CLAIMS

1. A process for preparing a powder formulation for inhalation for use in a dry powder inhaler, said powder comprising:

(A) a carrier comprising:

(a) 80 to 95 percent by weight, based on the total weight of said carrier, of coarse particles of a physiologically acceptable excipient having a mean particle size of at least 175 μm; and

(b) 19.6 to 4.9 percent by weight, based on the total weight of said carrier, of micronized particles of a physiologically acceptable excipient, and 0.1 to 0.4 percent by weight, based on the total weight of said carrier, of a salt of a fatty acid; and

(B) micronized particles of an anti-muscarinic drug, a long-acting β_2-agonist (LABA), and optionally, an inhaled corticosteroid (ICS), as active ingredients, said process comprising:

(i) mixing all of said coarse particles of a physiologically acceptable excipient, all of said salt of a fatty acid, a first portion of said micronized particles of a physiologically acceptable excipient, all of said micronized particles of said long-acting β_2-agonist, said anti-muscarinic drug, and, optionally, said inhaled corticosteroid in a vessel of a shaker mixer at a speed of rotation not lower than 16 r.p.m. for a time of not less than 60 minutes, to obtain a first mixture; and

(ii) adding the remaining part of said micronized particles of a physiologically acceptable excipient to said first mixture, to obtain a second mixture, and mixing said second mixture at a speed of rotation not lower than 16 rpm for a time of at least 120 minutes,

wherein

the long-acting β_2-agonist is selected from the group consisting of formoterol, salmeterol, indacaterol, olodaterol, and vilanterol;

the anti-muscarinic drug is selected from the group consisting of glycopyrronium bromide or chloride, tiotropium bromide, umeclidinium bromide, and aclidinium bromide;

the inhaled corticosteroid is selected from the group consisting of beclomethasone dipropionate and its monohydrate form, budesonide, fluticasone propionate, fluticasone furoate, and mometasone furoate.

2. The process according to claim 1, further comprising: (iii) further mixing the formulation obtained in (ii) to achieve a homogeneous distribution of said active ingredients.

3. The process according to claim 1 or 2, wherein said first portion of said micronized particles of a physiologically acceptable excipient is 40% to 60%, based on the total weight of all of said micronized particles of a physiologically acceptable excipient.

4. The process according to claim 1, wherein the anti-muscarinic drug is glycopyrronium bromide, the ICS is beclometasone dipropionate, the LABA is formoterol fumarate dihydrate.

5. The process according to claim 1, wherein the salt of a fatty acid is selected from the group consisting of magnesium stearate; sodium stearyl fumarate; sodium stearyl lactylate; sodium lauryl sulphate, and magnesium lauryl sulphate.

6. The process according to claim 5, wherein the salt of the fatty acid is magnesium stearate.

7. The process according to any one of the preceding claims, wherein in step i) the mixing is performed at a speed of rotation comprised between 20 and 28 r.p.m for a time comprised between 60 and 120 minutes.

8. The process according to any one of the preceding claims, wherein in step ii) the mixing is performed at a speed of rotation comprised between 16 and 32 r.p.m for a time comprised between 120 and 180 minutes.

9. A powder formulation for inhalation for use in a dry powder inhaler, said powder comprising:

(A) a carrier, comprising:

(a) 80 to 95 percent by weight, based on the total weight of said carrier, of coarse particles of a physiologically acceptable excipient having a mean particle size of at least 175 μm; and

(b) 19.6 to 4.9 percent by weight, based on the total weight of said carrier, of micronized particles of a physiologically acceptable excipient, and 0.1 to 0.4 percent by weight, based on the total weight of said carrier, of magnesium stearate; and

(B) micronized particles of glycopyrronium bromide, beclometasone dipropionate, and formoterol fumarate dehydrate, as active ingredients, wherein said formulation is obtainable by a process comprising:

(i) mixing all of said coarse particles of a physiologically acceptable excipient, all of said magnesium stearate, a first portion of said micronized particles of a physiologically acceptable excipient, all of said micronized particles of glycopyrronium bromide, beclometasone dipropionate, and formoterol fumarate dihydrate in a vessel of a shaker mixer at a speed of rotation not lower than 16 rpm for a time of not less than 60 minutes, to obtain a first mixture; and

(ii) adding the remaining part of said micronized particles of a physiologically acceptable excipient to said first mixture, to obtain a second mixture, and mixing said second mixture at a speed of rotation not lower than 16 for a time of at least 120 minutes;

whereby the extrafine particle fraction of each active ingredient is comprised between 20 and 35%.

10. The powder formulation according to claim 9, wherein said process further comprises: (iii) further mixing the formulation obtained in (ii) to achieve a homogeneous distribution of the active ingredients.

11. The powder formulation according to claim 9 or 10, wherein said first portion of

said micronized particles of a physiologically acceptable excipient is 40% to 60%, based on the total weight of all of said micronized particles of a physiologically acceptable excipient.

12. The powder formulation according to any one of claims 9 to 11, whereby the extrafine particle fraction of beclometasone dipropionate, and formoterol fumarate dihydrate is comprised between 20 and 35%, and the extrafine particle fraction of glycopyrronium bromide is comprised between 20 and 30%.

13. The powder formulation according to any one of claims 9 or 12, wherein the physiologically acceptable excipient is alpha-lactose monohydrate.

14. The powder formulation according to any one of claims 9 to 13, wherein the coarse particles have a mass diameter comprised between 210 and 360 µm.

15. A dry powder inhaler device filled with the dry powder formulation of any one of claims 9 to 14.

16. The dry powder formulation of any one of claims 9 to 14 for use for the prevention and/or treatment of an inflammatory and/or obstructive airways disease.

17. The dry powder formulation for use according to claim 16, wherein the disease is asthma or chronic obstructive pulmonary disease (COPD).

18. Use of the dry powder formulation of any one of claims 9 to 14 in the manufacture of a medicament for the prevention and/or treatment of an inflammatory and/or obstructive airways disease.

19. The use according to claim 18, wherein the disease is asthma or chronic obstructive pulmonary disease (COPD).