

Microencapsulation wall material, suspension core capsule,
method and a production system for producing the same

The present application relates to a microencapsulation wall
5 material of a microencapsulation product for food and beverage
capsules, a suspension core capsule, a method for producing a
microencapsulation wall material, a method for producing a sus-
pension core capsule, and a production system for producing a
suspension core capsule.

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Food supplements are used to supplement the diet with vita-
mins, minerals, and other substances, such as long-chain fatty
acids, amino acids, fiber, or plant substances. They contain
the nutrients in a concentrated and dosed form and are offered
15 as capsules, powder sachets, or in similar dosage forms.

Dietary supplements can contain a single nutrient or a combi-
nation of different nutrients, so-called combination products.

20 It is an object of the present application to provide an im-
proved way to administer a health supplement

According to a first aspect, a microencapsulation wall mate-
rial of a microencapsulation product for food and beverage
25 capsules, wherein the microencapsulation wall material com-
prises a first mixture, wherein the first mixture comprises at
least one material out of the group of collagen, chitosan,
silk fibroin, gelatin, alginate, modified starch and biopoly-
mers, and a second mixture, wherein the second mixture com-
30 prises at least one material out of the group of lecithin, cy-
clodextrin and whey surfactant base mixture, wherein the first
mixture and the second mixture form an emulsion.

An emulsion is a finely divided mixture of two normally immiscible liquids without visible segregation. Materials of the first mixture can form particles in an emulsifier of the second mixture. The first mixture can be a W1-Phase. The second mixture can be the emulsifier. The second mixture can further be a W2-Phase. The emulsion can be a double emulsion with a type W1/O/W2. The first mixture and the second mixture can form an emulsion through emulsification.

10 Through this solution, a microencapsulation wall material is provided, which has improved diffusion characteristics and is eatable for animals and humans.

According to an embodiment, the microencapsulation wall material has an HLB value within the range of ≤ 10 .

An amphiphilic molecule is a value obtained by dividing a weight percentage of the hydrophilic part by five. There is a balance between the hydrophilic and lipophilic parts of amphiphilic molecules. This is expressed as the hydrophilic-lipophilic balance (HLB). The HLB value is an empirical scale as a measure of the HLB values of surfactants. With this, it is possible to determine a optimum range for each surface-active substance effect. A surfactant with a lower HLB has a lipophilic character. Spans, which are sorbitan esters, have lipophilic properties and low HLB values (1.8-8.6). Tweens, which are polyoxymethylene derivatives of spans, are hydrophilic and have high HLB values (9.6-16.7). To form stable emulsions, an emulsifier or emulsifier mixture having an HLB value equal to the HLB value of the oil phase should be used. This sol, a microencapsulation wall material is provided, which has lipophilic properties.

In an example embodiment, the microencapsulation wall material has an HLB value within the range of $\Rightarrow 10$

5 According to this solution, a microencapsulation wall material is provided, which has hydrophilic properties.

According to a second aspect, a suspension core capsule, wherein the suspension core capsule comprises a wall comprising microencapsulation wall material as described above and a
10 core comprising nutrients. The wall can border the core.

Through this solution, a suspension core capsule is provided, which has specific properties to absorb the nutrients. The wall controls the absorption of the nutrients.

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According to an embodiment, the wall comprises an inner wall comprising microencapsulation wall material as described above, and an outer wall comprising microencapsulation wall material as described above.

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This solution provides a wall, which has a cascaded wall, wherein the inner wall and the outer wall have different absorption properties. This allows to adjust the absorption more accurate and depending of the nutrients.

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In an example embodiment, an outside of the inner wall and an inside of the outer wall are touching each other. The inner wall can rest on the outer wall over its entire surface.

30 According to this solution an inner wall and an outer wall is provided, which are controlling the absorption. The inner wall and the outer wall form a double-walled wall, which combines

the absorption properties of the inner wall and the outer wall.

In an embodiment, the inner wall and the outer wall have a predefined thickness

The inner wall has a predefined thickness. The outer wall has a predefined thickness. The thickness of the inner wall can differ from the thickness of the outer wall.

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Through this solution, an inner wall and an outer wall is provided, which has cascaded properties. Depending on the thickness of each wall the absorption properties can be adjusted.

15 According to an embodiment, the wall comprises a time-released mechanism to absorb nutrients.

This solution provides a wall, which absorbs the neutrinos over time. This improves the intake of the neutrinos of the human body. This allows the delivery of the nutrients in a course of time.

According to a third aspect, a method for producing a microencapsulation wall material comprises in a first step providing a first mixture, wherein the first mixture comprises at least one material out of the group of collagen, chitosan, silk fibroin, gelatin, alginate, modified starch, and biopolymers and in a further step providing a second mixture, wherein the second mixture comprises at least one material out of the group of lecithin, cyclodextrin, and whey surfactant base mixture, and forming an emulsion with the first mixture and the second mixture.

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According to one of the examples above, the method can be performed in a single flow.

Through this solution, a method is provided, which improves
5 the producing process of the microencapsulation wall material.
This leads to cheaper and more effective production.

According to an embodiment, the method is further comprising a
step of atomizing the emulsion into vapor microparticles. The
10 vapor microparticles can be vapor nanoparticles.

Through this solution, a method is provided to produce vapor
microparticles, which further improve the properties of the
wall material and simplify the production process.

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According to an embodiment, the method is further comprising a
step of providing a homogenizer.

Through this solution, a method is provided, which homogenizes
20 the particles. Related to the homogenization the wall material
can be produced with more uniform properties.

The above-described embodiments of the method are particularly
suitable to produce a wall material according to one of the
25 above-described embodiments of the wall material.

According to a fourth aspect, a method for producing a suspen-
sion core capsule comprising the method steps of the method
described above and further comprising the method steps of
30 providing a core comprising nutritious, providing a microen-
capsulated wall material, and encapsulating the microencapsu-
lated wall material around the core.

The above-described embodiment of the method is particularly suitable to produce a suspension core capsule according to one of the above-described embodiments of the suspension core capsule.

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Through this solution, a method for producing a suspension core capsule is provided, which improves and simplifies the production process of the suspension core capsule. This solution reduces the production costs and increases the production efficiency.

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According to a fifth aspect, a production system for producing a suspension core capsule, as described above, comprises a homogenizer, an atomizer, an emulsification bath, a spray nozzle, mixer, a spray chamber, a cooker, a holding tank, a dispersion system, and an encapsulation machine, wherein the system is configured to carry out a method as described above. Through this solution, is provided, which is

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20 The above-described embodiment of the production system is particularly suitable to carry out a method for producing a microencapsulation wall material and a method for producing a suspension core capsule as described above.

25 The above-described embodiment of the production system is further particularly suitable to produce a microencapsulation wall material and a suspension core capsule as described above.

30 Through this solution, a production system is provided, which reduces the costs and improves reliability.

Embodiments of the application will now be described with reference to the attached drawings, in which the same reference numerals denominate the same or similar features.

5 Fig. 1 shows a section view of a suspension core capsule that contains a multi-nucleated food and beverage extract core,

Fig. 2a shows a section view of a suspension core capsule with multi-nucleated nutrient core in a liquid meta-core suspen-
10 sion,

Fig. 2b shows a section view of a suspension core capsule with multi-nucleated nutrient core in a solid meta-core suspension,

15 Fig. 3 shows a flow chart for manufacturing a suspension core capsule.

Fig. 1 shows a section view of a suspension core capsule 1 that contains a multi-nucleated food and beverage extract core
20 21. The multi-nucleated food and beverage extract core 21 is also called multi-nucleates nutrient core 21.

The suspension core capsule 1 comprises a microencapsulation wall 10. The microencapsulation wall 10 can be single or dou-
25 ble-walled. In case the microencapsulation wall 10 is double-walled and outside of the inner wall and an inside of the outer wall are touching each other, over a whole surface.

The microencapsulation wall 10 includes or comprises a meta-
30 core suspension 20. The meta-core suspension 20 can be liquid or solid.

In the meta-core suspension 20 are multi-nucleates nutrient core 21 arranged. The multi-nucleates nutrient core 21 can comprise an additional wall. The microencapsulation wall 10 can be single or double-walled.

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The microencapsulation wall material, the microencapsulation wall 10 is made, is composed of a large galantine mix. The galantine mix serves to protect the multi-nucleates nutrient core 21 and the meta-core suspension 20 from the process of oxidation. It can be single-walled and can contain a matrix of suspended solids.

The multi-nucleates nutrient core 21 is the highly volatile microencapsulated and/or nano encapsulated vitamin and nutrient core. Multi-nucleates nutrient core 21 delivers nutraceuticals and flavonoids to the consumer upon consumption of the suspension core capsule 1.

The microencapsulation wall 10 provides for the protection of degradation and reaction with the outer food and beverage core extract 21 within the suspension core capsule 1. The microencapsulation wall 10 can be single or double walled and protects against UV oxidation.

The multi-nucleates nutrient core 21 in the meta-core suspension 20 can contain reactants and/or adjuvants to accelerate and assist in the nutrient delivery process and timed mechanisms of vitamin absorption.

The meta-core suspension 20 provides a medium of suspending single and multi-nucleated nutrient core particles 21 in a liquid and/or emulsifying matrix. The emulsifying matrix will react with either temperature, pressure, or dilution upon

breakage of the microencapsulation wall material to produce a water-based liquid slurry in oil or vice versa. The microencapsulation wall material is palatable for the consumption of a healthy, food and/or beverage product. Food and/or beverage product are filled with nutrients and added vitamins and minerals to promote convenient and healthy diets.

Fig. 2a shows a section view of a suspension core capsule 1, as described in Fig. 1, with multi-nucleated nutrient core 21 in a liquid meta-core suspension 20.

The microencapsulation wall 10 can comprise an inner wall and an outer wall. The inner wall can comprise an inner wall matrix 11.

The microencapsulation inner wall material of the suspension core capsule 1 can be a double layer matrix that is immiscible with each other. The double layer matrix acts as barriers to external reactants and diffusers. Furthermore, the meta-core suspension 20 of the suspension core capsule 1 can be a liquid.

Fig. 2b shows a section view of a suspension core capsule 1, as shown in Fig. 2a, with multi-nucleated nutrient core 21 in a solid meta-core suspension 1.

The suspension core capsule 1 comprises a solid meta-core suspension 20 instead of a liquid meta-core suspension 20, as shown in Fig. 2a.

Fig. 3 shows a flow chart for manufacturing a suspension core capsule 1.

The system process for manufacturing the suspension core capsule 1 can be a single flow process from the filling of active ingredients to the encapsulation of the multi-nucleated core 21.

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The system process starts with the active ingredients packed into canisters for filling into a feed composite mixture. The active ingredients may be contained in the canisters as powdered, liquid, or hybrid material phases.

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From the active ingredient canisters, the feed material is dispensed into a filler in a method step S1. The filler separates the feed material and controls the rate at which the active ingredients are dispensed to the feeder in a method step 15 S2a. In this step, the active ingredients are environmentally measured, maintained, and stored in holding containments in preparation for the next step of processing.

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In the next step, an intelligent feeder collects mixtures of the active ingredients and prepares them for homogenization in a method step S3a. At this step, impurities and concentrations are tested to verify and ensure that correct chemical balances are reached and maintained.

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The feeder provides a feedback loop through a collection of sensor and machine data to inform the filler of the necessary control parameters to tune when dispensing the active ingredients in a method step S2b.

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These parameters may include the rate of active ingredient dispense, flow, temperature, humidity, etc.

The next step is where ingredients are homogenized by batches in classes. Different classes of homogenization from the feed ingredients are stored in the apparatus in this step.

- 5 The homogenizer actuates the homogenization process through a variety of methods, e.g., high pressure, energy dispersion, turbulent dissipation, cavitation, etc. It also contains an intelligent feedback system to control the feeder operating parameters in real-time in a method step S3b.

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- The next step is the emulsifier which adds in the surfactants and the core multi-nucleated nutrient/vitamin of the product in a method step S4a. In this step, the emulsification is performed through the effect of high energy homogenization on the active ingredients, the core capsule suspension 20, and the emulsifying agents. This step also includes an intelligent feedback sensor to the feeder in a method step S4b.

- In the next step, an atomizer atomizes the completed emulsion from the previous steps into vapor nanoparticles and microparticles of similar sizes in a method step S5a. The atomizer contains an intelligent feedback loop to the homogenizer based on sensor and machinery data to control, the operational behavior and parameters of the homogenizer during and before the emulsification process in a method step S5b.

- After spray drying, the double and singled walled matrix microcapsules and nanoparticles produced from the spray dryer process are collected via a canonical cyclone drum. They are loaded into the food and beverage suspension via a vibrational sifter in a method step S6a. The spray dryer includes an intelligent feedback system that feeds sensor and machine data

back to the emulsification module to automate the control of the spray dryer operational parameters in a method step S6b.

As a next step, a homogenization process takes place in a method step S7. In this step, nanoparticles and microparticles from different spray drying processes containing different nutrient and/or vitamin core multi-nucleates 21 are loaded into the baseline food and beverage liquid / semi-liquid core. The process at this step involves low energy dissipation agitative components to homogenize the meta-core suspension 20.

The meta-core suspension 20 is then loaded into the hopper of a standard soft/hard gel encapsulation machine in a method step S8a. The standard mixture will include the feed and a galantine-based call coating which is weaved into the die-cutting rollers of the machine. The encapsulation contains an intelligent sensing feedback loop that automates control of the spray dryer for operational parameterization in a method step S8b. The product as described in Fig. 1 is then produced from this highly structured, systemic manufacturing process in a method step S9.

In an embodiment, the microencapsulation wall material borders a core and protects the core against UV oxidation.

In an embodiment, the microencapsulation wall 10 has an ellipsoid, spherocylindrical, spherical, oval, oblong, and/or tubular shape.

CLAIMS

1. Microencapsulation wall material of a microencapsulation product for food and beverage capsules, wherein the micro-encapsulation wall material comprises:
 - a first mixture, wherein the first mixture comprises at least one material out of the group of collagens, chitosan, silk fibroin, gelatin, alginate, modified starch, and biopolymers, and
 - a second mixture, wherein the second mixture comprises at least one material out of the group of a lecithin, cyclodextrin and whey surfactant base mixture,wherein the first mixture and the second mixture form an emulsion.
2. Microencapsulation wall material according to claim 1, wherein the microencapsulation wall material has an HLB value within the range of ≤ 10 .
3. Microencapsulation wall material according to claim 1, wherein the microencapsulation wall material has an HLB value within the range of ≥ 10 .
4. A suspension core capsule, wherein the suspension core capsule comprises a wall comprising microencapsulation wall material according to one of the claims 1 to 3 and a core comprising nutrients.
5. A suspension core capsule according to claim 4, wherein the wall comprises an inner wall comprising microencapsulation wall material according to claim 1 to 3, and an outer wall comprising microencapsulation wall material according to claim 1 to 3.

6. A suspension core capsule according to claims 5, wherein an outside of the inner wall and an inside of the outer wall are touching each other.
- 5 7. A suspension core capsule according to any of the claims 5 to 6, wherein the inner wall and the outer wall have a pre-defined thickness.
- 10 8. A suspension core capsule according to any of the claims 4 to 7, wherein the wall comprises a time-released mechanism to absorb nutrients.
9. Method for producing a microencapsulation wall material,
15 wherein the method comprises the following steps:
- providing a first mixture, wherein the first mixture comprises at least one material out of the group of collagens, chitosan, silk fibroin, gelatin, alginate,
20 modified starch, and biopolymers,
 - providing a second mixture, wherein the second mixture comprises at least one material out of the group of a lecithin, cyclodextrin and whey surfactant base mixture, and
 - 25 – forming an emulsion with the first mixture and the second mixture.
10. Method for producing a microencapsulation wall material according to claim 9, further comprising a step of atomiz-
30 ing the emulsion into vapor microparticles.
11. Method for producing a microencapsulation wall material according to claim 9 or 10, further comprising a step of providing a homogenizer.

12. Method for producing a suspension core capsule comprising the method steps of the method according to the claims 9 to 10 and further comprising the method steps of:

- 5 - providing a core comprising nutrients
 - providing a microencapsulated wall material, and
 - encapsulating the microencapsulated wall material around the core.

10 13. Production system for producing a suspension core capsule, wherein the production system comprises a homogenizer, an atomizer, an emulsification bath, a spray nozzle, mixer, a spray chamber, a cooker, a holding tank, a dispersion system, and an encapsulation machine, wherein the system is
15 configured to carry out a method according to one of the claims 9 to 12.