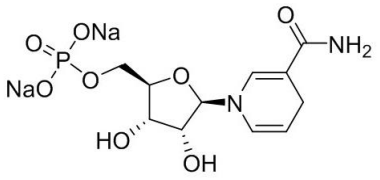
Claims

1. A crystal of a reduced β-nicotinamide mononucleotide disodium salt of formula (I), wherein the crystal is a hydrate of reduced β-nicotinamide mononucleotide disodium salt, and crystal form of the crystal is crystal form A, crystal form B or crystal form C,



(I)

wherein the XRPD pattern of the crystal form A comprises 5 or more 2θ values selected from the group consisting of: 12.7°±0.2°, 15.9°±0.2°, 18.0°±0.2°, 20.4°±0.2°, 20.9°±0.2°, and 31.8°±0.2°;

the XRPD pattern of the crystal form B comprises 5 or more 2θ values selected from the group consisting of: 12.0°±0.2°, 14.5°±0.2°, 15.3°±0.2°, 17.5°±0.2°, 19.9°±0.2°, and 21.5°±0.2°; and

the XRPD pattern of the crystal form C comprises 5 or more 2θ values selected from the group consisting of: 6.3°±0.2°, 15.3°±0.2°, 17.7°±0.2°, 19.9°±0.2°, 20.2°±0.2°, and 21.5°±0.2°.

2. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the XRPD pattern of the crystal form A further comprises 1 or more 2θ values selected from the group consisting of: 10.5°±0.2°, 19.8°±0.2°, 22.6°±0.2°, 24.0°±0.2°, 26.1°±0.2°, 28.7°±0.2°, 30.8°±0.2°, and 33.4°±0.2°.

3. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the crystal form A further has one or more features selected from the following group:

1) the XRPD pattern of the crystal form A comprises the following 2θ values: 5.0°±0.2°, 10.5°±0.2°, 12.7°±0.2°, 13.7°±0.2°, 14.9°±0.2°, 15.9°±0.2°, 16.1°±0.2°, 16.6°±0.2°, 18.0°±0.2°, 19.8°±0.2°, 20.4°±0.2°, 20.9°±0.2°, 22.6°±0.2°, 24.0°±0.2°, 24.7°±0.2°, 25.2°±0.2°, 25.7°±0.2°, 26.1°±0.2°, 27.8°±0.2°, 28.7°±0.2°, 29.3°±0.2°, 30.3°±0.2°, 30.8°±0.2°, 31.8°±0.2°, 32.7°±0.2°, 33.4°±0.2°, 34.2°±0.2°, 35.8°±0.2°, 36.4°±0.2°, 37.4°±0.2°, 39.7°±0.2°, 41.2°±0.2°, 41.7°±0.2°, 42.6°±0.2°, 43.9°±0.2°, 44.3°±0.2°, 46.0°±0.2°, 46.4°±0.2°, and 49.2°±0.2°;

2) the TGA pattern of the crystal form A has a weight loss of 19%-30% at 15°C-200°C;

3) the DSC pattern of the crystal form A has a heat absorption peak in the range of 50°C-80°C.

4. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the crystal form A further has one or more features selected from the following group:

1) the XRPD pattern of the crystal form A is substantially as characterized in Fig. 1;

2) the TGA pattern of the crystal form A is substantially as characterized in Fig. 2;

3) the DSC pattern of the crystal form A is substantially as characterized in Fig. 3.

5. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the crystal form B has one or more features selected from the following group:

1) the XRPD pattern of the crystal form B further comprises 1 or more 2θ values selected from the group consisting of: 21.1°±0.2°, 23.1°±0.2°, and 25.5°±0.2°;

2) the TGA pattern of the crystal form B has a weight loss of 12%-23% at 15°C-200°C;

3) the DSC pattern of the crystal form B has a heat absorption peak in the range of 50°C-80°C.

6. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the crystal form B has one or more features selected from the following group:

1) the XRPD pattern of the crystal form B is substantially as characterized in Fig. 4;

2) the TGA pattern of the crystal form B is substantially as characterized in Fig. 5; and

3) the DSC pattern of the crystal form B is substantially as characterized in Fig. 6.

7. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the XRPD pattern of the crystal form B comprises the following 2θ values: 5.2°±0.2°, 7.7°±0.2°, 10.5°±0.2°, 11.5°±0.2°, 12.0°±0.2°,

12.6°±0.2°, 13.7°±0.2°, 14.5°±0.2°, 15.3°±0.2°, 16.5°±0.2°, 17.1°±0.2°, 17.5°±0.2°, 18.5°±0.2°, 19.4°±0.2°, 19.9°±0.2°, 21.1°±0.2°, 21.5°±0.2°, 22.5°±0.2°, 23.1°±0.2°, 24.1°±0.2°, 24.7°±0.2°, 25.5°±0.2°, 26.4°±0.2°, 27.2°±0.2°, 27.7°±0.2°, 28.3°±0.2°, 29.2°±0.2°, 29.5°±0.2°, 31.2°±0.2°, 32.1°±0.2°, 32.6°±0.2°, 34.2°±0.2°, 35.1°±0.2°, 36.6°±0.2°, 38.3°±0.2°, 39.7°±0.2°, 41.4°±0.2°, 43.0°±0.2°, 45.1°±0.2°, and 45.7°±0.2°.

8. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the crystal form C has one or more features selected from the following group:

1) the XRPD pattern of the crystal form C further comprises 1 or more 2θ values selected from the group consisting of: 6.3°±0.2°, 10.0°±0.2°, 12.1°±0.2°, 12.3°±0.2°, 12.8°±0.2°, 15.3°±0.2°, 16.6°±0.2°, 17.7°±0.2°, 19.9°±0.2°, 20.2°±0.2°, 21.5°±0.2°, 23.3°±0.2°, 24.9°±0.2°, 25.6°±0.2°, and 33.7°±0.2°;

2) the TGA pattern of the crystal form C has a weight loss of 8%-16% at 15°C-200°C;

3) the DSC pattern of the crystal form C has a heat absorption peak in the range of 50°C-80°C.

9. The crystal of the reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the crystal form C has one or more features selected from the following group:

1) the XRPD pattern of the crystal form C is substantially as characterized in Fig. 7;

2) the TGA pattern of the crystal form C is substantially as characterized in Fig. 8; and

3) the DSC pattern of the crystal form C is substantially as characterized in Fig. 9.

10. A method for preparing the crystal of reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein the method comprises the following steps:

1) The reduced β-nicotinamide mononucleotide disodium salt was added to water to obtain a water solution containing reduced β-nicotinamide mononucleotide disodium salt;

2) under stirring conditions, the solution was purged with nitrogen, and crystallized to obtain the crystal form A according to claim 1; alternatively, under stirring conditions, the solution was added crystal form A as a crystalline seed and

concentrated under reduced pressure, and crystallized to obtain the crystal form A according to claim 1.

11. A method for preparing the crystal of reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein crystal form is crystal form B, and the method comprises the following step: subjecting the crystal form A to vacuum drying transcrystallization to obtain the crystal form B.

12. A method for preparing the crystal of reduced β-nicotinamide mononucleotide disodium salt according to claim 1, wherein crystal form is crystal form C, and the method comprises the following step: subjecting the crystal form B to vacuum drying transcrystallization to obtain the crystal form C.

13. A composition, comprising: (a) the crystal according to any one of claims 1-9, and (b) pharmaceutically acceptable excipients, or acceptable excipients for cosmetic.

14. A use of the crystal according to claim 1 in the preparation of a drug or a cosmetic.