- a) an inorganic, porous core in which one or more water-soluble functional ingredients are impregnated, and
- b) a hydrophobic, water-insoluble outer coating having a
20 melting point of greater than 100°C and comprising one or more multivalent metal salts of fatty acids of chain length not less than 8.

According to the second aspect of the invention, there is
25 provided a process to make substantially encapsulated food additive particles, the process comprising the steps of:

- a) forming an impregnated core by adding an aqueous solution of a water-soluble functional ingredient to an inorganic, porous core material such that the solution does not
30 occupy more than 90% of the pore volume of the porous core material, and
- b) optionally drying the impregnated core, and

c) forming a hydrophobic, water-insoluble outer coating of one or more multivalent metal salts of a fatty acid of chain length not less than 8 on the impregnated core and wherein the coating has a melting point of greater than 100°C.

According to a third aspect of the invention, there is provided a synergistically fortified food article comprising the substantially encapsulated food additive particle of the invention.

A particularly preferred fortified food article is fortified common salt which further comprises the substantially encapsulated food additive particle of the invention with potassium iodate or potassium iodide as the water-soluble functional ingredient.

Examples of water-soluble functional ingredients are iodine-containing compounds, iron-containing compounds, Vitamin C, carotenoids and oligopeptides.

The present invention has the advantage of providing one or more of the following:

- a) stability during processing, storage and use of functional ingredients incorporated into food preparations,
- b) stability of functional ingredients in the presence of reducing agents,
- c) moisture, heat and pH resistance of functional ingredients, and/or
- d) break down of the coating of the invention in the digestive system to make functional ingredients incorporated in food preparations more easily available to the body for bio-absorption.

The encapsulated particle of the invention also isolates the functional ingredient from other components of the food preparation and thereby significantly improves the organoleptic properties of the food compared to that achieved with the use of the same non-encapsulated functional ingredient.

Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of materials and/or use are to be understood as modified by the word "about." All amounts are by weight, unless otherwise specified.

15 DETAILED DESCRIPTION OF THE INVENTION

Forms of this invention, including preferred and optional features, and materials which may be used, will now be discussed in greater detail.

The term "encapsulated particle" as used herein refers to the substantially encapsulated food additive particle of the invention.

25 The encapsulated particle

The encapsulated particle comprises one or more functional ingredients that are dispersed (impregnated) in an inorganic, porous core. The porous core is preferably hydrophilic in nature.

The inorganic porous core is referred to hereinafter as the porous core and the porous core comprising one or more

functional ingredients is referred to hereinafter as the impregnated core.

The impregnated core is further coated with one or more
5 multivalent metal salts of fatty acids (referred to hereinafter as the outer coating). The inorganic porous core and the outer coating are preferably present in a weight ratio of from 1:0.1 to 1:10, more preferably of from 1:0.2 to 1:5 and most preferably of from 1:0.2 to 1:3.

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It is essential that the outer coating substantially encapsulates the impregnated core.

The particle size of the encapsulated particle is preferably
15 from 0.1 to 100 micron, more preferably from 0.5 to 80 micron and most preferably from 1 to 50 micron.

Process of coating or encapsulation

The porous core is impregnated with one or more water-soluble
20 functional ingredients by adding an aqueous solution of the functional ingredient to the inorganic porous material. A preferable method of addition is by spraying on the aqueous solution or, by adding it drop-wise to a stirred powder of the inorganic, porous material.

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It is preferable that the aqueous solution of the functional ingredient be added in a gradual manner to the inorganic, porous material to prevent agglomeration of the inorganic, porous material. The aqueous solution occupies not more than
30 90% of the pore volume of the core material during the preparation method. The occupied pore volume may reduce with

time, for example, when water is removed by drying or by treatment with a suitable solvent.

The impregnated core may be optionally dried to remove water
5 from the pores. Water can also be removed from the pores by dispersing the impregnated core in a solvent in which water is soluble but the functional ingredient is insoluble.

The impregnated core that is formed needs to be further coated
10 with the one or more multivalent metal salts of fatty acids. The coating can be provided by several methods, for example, as described below.

A preferred method to obtain the coating is to first add the
15 impregnated core to a mixture of a multivalent metal hydroxide, a multivalent metal halide and a suitable solvent. A melt of one or more fatty acids of chain length of not less than 8 is then added to this mixture to generate the water insoluble, outer coating of the impregnated core. The outer coating is
20 formed by the in-situ generation of the one or more metal salts of fatty acids and precipitation thereof on the impregnated core. The solvent can be removed by any suitable method after formation of the coating. It is essential according to this preferred method that the pH of the mixture of the multivalent
25 metal hydroxide, multivalent metal halide and the solvent is in the range of from 8 to 10.5. Without being limited by theory, it is believed that this buffering is necessary to retain the required structure of the impregnated core. More preferably the pH is in the range of from 9 to 10.5 and most preferably of
30 from 9.9 to 10.3.

Calcium and magnesium hydroxide are especially preferred multivalent metal hydroxides. Calcium and magnesium chlorides are especially preferred multivalent metal halides. The multivalent metal halide is preferably present in an amount of 5 from 35 to 50% by weight of the multivalent metal hydroxide, more preferably of from 39 to 42% by weight of the alkaline earth hydroxide.

The solvent should have a moderate dielectric constant, should 10 not dissolve the functional ingredient present in the impregnated core and should solubilise the fatty acid. Examples of such solvents are C₁-C₆ chain alcohols. Ethanol is an especially preferred solvent.

15 Without being limited by theory, it is believed that the solvent enables dissociation of the fatty acid as well as of the metal hydroxide resulting in the formation of the fatty acid salt.

20 In a typical process, the impregnated core is added to a mixture of the multivalent metal hydroxide, multivalent metal halide and solvent and stirred. This dispersion is then added to a melt of one or more fatty acids. It is required that the mixture be continuously stirred. The temperature of the 25 reaction mixture is from 60-75°C, more preferably from 65-75°C. The mixing time is not critical, but preferably the time is at least 10 minutes. In-situ precipitation of the fatty acid salt(s) takes place on the impregnated core to give substantially encapsulated particles.

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The solvent can be removed by any conventional process of drying or evaporation and can be recycled.

It is known in the art that complete encapsulation does not generally take place. The process of the invention thus provides for substantial encapsulation of the porous core.

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Functional ingredients

The amount of the functional ingredient in the porous core is preferably from 0.1 to 60% by weight of the weight of the porous core, more preferably from 1 to 30%, most preferably
10 from 5 to 20%.

The functional ingredient is present in the pores of the inorganic, porous material.

15 When the functional ingredient is an iodine-containing compound, it is preferably chosen from alkali metal iodides or iodates or mixtures thereof. Potassium iodate and potassium iodide and mixtures thereof are especially preferred.

20 Iron compounds suitable for encapsulation include ferrous sulphate, ferrous gluconate and ferrous fumarate as well as iron-amino acid complexes such as ferrous sulphate-glycine.

Vitamin C and its precursors, carotenoids and oligopeptides are
25 also suitable water-soluble functional ingredients that can be encapsulated by the process of the invention. Peptides containing fewer than 10 amino acids are called oligopeptides.

The porous core

30 The porous core is inorganic, water insoluble and hydrophilic in nature. It is chosen such that its average pore diameter is greater than that of the hydrated sphere of the functional

ingredient or its dissociated ion. The pore volume is large enough to contain the aqueous solution of functional ingredients.

- 5 The porous core is preferably made from material selected from one or more of silica, silicates and alumino-silicates. Silica is the preferred material and is preferably present in the form of amorphous silica. Silicates include the alkali metal and alkaline earth metal silicates. Alumino-silicates include
10 zeolites. Amorphous silica is an especially preferred core material.

The particle size of the inorganic porous core is preferably of from 0.1 to 50 micron, more preferably of from 0.2 to 25
15 micron, most preferably from 0.5 to 10 micron.

The pore diameter of the pores of the porous core is preferably in the range of from 0.1 to 500 nm, more preferably of from 0.4 to 100 nm, most preferably of from 0.5 to 50 nm.

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The pore volume of the porous core is preferably from 2 to 5.5 ml/g, more preferably from 2.5 to 2.8 ml/g.

The outer coating

- 25 The outer coating is hydrophobic, water insoluble and has a melting point greater than 100°C. The outer coating comprises one or more multivalent metal salts of a fatty acid of chain length not less than 8. More preferably, the outer coating is the multivalent metal salt, especially calcium or magnesium, of
30 one or more of stearic, palmitic and myristic acid. Most preferably the outer coating comprises the calcium salt of stearic acid.

When a mixture of fatty acids is used, any ratio of the individual fatty acids can be used without affecting the stability and the water insoluble nature of the outer layer, provided the melting point of the outer coating is greater than 5 100°C.

The thickness of the outer layer is preferably of from 0.003 micron to 1 micron, more preferably of from 0.01 micron to 0.8 micron, most preferably of from 0.1 to 0.5 micron.

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The outer coating is stable at pH 4.0 and above.

The pH in the stomach typically varies from 0.9 to 3.0. Thus the coating of an ingested encapsulated food additive particle 15 will break down during the digestive process and the functional ingredient(s) will be released from the porous core.

Incorporation of the encapsulated particle into a food article

The encapsulated particle of the invention can be added to food 20 articles (preparations). Examples of such food articles include salt, beverages, flour including wheat flour, fruit juices, cereals etc.

The invention is further illustrated by the following non- 25 limiting examples, in which parts and percentages are by weight unless otherwise specified. Further examples within the scope of the present invention will be apparent to the person skilled in the art.

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EXAMPLESComparative Example A

18 ml of an aqueous solution of potassium iodate (ex E. Merck
5 (I) Ltd.) was added slowly to 10g of dry precipitated silica
(ex Madhu Silica Pvt. Ltd., India) at 25°C with continuous
stirring for 30 minutes. The impregnated core was recovered as
a dry powder at the end of this process. The average particle
diameter was determined by Zeiss microscope and was found to be
10 4-15 micron. The total iodate content was determined by
iodometry and was found to be 8% by weight (with respect to
silica).

Comparative Example B

15 8g of potassium iodate was added to a mixture of molten stearic
and palmitic acid (ex Loba Chemie, Mumbai, India). The weight
ratio of the stearic acid: palmitic acid was 55:45. The molten
fatty acid was maintained at 75 °C. The mixture was stirred and
subsequently cooled down to laboratory temperature. The
20 average[#] particle diameter as determined by Zeiss Microscope was
found to be 50-200 micron and the total iodate content was 8%
by weight (with respect to calcium stearate) as determined by
iodometry.

25 Example 1Process for preparing the encapsulated particle*a. Method of preparing the impregnated core*

30 18 ml of an aqueous solution of potassium iodate (ex E. Merck
(I) Ltd.) was added slowly over a period of 30 minutes to 8g of
dry precipitated silica (ex Madhu Silica Pvt. Ltd., India) at

25°C. The mixture was continuously stirred during the addition. The impregnated core was recovered as a dry powder at the end of this process.

5 *b. Method for preparing the encapsulated particle*

2.15g. of calcium chloride was added to ethanol to form a homogeneous solution. This solution was further added to an ethanolic dispersion of calcium hydroxide. The pH of the
10 stirred mixture was 10.3. The KIO₃ containing impregnated core was added to the ethanolic dispersion. There was no significant change in pH.

The ethanolic dispersion comprising the impregnated core was
15 poured into 24g of molten stearic and palmitic acid (ex Loba Chemie, Mumbai, India). The ratio of the stearic acid: palmitic acid was 55:45. The mixture was maintained at 75 °C and continuously stirred. It was subsequently cooled down to laboratory temperature. The excess ethanol was removed by
20 filtration. The encapsulated particle was obtained as a free flowing powder with an average particle diameter is 5 micron. The total iodate content was 3.3% by weight in the encapsulated particle.

25 Stability in water at room temperature and boiling temperature.
The stability of the encapsulated particle in water and its ability to retain the iodate was determined.

In the first test, the material of Example 1 was stirred in
30 water for 30 minutes. The dispersion was then filtered and the amount of potassium iodate in the filtrate was determined by iodometry. The procedure was repeated for Comparative Examples A and B.

In the second test, the material of Example 1 was dispersed in water and the temperature of the water was raised to boiling temperature. The boiling was continued for 30 minutes. The dispersion was then filtered and the amount of potassium iodate in the filtrate was determined by iodometry. The procedure was repeated for Comparative Examples A and B.

The potassium iodate retained in the particle is expressed as follows:

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$$\% \text{ iodate retained by the particle} = (I_{\text{total}} - I_{\text{filtrate}}) / I_{\text{total}} \times 100$$

where I_{total} is the total iodate content in the particle and I_{filtrate} is the iodate content in the water (after filtration). The results are shown in Table 1.

Table 1 : Potassium iodate retention

Example	% iodate retained in the particle	
	Water (Room Temperature)	Water (Boiling temperature)
A	0	0
B	25	20
Example 1	89	89

The data in Table 1 shows that most of the iodate is retained by using the encapsulated particle of the invention.

Acid Stability

The stability of the particle was determined under cooking pH conditions as well as in stomach pH conditions.

For determining stability in cooking pH conditions, the material of Example 1 was dispersed in water and the pH of the

dispersion was adjusted to 4.2. The dispersion was then boiled for 30 minutes. The dispersion was then cooled, filtered and the potassium iodate content of the filtrate was determined by iodometry. The procedure was repeated for Comparative Example A and Comparative Example B.

For determining stability in stomach pH conditions, the material of Example 1 was dispersed in a 0.33 N solution of hydrochloric acid and the mixture was stirred for 30 minutes. The dispersion was filtered and the potassium iodate content of the filtrate determined by iodometry. The procedure was repeated for Comparative Example A and Comparative Example B. The percentage of iodate in the particle after the treatment was determined as explained above. The data are shown in Table 2

Table 2: Stability in acidic solutions

Example	% iodate retained in the particle	
	Cooking pH	Stomach pH
A	0	0
B	15	0
Example 1	75	1.5

The data shows that the encapsulated particle of the invention is stable at cooking pH but breaks down, liberating the iodate, at stomach pH. Thus the encapsulated particle of the invention is stable under normal cooking conditions and loss or breakdown of the iodate is prevented during cooking. However, it breaks down in stomach pH conditions and can thus make the iodate bio-available for absorption by the body.

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Claims

1. A substantially encapsulated food additive particle comprising:
 - a) an inorganic, porous core in which one or more water-soluble functional ingredients are impregnated, and
 - b) a hydrophobic, water-insoluble outer coating having a melting point of greater than 100°C and comprising one or more multivalent metal salts of fatty acids of chain length not less than 8 and wherein the weight ratio of the inorganic, porous core to the outer coating is the range of from 1:0.1 to 1:10.
2. A food additive particle according to claim 1 wherein the weight ratio is the range of from 1:0.2 to 1:5.
3. A food additive particle according to either of claims 1 or 2 having a particle size of from 0.1 to 100 micron.
4. A food additive particle according to claim 3 having a particle size of from 0.5 to 80 micron.
5. A food additive particle according to any one of the preceding claims wherein the particle size of the inorganic porous core is in the range of from 0.1 to 50 micron.
6. A food additive particle according to claim 5 wherein the particle size of the porous core is in the range of from 0.2 to 25 micron.
7. A food additive particle according to any one of the preceding claims wherein the inorganic porous core has

pores having a diameter in the range of from 0.1 to 500 micron.

8. A food additive particle according to claim 7 wherein the pores have a diameter in the range of from 0.4 to 100 micron.
9. A food additive particle according to any one of the preceding claims wherein the pore volume of the porous core is in the range of from 2 to 5.5 ml/g.
10. A food additive particle according to claim 9 wherein the pore volume is in the range of from 2.5 to 2.8 ml/g.
11. A food additive particle according to any one of the preceding claims wherein the thickness of the outer coating is in the range of from 0.003 to 1 micron.
12. A food additive particle according to claim 11 wherein the thickness of the outer coating is in the range of from 0.01 to 0.8 micron.
13. A food additive particle according to any one of the preceding claims wherein the inorganic porous core is made from material selected from silica, silicates and aluminosilicates.
14. A food additive particle according to claim 13 wherein the material is silica.
15. A food additive particle according to claim 14 wherein the material is amorphous silica.

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- 16.A food additive particle according to any one of the preceding claims wherein the outer coating comprises calcium or magnesium salts of stearic, palmitic and/or myristic acid.
- 17.A food additive particle according to claim 16 wherein the outer coating comprises the calcium salt of stearic acid.
- 18.A food additive particle according to any one of the preceding claims wherein the amount of the water-soluble functional ingredient is of from 0.1 to 60% by weight of the weight of the inorganic porous core.
- 19.A food additive particle according to claim 18 wherein the amount of the water-soluble functional ingredient is of from 1 to 30% by weight.
- 20.A food additive particle according to any one of the preceding claims wherein the water-soluble functional ingredient is selected from iodine-containing compounds, iron-containing compounds, vitamin C, carotenoids and oligopeptides.
- 21.A food additive particle according to claim 20, wherein the water-soluble functional ingredient is potassium iodate or potassium iodide.
- 22.A process to make substantially encapsulated food additive particles, the process comprising the steps of:
- a) forming an impregnated core by adding an aqueous solution of a water-soluble functional ingredient to an inorganic, porous core material such that the solution does not occupy more than 90% of the pore volume of the porous core material, and

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- b) optionally drying the impregnated core, and
- c) forming a hydrophobic, water-insoluble outer coating of one or more multivalent metal salts of a fatty acid of chain length not less than 8 on the impregnated core and wherein the coating has a melting point of greater than 100°C and wherein the weight ratio of the inorganic, porous core to the outer coating is in the range of from 1:0.1 to 1:10.

23.A process according to claim 22 wherein the outer coating is formed by adding the impregnated core to a mixture of a multivalent metal hydroxide, a multivalent metal halide and a solvent, the mixture having a pH of from 8 to 10.5, adding a melt of one or more fatty acids of chain length not less than 8, and removing the solvent after formation of the coating.

24.A process according to claim 23 wherein the pH of the mixture is from 9 to 10.5.

25.A process according to either claim 23 or 24 wherein the multivalent metal hydroxide is calcium or magnesium hydroxide and the multivalent metal halide is calcium or magnesium chloride.

26.A process according to any one of claims 23 to 25 wherein the multivalent metal halide is present in an amount of from 35 to 50% by weight of the multivalent metal hydroxide.

27.A process according to claim 26 wherein the multivalent metal halide is present in an amount of from 39 to 42% by weight.

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28. A process according to any one of claims 22 to 27 wherein the solvent is a C₁-C₆ chain alcohol.
29. A process according to claim 28 wherein the solvent is ethanol.
30. A fortified food article comprising the substantially encapsulated food additive particle of any one of claims 1 to 21.
31. A fortified food article according to claim 22 wherein the food article is fortified common salt comprising the substantially encapsulated food additive particle of any one of claims 1 to 21 and further wherein the water-soluble functional ingredient in the substantially encapsulated food additive particle is potassium iodate or potassium iodide.