WO1999047253; Donath, E., et al., 1998, Angewandte Chemie International Edition, 37(16), 2201-2205). However, no attention was paid to the application of carrier particles to improve the properties of solid pharmaceutical compositions in administrable form.

Therefore, there is a need for improved means and methods to obtain solid pharmaceutical compositions with desired drug delivery properties.

The above technical problem is solved by the embodiments disclosed herein and as defined in the claims.

Summary

In one aspect, the present disclosure provides a method for the production of carrier particles with secondary internal structures comprising the steps of a) combining a carrier material with a template material, wherein the carrier material forms a primary structure around the template material; b) transforming the template material; c) removing the transformed template material; and d) obtaining carrier particles with secondary internal structures.

In another aspect, the present disclosure provides a carrier particle with secondary internal structures obtainable by the method as disclosed herein.

In another aspect, the present disclosure provides a method for the production of a compacted carrier matter, the method comprising the steps of: a) i) producing a carrier particle according to any one of claims 1 to 13, and/or ii) providing the carrier particle according to any one of claims 14 to 16; and b) compacting the carrier particles with secondary internal structures to obtain the compacted carrier matter.

In another aspect, the present disclosure provides a solid pharmaceutical composition comprising the carrier particle as disclosed herein or the compacted carrier matter produced as disclosed herein.

In another aspect, the present disclosure provides the use of the solid pharmaceutical composition as disclosed herein, the compacted carrier matter produced according to the method as disclosed herein, or the carrier particle as disclosed herein in the manufacture of a medicament for the treatment of a geriatric disease or disorder.

In another aspect, the present disclosure provides the use of the solid pharmaceutical composition as disclosed herein, the compacted carrier matter produced according to the method as disclosed herein or the carrier particle as disclosed herein in the manufacture of a medicament for the treatment of a pediatric disease or disorder; or the use as disclosed herein, wherein the geriatric disease or disorder is a geriatric and pediatric disease or disorder.

In another aspect, the present disclosure provides the use of the solid pharmaceutical composition as disclosed herein, the compacted carrier matter produced according to the method as disclosed herein, or the carrier particle as disclosed herein in the manufacture of a medicament for the treatment of a disease or disorder selected from the group of anxiety disorders, bipolar disorders, pain, infections, migraine, sleeping disorders, and depressive disorders; or the use as disclosed herein, wherein the pediatric disease or disorder, the geriatric disease or disorder or the geriatric and pediatric disease or disorder are selected from the group of anxiety disorders, bipolar disorders, pain, infections, migraine, sleeping disorders, and depressive disorders.

In another aspect, the present disclosure provides the use of the solid pharmaceutical composition as disclosed herein, the compacted carrier matter produced according to the method as disclosed herein, or the carrier particle as disclosed herein, in the manufacture of a medicament for the treatment of a veterinary disease or disorder.

In another aspect, the present disclosure provides the solid pharmaceutical composition as disclosed herein, the compacted carrier matter produced according to the method as disclosed herein, or the carrier particle as disclosed herein for use in diagnostic purposes; preferably for use in scintigraphy.

Detailed Description

Accordingly, the invention relates to, inter alia, the following embodiments:

1. A method for the production of carrier particles with secondary internal structures comprising the steps of

    a) combining a carrier material with a template material, wherein the carrier material forms a primary structure around the template material;

    b) transforming the template material;

    c) removing the transformed template material; and

    d) obtaining carrier particles with secondary internal structures.

2. The method according to embodiment 1, wherein the template material is an inorganic material or consists primarily of inorganic material.

3. The method according to embodiment 1 or 2, wherein the carrier material is an inorganic material or consists primarily of inorganic material.

4. The method according to embodiment 3 or 4, wherein the carrier material and the template material are inorganic salts or consist primarily of inorganic salts.

5. The method according to any one of embodiments 1 to 4, wherein combining a carrier material with a template material comprises chemical precipitation, layering and/or crystallization of the carrier material on the template material.

6. The method according to any one of embodiments 1 or 5, wherein transforming the template material comprises heating to a temperature from 600 °C to 1200 °C.

Claims

1. A method for the production of carrier particles with secondary internal structures comprising the steps of

    a) combining a carrier material with a template material, wherein the carrier material forms a primary structure around the template material;

    b) transforming the template material;

    c) removing the transformed template material; and

    d) obtaining carrier particles with secondary internal structures.

2. The method according to claim 1, wherein template material or carrier material is an inorganic material or consists primarily of inorganic material.

3. The method according to claim 1, wherein carrier material and the template material are inorganic salts or consist primarily of inorganic salts.

4. The method according to any one of claims 1 to 3, wherein combining a carrier material with a template material comprises chemical precipitation, layering and/or crystallization of the carrier material on the template material.

5. The method according to any one of claims 1 or 4, wherein transforming the template material comprises heating to a temperature from 600 °C to 1200 °C;

    preferably wherein transforming the template material comprises heating to a temperature from 600 °C to 900 °C.

6. The method according to claim 5, wherein the step of transforming the template material comprises calcination.

7. The method according to any one of claims 5 or 6, wherein the step of transforming the template material comprises a subsequent addition of water;

    preferably wherein the addition of water is an exothermic reaction.

8. The method according to any one of claims 1 to 7, wherein removing the template material comprises dissolution of the transformed template material to form secondary internal structures.

9. The method according to any one of claims 2 to 8, wherein the template material comprises calcium carbonate.

10. The method according to any one of claims 3 to 9, wherein the carrier material comprises at least one salt and/or complex selected from the group of calcium phosphate and magnesium phosphate.

11. The method according to claim 10, wherein the carrier particles have a diameter of 1 to 300 µm and/or

wherein the carrier particles have a surface area between 15m2/g to 400m2/g.

12. The method according to any one of claim 10 or 11, wherein the secondary internal structure comprises pores having a diameter size in the range of ≥ 0.2 µm and ≤ 1.5 µm.

13. The method according to any one of claims 10 to 12, wherein the total volume of the secondary internal structures in the obtained carrier particles with secondary internal structures is in the range of ≥ 10% to ≤ 90% of the particle volume.

14. A carrier particle with secondary internal structures obtainable by the method according to any one of claims 1 to 13.

15. The carrier particle according to claim 14, wherein the carrier particle has a loading capacity of ≥ 60% v/v.

16. The carrier particle according to claim 14 or 15, wherein the carrier particle comprises a therapeutic agent.

17. A method for the production of a compacted carrier matter, the method comprising the steps of:

a) i) producing a carrier particle according to any one of claims 1 to 13, and/or

ii) providing the carrier particle according to any one of claims 14 to 16; and

b) compacting the carrier particles with secondary internal structures to obtain the compacted carrier matter.

18. A solid pharmaceutical composition comprising the carrier particle according to any one of claims 14 to 16 or the compacted carrier matter produced according to claim 17.

19. The solid pharmaceutical composition according to claim 18, the compacted carrier matter produced according to claim 17 or the carrier particle according to claim 16, wherein the therapeutic agent is selected from the group of anxiolytic agents, sedative agents, narcotic agents, antidepressant agents, anti-migraine agents, anti-inflammatory agents, and anti-infective agents.

20. The solid pharmaceutical composition according to claim 18 or 19, wherein the solid pharmaceutical composition comprises at least one adjuvant;

wherein preferably the at least one adjuvant is selected from the group of disintegrants, lubricants, and flowability enhancement agents, and/or

wherein the at least one adjuvant is selected from the group taste altering agents, such as taste altering agent is selected from the group of artificial sweeteners, acidity modifiers, gums, cellulose derivatives, hard fats, and salts; smell altering agents; and appearance altering agents.

21. The solid pharmaceutical composition according to any one of claims 18 to 20, the compacted carrier matter produced according to claim 17, or the carrier particle according to claim 16 for use in treatment.

22. Use of the solid pharmaceutical composition according to any one of claims 18 to 20, the compacted carrier matter produced according to claim 17, or the carrier particle according to claim 16 in the manufacture of a medicament for the treatment of a geriatric disease or disorder.

23. Use of the solid pharmaceutical composition according to any one of claims 18 to 20, the compacted carrier matter produced according to claim 17 or the carrier particle according to claim 16 in the manufacture of a medicament for the treatment of a pediatric disease or disorder; or

the use according to claim 22, wherein the geriatric disease or disorder is a geriatric and pediatric disease or disorder.

24. Use of the solid pharmaceutical composition according to any one of claims 18 to 20, the compacted carrier matter produced according to claim 17, or the

carrier particle according to claim 16 in the manufacture of a medicament for the treatment of a disease or disorder selected from the group of anxiety disorders, bipolar disorders, pain, infections, migraine, sleeping disorders, and depressive disorders; or

the use according to claim 22 or 23, wherein the pediatric disease or disorder, the geriatric disease or disorder or the geriatric and pediatric disease or disorder are selected from the group of anxiety disorders, bipolar disorders, pain, infections, migraine, sleeping disorders, and depressive disorders.

25. Use of the solid pharmaceutical composition according to any one of claims 18 to 20, the compacted carrier matter produced according to claim 17, or the carrier particle according to claim 16, in the manufacture of a medicament for the treatment of a veterinary disease or disorder.

26. The solid pharmaceutical composition according to any of claims 18 to 20, the compacted carrier matter produced according to claim 17, or the carrier particle according to claim 16 for use in diagnostic purposes;

preferably for use in scintigraphy.