Title: NOVEL COATING SYSTEM

Abstract: The present patent application relates to a novel coating system, coated compositions with such a coating system, as well as to the use of such compositions in the production, food, feed, dietary supplements and/or pharmaceutical products, as well as to food, feed, dietary supplements and/or pharmaceutical products comprising such compositions.
NOVEL COATING SYSTEM

The present patent application relates to a novel coating system, wherein the coating comprises at least one lipid compound and at least one gum having emulsifying properties and at least one film forming compound, characterised in that the lipid compound has a mass median diameter (MMD) of less than 1 µηη. Furthermore it relates to compositions coated with such a coating system and the use of such compositions in the production of food, feed, dietary supplements and/or pharmaceutical products.

The goal of the present invention was to find a coating system, which improves the properties of the active ingredient(s), which are coated by such a coating system.

Surprisingly, it was found out that by using a coating system comprising
(i) at least one lipid compound and
(ii) at least one gum having emulsifying properties, and
(iii) at least one film forming compound and/or at least one emulsifier, characterised in that the mass median diameter of the lipid compound is less than 1 µηη,

improved coated compositions are obtained.

The compositions coated by a coating system according to the present invention are improved in regard to
(a) storage stability;
(b) sensory (smell and odour); (this is crucial when a strong tasting active ingredient is used);
(c) control release of the active ingredient.

Therefore the present invention relates to a coating system comprising
(i) at least one lipid compound and
(ii) at least one gum having emulsifying properties, and
(iii) at least one film forming compound and/or at least one emulsifier,
characterised in that the mass median diameter of the lipid compound is less than 1 µηη.

Mass Median Diameter or "MMD" is a measurement of the average particle size distribution. The results are expressed as diameters of the total volume distribution at 50 % total throughput. The mass median diameters (MMD) given in the present patent application are measured by using a Malvern Mastersizer 2000. The mean diameter (MD) is measured by using a Coulter N4 Plus. It is to be said that all particle sizes given in this patent application are average particles sizes.

Monodispersity of the particles is not an essential criterion of the present invention.

The MMD of the lipid compound used in the coating of the composition according to the invention is less than 1 µηη. Preferably, the MMD is below 0.95 µηη, more preferably below 0.8 µηη.

Preferably, for all compositions in this patent application the d50 (measured by a Malvern Mastersizer 200 with Ultrasound) of the lipid compound, most preferably stearic acid, (in the suspension) is 0.10 - 0.30 µηη.

Preferred lipid compounds according to the present invention are saturated fatty acids as well as salts thereof, more preferred stearic acid or palmitic acid, as well as their salts. It is clear that one single lipid compound can be used as well as mixtures of two and more lipid compounds.

The coating system comprises at least one gum having emulsifying properties. Emulsifying properties are such, which allow to producing oil-in-water emulsions. A gum in the context of the present invention is a viscous substance that is extruded by certain plants and trees harden on exposure to air and dry into water-soluble, non crystalline, brittle solids or viscous mass.

Suitable gums according to the present invention are gum acacia, gum ghatti and tic gums. These gums are also the preferred gums. More preferred is gum acacia.
Therefore the present invention relates to a coating system comprising
(i) at least one lipid compound and
(ii) at least one gum chosen from the group consisting of gum acacia, gum ghatti and tic gums, and
(iii) at least one film forming compound and/or at least one emulsifier, characterised in that the mass median diameter of the lipid compound is less than 1\(\mu\)m.

Preferred film forming compounds according to the present invention are hydrocolloids. The hydrocolloid can be either a polysaccharide or a protein. The term polysaccharides includes gums (alginites, pectins, guar, caroube, xanthan), wherein the gums having emulsifying properties are excluded, starches and modified starches, cellulose and cellulose derivatives like carboxymethylcellulose or hydroxypropylmethylcellulose. It is clear that one single film forming compound can be used as well as mixtures of two and more film forming compounds.

Preferred emulsifiers according to the present invention are sucrose ester, ascorbyl palmitate, polyoxyethylene-sorbitan- fatty acid esters (available under the trade name Tween). It is clear that one single emulsifier can be used as well as mixtures of two and more emulsifiers.

Therefore a preferred embodiment of the present invention relates to a coating system comprising
(i) at least one lipid compound chosen from the group consisting of stearic acid or palmitic acid, as well as their salts and
(ii) at least one gum chosen from the group consisting of gum acacia, gum ghatti and tic gums, and
(iii) at least one film forming compound and/or at least one emulsifier chosen from the group consisting of alginites, pectins, guar gum, caroube gum, xanthan, starches, modified starches, cellulose, cellulose derivatives (like carboxymethylcellulose or hydroxypropylmethylcellulose), su-
crose ester, ascorbyl palmitate and polyoxyethylene-sorbitan- fatty acid esters,
characterised in that the mass median diameter of the lipid compound is less than 1 µm.

Optionally, the coating system according to the present invention also comprises at least one plasticizer.
Preferred plasticizers according to the present invention are sugars like sucrose or a sugar derivative (mannitol, sorbitol), glycerol, mono- and diglyceride, acetylated monoglyceride, polyethylene glycol (PEG), polypropylene glycol. Preferably the PEG has a molecular weight between 200 and 6000. It is clear that one single plasticizer can be used as well as mixtures of two and more plasticizers.

Therefore the present invention also relates to a coating system comprising

(i) at least one lipid compound chosen from the group consisting of stearic acid or palmitic acid, as well as their salts and

(ii) at least one gum chosen from the group consisting of gum acacia, gum ghatti and tic gums, and

(iii) at least one film forming compound and/or at least one emulsifier chosen from the group consisting of alginates, pectins, guar gum, caroube gum, xanthan, starches, modified starches, cellulose, cellulose derivatives (like carboxymethylcellulose or hydroxypropylmethylcellulose), sucrose ester, ascorbyl palmitate and polyoxyethylene-sorbitan- fatty acid esters, and

(iv) at least one plasticizer chosen from the group consisting of sugars (like sucrose), derivatives (mannitol, sorbitol), glycerol, mono- and diglyceride, acetylated monoglyceride, polyethylene glycol (PEG) and polypropylene glycol,

characterised in that the mass median diameter of the lipid compound is less than 1 µm.
The coating system can optionally comprise further components. These components can be useful for the production of the coating, the production of the coated composition, the production of the food, feed, dietary supplement or pharmaceutical product, or it can be added for other reasons. Such components can be e.g. dyestuffs, antioxidants, fillers, pH buffers, taste masking substances, etc. If present, such ingredients are used in an amount of up to 5 weight-percent (wt-%), based on the total weight of the coating system (preferably 0.5 to 5 wt-%).

The coating system according to present invention preferably comprises 10 to 50 wt-% of at least one lipid compound, preferably, 20 to 40 wt-%, based on the total weight of the coating system.

The coating system according to present invention preferably comprises 5 to 30 wt-% of at least one gum having emulsifying properties, preferably 10 to 25 wt-%, based on the total weight of the coating system.

The coating system according to present invention preferably comprises 40 to 80 wt-%, preferably 45 to 70 wt-% of at least one film forming compound and/or at least one emulsifier, based on the total weight of the coating system.

It is obvious that the sum of the above mentioned percentages of the coating system always adds up to 100.

Therefore a preferred embodiment of the present invention also relates to a coating system comprising

(i) 10 to 50 wt-%, based on the total weight of the coating system, of at least one lipid compound chosen from the group consisting of stearic acid or palmitic acid, as well as their salts and

(ii) 5 to 30 wt-%, based on the total weight of the coating system, of at least one gum chosen from the group consisting of gum acacia, gum ghatti and tic gums, and

(iii) 40 to 80 wt-%, based on the total weight of the coating system, of at least one film forming compound and/or at least one emulsifier chosen from the group consisting of alginates, pectins, guar gum,
caroube gum, xanthan, starches, modified starches, cellulose, cellulose derivatives (like carboxymethyl cellulose or hydroxy propyl methylcellulose), sucrose ester, ascorbyl palmitate and polyoxyethylene-sorbitan-fatty acid esters, characterised in that the mass median diameter of the lipid compound is less than 1\(\mu\)m.

Therefore the present invention also relates to a coating system comprising

(i) 10 to 50 wt-%, based on the total weight of the coating system, of at least one lipid compound chosen from the group consisting of stearic acid or palmitic acid, as well as their salts and

(ii) 5 to 30 wt-%, based on the total weight of the coating system, of at least one gum chosen from the group consisting of gum acacia, gum ghatti and tic gums, and

(iii) 40 to 80 wt-%, based on the total weight of the coating system, of at least one film forming compound and/or at least one emulsifier chosen from the group consisting of alginates, pectins, guar gum, caroube gum, xanthan, starches, modified starches, cellulose, cellulose derivatives (like carboxymethyl cellulose or hydroxy propyl methylcellulose), sucrose ester, ascorbyl palmitate and polyoxyethylene-sorbitan-fatty acid esters, and optionally

(iv) 5 to 20 wt-%, based on the total weight of the coating system, of at least one plasticizer chosen from the group consisting of sugars (like sucrose), derivatives (mannitol, sorbitol), glycerol, mono- and diglyceride, acetylated monoglyceride, polyethylene glycol (PEG) and polypropylene glycol, and optionally

(v) up to 5 wt-%, based on the total weight of the coating system, of at least one further ingredient chosen from the group consisting of dyes, antioxidants, fillers, pH buffers and taste masking substances, characterised in that the mass median diameter of the lipid compound is less than 1\(\mu\)m.
A coating system according to the present invention is used for coating an active ingredient (or a formulation comprising at least one active ingredient). Such a coated system comprises a core (comprising the active ingredient) and the coating system. The active ingredient which is coated is a fat soluble compound.

Therefore the present invention also relates to a composition comprising
(a) a core, wherein the core comprises at least one fat soluble compound and
(b) a coating system, comprising
(i) at least one lipid compound and
(ii) at least one gum chosen from the group consisting of gum acacia, gum ghatti and tic gums, and
(iii) at least one film forming compound and/or at least one emulsifier,
characterised in that the mass median diameter of the lipid compound is less than 1\(\mu\)m.

All the preferences for the coating system apply to the above mentioned compositions.

At least one fat soluble compound is coated by the coating system according to the present invention. Preferably the fat soluble compound is a fat soluble vitamin (or vitamin derivate), such as vitamin A or its esters (for example vitamin A acetate and vitamin A palmitate), vitamin E or its esters (for example vitamin E acetate), vitamin K (phytomenadione) and vitamin D3 (cholecalciferol), a PUFA (Poly Unsaturated Fatty Acid) or a carotenoid (such as \(\alpha\)- or \(\beta\)-carotene, 8'-apo-p-carotenal, 8'-apo-p-carotenoic acid esters, canthaxanthin, astaxanthin, lycopene, lutein, zeaxanthin or crocetin). Most preferred the fat soluble compound is a vitamin, such as vitamin A or its esters (for example vitamin A acetate and vitamin A palmitate), vitamin E or its esters (for example vitamin E acetate), vitamin K (phytomenadione) and vitamin D3 (cholecalciferol).

Therefore the present invention also relates to a composition comprising
(a) a core, wherein the core comprises at least one fat soluble compound
chosen from the group consisting of vitamin A, vitamin A acetate, vitamin
A palmitate, vitamin E, vitamin E acetate, vitamin K (phytomenadione),
vitamin D3 (cholecalciferol), PUFA and carotenoids (such as α- or β-
carotene, 8'-apo-p-carotenal, 8'-apo-p-carotenoic acid esters, canthaxan-
thin, astaxanthin, lycopene, lutein, zeaxanthin or crocetin), and

(b) a coating system, comprising

(i) at least one lipid compound and
(ii) at least one gum chosen from the group consisting of gum acacia, gum
ghatti and tic gums, and
(iii) at least one film forming compound and/or at least one emulsifier,
characterised in that the mass median diameter of the lipid compound is less than
1 µm.

Furthermore the composition according to present invention comprises

(a) 50 to 95 wt-%, based on the total weight of the composition, of core and

(b) 5 to 50 wt-%, based on the total weight of the composition, of coating
system.

Furthermore the composition according to present invention comprises

(a) 50 to 95 wt-%, based on the total weight of the composition, of core com-
prised at least one fat soluble compound chosen from the group consisting
of vitamin A, vitamin A acetate, vitamin A palmitate, vitamin E, vitamin E
acetate, vitamin K (phytomenadione), vitamin D3 (cholecalciferol), PUFA
and carotenoids (such as α- or β-carotene, 8'-apo-p-carotenal, 8'-apo-p-carotenoic acid esters, canthaxanthin, astaxanthin, lycopene, lutein, zeaxanthin or crocetin), and

(b) 5 to 50 wt-%, based on the total weight of the composition, of coating system comprising

(i) 10 to 50 wt-%, based on the total weight of the coating system, of at least one lipid compound chosen from the group consisting of stearic acid or palmitic acid, as well as their salts and

(ii) 5 to 30 wt-%, based on the total weight of the coating system, of at least one gum chosen from the group consisting of gum accacia, gum ghatti and tic gums, and

(iii) 40 to 80 wt-%, based on the total weight of the coating system, of at least one film forming compound and/or at least one emulsifier chosen from the group consisting of alginates, pectins, guar gum, caroube gum, xanthan, starches, modified starches, cellulose, cellulose derivatives (like carboxymethylcellulose or hydroxy propyl methylcellulose), sucrose ester, ascorbyl palmitate and polyoxyethylene-sorbitan fatty acid esters, and optionally

(iv) 5 to 20 wt-%, based on the total weight of the coating system, of at least one plasticizer chosen from the group consisting of sugars (like sucrose), derivatives (mannitol, sorbitol), glycerol, mono- and diglyceride, acetylated monoglyceride, polyethylene glycol (PEG) and polypropylene glycol, and optionally

(v) up to 5 wt-%, based on the total weight of the coating system, of at least one further ingredient chosen from the group consisting of dye-stuffs, antioxidants, fillers, pH buffers and taste masking substances, characterised in that the mass median diameter of the lipid compound is less than 1 µm.

The composition as described above can optionally been further coated for example by a fat layer.
The coated (single coating or multiple coating) compositions according to the present invention can be used in any kind of formulations, wherein the use of such fat soluble ingredients is useful. Usually such compositions can be used in food products. The food products can be in any form.

The coated compositions according to the present invention can also be used in feed products for animals such as poultry, pigs, fish, ruminants, etc. The feed products can be in any form.

The compositions according to the present invention can also be used as or used in dietary supplements. The dietary supplements can be in any form.

The coated compositions according to the present invention can also be used in pharmaceutical products. The pharmaceutical products can be in any galenical form, usually in the form of tablets.

A further embodiment of the present invention relates to food products, feed products, dietary supplements and/or pharmaceutical products, comprising at least one coated composition as defined above.

The invention is illustrated by the following Example. All temperatures are given in °C and all parts and percentages are related to the weight.

**Example 1: Coated particles comprising vitamin A**

**Step 1 : Coating formulation**

100g Hydroxypropylmethylcellulose (HPMC) type methocel E19 are added in 1550g deionised water (80-90°C) and left for about 1 hour. Then 40g of gum acacia Senegal (Benecke) is added. The solution is then left overnight at room temperature for degassing. 676g of the previous solution is heated up at 50-60°C. 24g of stearic acid (Merck, "plant type") is added and mixed. The micronisation of the stearic acid is then ensured by a Polytron 6000 rotor stator system by 20000rpm for 10 minutes. The quick cooling of the suspension is ensured by the addition of it
in a 284g of water/ice mixed (about 250g ice and 34g water). The final composition of the coating formulation is: 40g HPMC, 24g stearic acid, 16g of gum acacia, 904g of demineralised water.

The size of the particles of stearic acid in the suspension are measured with a Malvern Mastersizer 2000 with Ultrasound at $d_{3,2}=0.144 \mu m$, $d_{10}=0.075 \mu m$, $d_{50}=0.171 \mu m$, $d_{90}=0.83 \mu m$.

Step 2: Application of the coating formulation on the core surface

300g of a beadlet Vitamin A form (as described in patent WO 2007/045488 and containing 38% Vitamin A acetate, 46% capsul HS, 11% sucrose, 5% silicic acid) is fluidised in a small laboratory fluid bed equipment (DMR, WFP mini) and used as Core particles. 194g of the coating formulation obtained in the step 1 is sprayed on the surface of the beadlets with a 2-fluid nozzle (air pressure: 1.5bars) in a bottom-spray configuration. The spraying time is of about 75min with an inlet air temperature of 80°C. The final composition of the product obtained is:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Wt-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE (beadlets)</td>
<td>95</td>
</tr>
<tr>
<td>HPMC</td>
<td>2.5</td>
</tr>
<tr>
<td>Gum acacia</td>
<td>1.0</td>
</tr>
<tr>
<td>Stearic acid</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Table 1: Compound of Example 1

Example 2: Coated particles comprising vitamin A

Step 1: Coating formulation

100g Hydroxypropylmethylcellulose (HPMC) type methocel E19 are added in 1300g deionised water (80-90°C) and left for about 1 hour. Then 40g of gum acacia Senegal (Benecke) is added. The solution is then left overnight at room tern-
perature for degassing. 60g of stearic acid (Merck, "plant type") is added and mixed. The micronisation of the stearic acid is then ensured by a Polytron 6000 rotor stator system by 20000rpm for 60minutes. The quick cooling of the suspension is ensured by the addition of it in a 500g of water/ice mixed (about 450g ice and 50g water). Finally, 96g of deionised water are added. The final composition of the coating formulation is: 100g HPMC, 60g stearic acid, 40g of gum acacia, 1800g of demineralised water.

The size of the particles of stearic acid in the suspension are measured with a Malvern Mastersizer 2000 at $d_{3.2}=0.163\mu m$, $d_{10}=0.078\mu m$, $d_{50}=0.4^m$, $d_{90}=7.3\mu m$.

### Step 2: Application of the coating formulation on the core surface

300g of a beadlet Vitamin A form (as described in patent WO 2007/045488 and containing 26% Vitamin A acetate, 1% of mixed tocopherol, 55% capsul HS, 14% fructose, 4% starch) is fluidised in a small laboratory fluid bed equipment (DMR, WFP mini) and used as Core particles. 410g of the coating formulation obtained in the step 1 is sprayed on the surface of the beadlets with a 2-fluid nozzle (air pressure: 1.5bars) in a top-spray configuration. The spraying time is of about 157min with an inlet air temperature of 80°C.

50g of the obtained product is then mixed with 9g stearic acid plant (Merck) and heated up to 75°C for 10minutes. The product is then cooled to RT by mixing. The final composition of the product obtained is:

### Table 2: Compound of Example 2

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Wt-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE (beadlets)</td>
<td>74.6</td>
</tr>
<tr>
<td>HPMC</td>
<td>5.1</td>
</tr>
</tbody>
</table>
Gum acacia  |  2.0  
Stearic acid micronised |  3.1  
Stearic acid pure as additional layer |  15.2  

Retention in typical feed premix composition at 25°C, 80% r.H. after 3 months
Rovimix® A 500 WS (non coated form) 30%
Compound of example 2 86.3%

**Example 3: Coated particles comprising PUFA**

**Step 1: Coating formulation**

156g Hydroxypropylmethylcellulose (HPMC) type methocel E7 are added in 1044g deionised water (80-90°C) and left for about 1 hour. The solution is then left overnight at room temperature for degassing. In 1031g of the previous solution, 36g of stearic acid (Merck, "plant type") is added and mixed. The micronisation of the stearic acid is then ensured by a Polytron 6000 rotor stator system by 18000rpm for 20 minutes. The quick cooling of the suspension is ensured by the addition of 150g of cold water. In 1015g of the solution, 310g of ice/water mix (250g ice/ 60g water) is added. Then 26g gum acacia is added and stirred until dissolved. The final composition of the coating formulation is: 112g HPMC, 30g stearic acid, 26g of gum acacia, 1183g of demineralised water.

The size of the particles of stearic acid in the suspension are measured with a Coulter N4 Plus at a mean diameter of 0.496µm.

**Step 2: Application of the coating formulation on the core surface**

428.6g Ropufo® '10' n-3 INF Powder are mixed with 71.4g stearic acid plant (Merck) and heated up to 55-60°C for 30 minutes. The mix is then cooled down to RT while mixing.
250g of the mix is fluidised in a small laboratory fluid bed equipment (DMR, WFP mini) and used as Core particles. 200g of the coating formulation obtained in the step 1 is sprayed on the surface of the beadlets with a 2-fluid nozzle (air pressure : 1.5bars) in a top-spray configuration. The spraying time is of about 12.1 min with an inlet air temperature of 55°C.

The final composition of the product obtained is:

Table 3: Compound of Example 3

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Wt-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE (Ropufa+stearic acid)</td>
<td>91</td>
</tr>
<tr>
<td>HPMC</td>
<td>6</td>
</tr>
<tr>
<td>Gum acacia</td>
<td>1.4</td>
</tr>
<tr>
<td>Stearic acid micronised</td>
<td>1.6</td>
</tr>
</tbody>
</table>

The sensory of these particles were evaluated by sniff test.

Sniff test consists in presenting the forms to a panel of judges, ask them to sniff the products and then rate some given characteristics (sensory descriptors), by the use of an arbitrary scale. In this case it was used a scale from 1 to 7 (1 means the absence of fishiness and 7 an extremely high presence of the fishiness).

Ropufa® 1 0’ n-3 INF Powder (non coated form)
Between slightly fishy (level 3) and middle intense fishy (level 4)

Compound of example 3
Between not detectable (level 1) and very slightly fishy (level 2)

**Example 4 : Coated particles comprising vitamin A**

**Step 1 : Coating formulation**
Same coating formulation as in example 1.

Step 2: Application of the coating formulation on the core surface

300g of a beadlet Vitamin A form (as described in patent WO 2007/045488 and containing 26% Vitamin A, 45% gum acacia Senegal, 19% maltodextrin, 10% starch) is fluidised in a small laboratory fluid bed equipment (DMR, WFP mini) and used as Core particles. 270g of the coating formulation obtained in the step 1 is sprayed on the surface of the beadlets with a 2-fluid nozzle (air pressure: 1.5bars) in a bottom-spray configuration. The spraying time is of about 105min with an inlet air temperature of 80°C. 50g of the obtained product is then mixed with 16.7g of candelilla wax and heated up to 80°C for 20minutes. The mixed is then cooled to RT by mixing.

The final composition of the product obtained is:

Table 4: Compound of Example 4

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Wt-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE</td>
<td>69.9</td>
</tr>
<tr>
<td>HPMC</td>
<td>2.6</td>
</tr>
<tr>
<td>Gum acacia</td>
<td>1.0</td>
</tr>
<tr>
<td>Stearic acid micronised</td>
<td>1.5</td>
</tr>
<tr>
<td>Candelilla wax</td>
<td>25</td>
</tr>
</tbody>
</table>
Claims

1. A coating system comprising
   (i) at least one lipid compound and
   (ii) at least one gum having emulsifying properties, and
   (iii) at least one film forming compound and/or at least one emulsifier,
   characterised in that the mass median diameter of the lipid compound is less than 1µm.

2. Coating system according to claim 1, wherein the mass median diameter of the lipid compound is less than 0.8 µm.

3. Coating system according to any one of the preceding claims, wherein the lipid compound is a saturated fatty acid as well as salts thereof.

4. Coating system according to any one of the preceding claims, wherein the gum having emulsifying properties is chosen from the groups consisting of gum acacia, gum ghatti and tic gums.

5. Coating system according to any one of the preceding claims, wherein the film forming compound is a hydrocolloid, preferably alginates, pectins, guar gum, caroube gum, xanthan gum, starches, modified starches, cellulose and cellulose derivates (such as carboxymethylcellulose or hydroxypropylmethylcellulose).

6. Coating system according to any one of the preceding claims, wherein the emulsifier is chosen from the group consisting of sucrose ester, ascorbyl palmitate and polyoxyethylene-sorbitan- fatty acid esters.

7. Coating system according to any one of the preceding claims, wherein the coating system comprises at least one plasticizer.
8. Coating system according to any one of the preceding claims comprising 10 to 50 wt-% of at least one lipid compound, preferably, 20 to 40 wt-%, based on the total weight of the coating system.

9. Coating system according to any one of the preceding claims comprising 5 to 30 wt-% of at least one gum having emulsifying properties, preferably 10 to 25 wt-%, based on the total weight of the coating system.

10. Coating system according to any one of the preceding claims comprising 40 to 80 wt-%, preferably 45 to 70 wt-% of at least one film forming compound and/or at least one emulsifier, based on the total weight of the coating system.

11. Coating system according to any one of the preceding claims comprising 5 to 20 wt-%, based on the total weight of the coating system, of at least one plasticizer chosen from the group consisting of sugars (like sucrose), derivatives (mannitol, sorbitol), glycerol, mono- and diglyceride, acetylated monoglyceride, polyethylene glycol (PEG) and polypropylene glycol.

12. Coating system according to any one of the preceding claims comprising up to 5 wt-%, based on the total weight of the coating system, of at least one further ingredient chosen from the group consisting of dyestuffs, antioxidants, fillers, pH buffers and taste masking substances.

13. A composition comprising
(a) a core, wherein the core comprises at least one fat soluble compound and
(b) a coating system according to any of claims 1 - 12.

14. Composition according to claim 13, wherein the fat soluble compound is chosen from the group consisting of vitamin A, vitamin A acetate, vitamin A palmitate, vitamin E, vitamin E acetate, vitamin K (phytomenadione), vitamin D3 (cholecalciferol), PUFA and carotenoids.
15. Composition according to any one of claims 13 - 14, comprising
   (a) 50 to 95 wt-%, based on the total weight of the composition, of core and
   (b) 5 to 50 wt-%, based on the total weight of the composition, of coating
       system according to any one of claims 1 - 12.

16. Use of a composition according to any of claims 13 - 15 in the production of
    food, feed, dietary supplements and/or pharmaceutical products.

17. Food product, feed product, dietary supplement and/or pharmaceutical
    product, comprising at least one composition according to any of claims 13
    - 15.

* * *
## A. CLASSIFICATION OF SUBJECT MATTER

INV. A23L1/00 A23L1/03 A23L1/035 A23L1/0524 A61K9/28

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A23L A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, BIOSIS, FSTA

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>EP 1 413 202 AI (CSM NEDERLAND BV [NL]) 28 April 2004 (2004-04-28) * claims 1-16 *</td>
<td>1-17</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  - A: document defining the general state of the art which is not considered to be of particular relevance
  - E: earlier application or patent but published on or after the international filing date
  - L: document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - O: document referring to an oral disclosure, use, exhibition or other means
  - P: document published prior to the international filing date but later than the priority date claimed
  - T: later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  - X: document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  - Y: document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  - Z: document member of the same patent family

Date of the actual completion of the international search: 13 March 2013

Date of mailing of the international search report: 20/03/2013

Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040;
Fax: (+31-70) 340-3016

Authorized officer:
Georgopoul os, N
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WO 2008088776 A2</td>
<td>24-07-2008</td>
<td>US 2008305173 A1</td>
<td>11-12-2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2008088776 A2</td>
<td>24-07-2008</td>
</tr>
<tr>
<td>WO 2007070082 A1</td>
<td>21-06-2007</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2501900 A1</td>
<td>06-05-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1705440 A</td>
<td>07-12-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DK 1553840 T3</td>
<td>22-10-2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1413202 A1</td>
<td>28-04-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1553840 A2</td>
<td>20-07-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES 2395723 T3</td>
<td>14-02-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2006503577 A</td>
<td>02-02-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KR 20050072769 A</td>
<td>12-07-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PT 1553840 E</td>
<td>22-01-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2004037004 A2</td>
<td>06-05-2004</td>
</tr>
</tbody>
</table>