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(54) Title: COMPOSITION FOR EPIGALLOCATECHIN GALLATE

(57) Abstract: Epigallocatechin gallate (EGCG) formulations with improved flowability are obtained by compounding EGCG with a polysaccharide, particularly pectin, into a powder or granulate.

Composition for epigallocatechin gallate

The present invention relates to a composition in the form of a powder and/or granules, which contain as principal components (-)-epigallocatechin gallate (hereinafter: EGCG), together with a polysaccharide.

EGCG is the most interesting compound among group of polyphenols contained in the leaves of the green tea plant *Camellia sinensis* because it exhibits a strong antioxidant effect. Furthermore, it has been demonstrated that EGCG has an antimutagenic effect, an antibacterial effect and also a beneficial effect on cholesterol level in blood. EGCG may be obtained by procedures described in, e.g., European patent application no.1 077 211 A2. EGCG is normally produced in crystalline powder form that has a very poor flowability. The poor powder flow renders the crystalline powder difficult for use in tablet formulation and other applications that require the powder to be free flowing.

It has now been found that a composition containing EGCG together with polysaccharides may be obtained in the form of a powder or of granules with improved flowability.

Thus, in one aspect, the present invention relates to a composition in the form of a powder or granules comprising:

(a) (-)-epigallocatechin gallate, and

(b) a polysaccharide.

In a further aspect, the present invention relates to a method of producing the composition of the present invention.

In still another aspect, the invention is concerned with the use of polysaccharides, particularly pectin, for improving the flowability of EGCG powder.

Examples of polysaccharides for use in the present invention are pectin, alginates, starch, cellulose derivatives such as hydroxypropyl methyl cellulose and carboxymethyl cellulose, carrageenan, agar, gum arabic, guar gum, xanthan gum and mixtures thereof. The preferred polysaccharide is pectin or alginate, most preferred is pectin.

Pectin is a polysaccharide and described for example in the book entitled Industrial Gums, third edition, Academic Press, Inc., 1993, pages 257ff. Commercial pectins are generally produced from either citrus peel or apple pomace. Other possible sources are sugarbeet, sunflower and mango. Preferred pectins to be used within the scope of the present invention are citrus pectins, which generally have lighter color than apple pectins and, thus, do not impart significant color to the granule product.

The polysaccharide is preferably used in quantities within the range of about 0.1 % to about 5 % by weight, based on the total weight of the composition. If pectin is used as the polysaccharide, it is preferably used in quantities of about 0.1 % to about 1 % by weight, based on the total weight of the composition. If alginate is used as the polysaccharide, it is preferably used in quantities of about 0.1 % to about 1 % by weight, based on the total weight of the composition. If starch is used as the polysaccharide, it is preferably used in quantities of about 0.1 % to about 5 % by weight, based on the total weight of the composition.

The composition of this invention may be produced by any method known *per se* for the production of powders or granules. Preferred are fluidized-bed granulation, high-shear granulation, extrusion, spray-drying and wet granulation.

For obtaining the composition of the present invention by spray-drying it is convenient to prepare an aqueous slurry of all the components. The slurry has preferably a solid content of about 10 to 70% by weight, and preferably about 25 to 50% by weight. The slurry is then spray-dried in a manner known per se.

For obtaining the composition of the present invention by fluidized-bed granulation it is convenient to use a known fluidized-bed granulating apparatus which comprises a fluidized-bed drying device fitted with spray means. Preferably the EGCG forms the fluidized bed, the fluidized bed being fluidized by air or an inert gas, e.g. nitrogen. The polysaccharide or polysaccharides are dissolved in an appropriate amount of water and sprayed in the form of an atomized mist onto the fluidized particles in such a manner that the granulating and drying operations is accomplished in a single step. Alternatively, the polysaccharide or polysaccharides are mixed with EGCG and the fluidized bed being fluidized by air or an inert gas, e.g. nitrogen. An appropriate amount of water is sprayed in the form of an atomized mist onto the fluidized particles in such a manner that the granulating and drying operations is accomplished in a single step. The

granulating process is continued until the desired-granule or powder is obtained. At the end of the granulation process, the granules may be sieved to fractionate the granules as to size. While the particle size is not narrowly critical to the invention it is, for practical purposes, preferably within 50 and 2000 micron, more preferably between 100 and 1000 microns.

The composition thus obtained may be further processed depending on the intended use of the EGCG or desired applications. For instance, the composition may be compressed into tablets with conventional tabletting methods and machinery. Optionally the powder or the granules may further be mixed with a lubricant or a mixture of lubricants and then compressed into tablets. If additional lubricant is used it is preferably selected from the group of stearic acid or the magnesium or calcium salt thereof, or glyceryl behenate 45 (Compritol 888 ATO), preferably in an amount of about 0.5 to 4% by weight, calculated to the total weight of the composition. Or the composition may be mixed with excipients. Examples for excipients are dextrinized sucrose (Di Pac sugar), microcrystalline cellulose or starch.

The invention is illustrated further by the following Examples.

Example 1

EGCG powder as obtained by the procedures disclosed in EP 1 077 211 A2 may be used. A pectin solution is prepared by dissolving 27.3 g of pectin (Pectin USP, 8.4% moisture content, Danisco Ingredients, Denmark) in 1000 g of water. EGCG powder is placed in a Glatt Fluidized-Bed granulator (Model Uniglatt, Glatt GmbH, Germany) and sprayed with a fine mist of pectin solution. The granulation conditions are suitably as follows:

EGCG powder: 594 g
Pectin solution: 246.6 g
Pectin solution spraying rate: 6.7 g/minute
Inlet air temperature: 80 °C
Outlet air temperature: 40 °C

The granules leaving the apparatus will have a moisture content of about 0.2 % by weight, based on the granule weight.

Example 2

A pectin solution was prepared by dissolving 5.82 g of pectin (Pectin USP/100, 8.96% moisture content, CP Kelco, Denmark) in 174.2 g of water. EGCG powder was placed in a Glatt Fluidized-Bed granulator (Model Uniglatt, Glatt GmbH, Germany) and sprayed with a fine mist of pectin solution. The granulation conditions were suitably as follows:

EGCG powder: 445.5 g

Pectin solution: 150 g

Pectin solution spraying rate: 6.7 g/minute

Inlet air temperature: 80 °C

Outlet air temperature: 40 °C

At the end of granulation, the granule was dried for about 5 minutes to a moisture content of about 0.2 % by weight, based on the granule weight. Sieve analysis gave the following particle size distribution.

Particle Size Micron	> 850	> 800	> 600	> 425	> 250	> 160	> 125	< 125
% by weight	1	0	6	15	26	28	9	13

Granulated EGCG was compared with EGCG powder (the starting material for granulation) for powder flowability using the Agway test. In that test, flowability is determined by placing 100 gram of the granules in a glass funnel with a 11-mm opening, which is sealed temporarily. The measurement is started by releasing the seal. Flowability is determined as the time for the entire powder to flow through the funnel in seconds per 100 g of granule.

The time for a 100-g sample of the product obtained flowing through an 11 mm opening Agway funnel was 9.2 seconds. EGCG powder did not flow whereas granulated EGCG showed an acceptable flowability for use in tabletting and improved handling properties in various food and beverage applications.

What is claimed is:

1. A composition in the form of a powder or granules comprising:

a) (-)-epigallocatechin gallate, and
b) a polysaccharide.

2. A composition according to claim 1, wherein the polysaccharide is pectin or alginate.

3. A composition according to claim 1, wherein the polysaccharide is pectin.

4. A composition according to any one of the claims 1-3, wherein the polysaccharide is present in quantities within the range of about 0.1 % to about 5% by weight, based on the total weight of the composition.

5. A composition according to claim 3, wherein the pectin is present in quantities within about 0.1 % to about 1 % by weight, based on the total weight of the composition.

6. A process for preparing a composition according to any one of the claims 1-5, which comprises preparing an aqueous slurry of all the components, preferably having a solid content of about 10 to 70% by weight, and preferably about 25 to 50% by weight and spray-drying the slurry in a manner known per se.

7. A process for preparing a composition according to any one of the claims 1-5, which comprises forming a fluidized bed of (-)-epigallocatechin gallate, with or without polysaccharide, within a fluidized-bed drying device fitted with spray means, said fluidized bed being fluidized by air or an inert gas, and spraying an aqueous solution of a polysaccharide or only with water in the form of an atomized mist onto the fluidized particles until the desired granule or powder is obtained.

8. A process as in claim 7 wherein the polysaccharide is pectin or alginate.

9. A process as in claim 7 wherein the polysaccharide is pectin.

10. The use of a polysaccharide for improving the flowability of EGCG powder.

11. The use of pectin for improving the flowability of EGCG powder.

12. The invention substantially as described hereinbefore, especially with reference to the Examples

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K47/36 A61K31/353

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)
IPC 7 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 practical, search terms used)
WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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