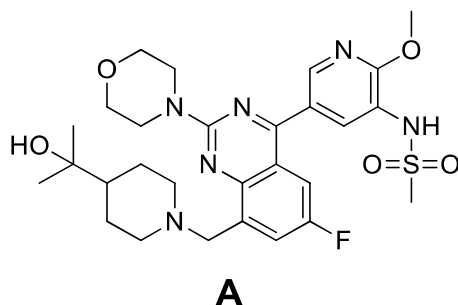


What is claimed is:

1. A crystal form I of the morpholino quinazoline compound represented by formula A having an X-ray powder diffraction pattern comprising diffraction peaks at angles  $2\theta$  of  $7.7\pm 0.2^\circ$ ,  $9.7\pm 0.2^\circ$ ,  $12.4\pm 0.2^\circ$ ,  $15.4\pm 0.2^\circ$ ,  $17.4\pm 0.2^\circ$ ,  $18.0\pm 0.2^\circ$  and  $18.4\pm 0.2^\circ$ ,



2. The crystal form I of the morpholino quinazoline compound represented by formula A of claim 1, wherein the X-ray powder diffraction pattern further comprises diffraction peaks at one or more of the following angles  $2\theta$ :  $11.0\pm 0.2^\circ$ ,  $11.3\pm 0.2^\circ$ ,  $19.5\pm 0.2^\circ$ ,  $20.1\pm 0.2^\circ$ ,  $21.8\pm 0.2^\circ$ ,  $22.6\pm 0.2^\circ$ ,  $23.2\pm 0.2^\circ$ ,  $23.6\pm 0.2^\circ$ ,  $24.3\pm 0.2^\circ$ ,  $25.8\pm 0.2^\circ$ , and  $28.7\pm 0.2^\circ$ .

3. The crystal form I of the morpholino quinazoline compound represented by formula A of claim 1, wherein the X-ray powder diffraction pattern comprises diffraction peaks at angles  $2\theta$  of  $7.7\pm 0.2^\circ$ ,  $9.7\pm 0.2^\circ$ ,  $11.0\pm 0.2^\circ$ ,  $12.4\pm 0.2^\circ$ ,  $15.4\pm 0.2^\circ$ ,  $17.4\pm 0.2^\circ$ ,  $18.0\pm 0.2^\circ$ ,  $18.4\pm 0.2^\circ$ ,  $23.6\pm 0.2^\circ$  and  $24.3\pm 0.2^\circ$ ;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has an infrared absorption spectrum comprising characteristic peaks at  $3445\text{cm}^{-1}$ ,  $3246\text{cm}^{-1}$ ,  $3018\text{cm}^{-1}$ ,  $3001\text{cm}^{-1}$ ,  $2972\text{cm}^{-1}$ ,  $2953\text{cm}^{-1}$ ,  $2924\text{cm}^{-1}$ ,  $2910\text{cm}^{-1}$ ,  $2891\text{cm}^{-1}$ ,  $2850\text{cm}^{-1}$ ,  $1604\text{cm}^{-1}$ ,  $1589\text{cm}^{-1}$ ,  $1552\text{cm}^{-1}$ ,  $1506\text{cm}^{-1}$ ,  $1489\text{cm}^{-1}$ ,  $1458\text{cm}^{-1}$ ,  $1413\text{cm}^{-1}$ ,  $1365\text{cm}^{-1}$ ,  $1155\text{cm}^{-1}$  and  $775\text{cm}^{-1}$ ;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has a differential scanning calorimetry graph having an absorption peak at  $204.3 \pm 3^\circ\text{C}$  and a heat of fusion of  $98.70\text{ J/g}$ ;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has a dynamic vapor sorption graph that the crystal form I increases by 0.23% by mass in

the relative humidity from 0 to 90% and 0.34% by mass in the relative humidity from 0% to 95% compared to the initial mass.

4. The crystal form I of the morpholino quinazoline compound represented by formula A of claim 3, wherein the X-ray powder diffraction pattern comprises diffraction peaks at angles  $2\theta$  of  $7.7\pm 0.2^\circ$ ,  $9.7\pm 0.2^\circ$ ,  $11.0\pm 0.2^\circ$ ,  $11.3\pm 0.2^\circ$ ,  $12.4\pm 0.2^\circ$ ,  $15.4\pm 0.2^\circ$ ,  $17.4\pm 0.2^\circ$ ,  $18.0\pm 0.2^\circ$ ,  $18.4\pm 0.2^\circ$ ,  $19.5\pm 0.2^\circ$ ,  $20.1\pm 0.2^\circ$ ,  $21.8\pm 0.2^\circ$ ,  $22.6\pm 0.2^\circ$ ,  $23.2\pm 0.2^\circ$ ,  $23.6\pm 0.2^\circ$ ,  $24.3\pm 0.2^\circ$ ,  $25.8\pm 0.2^\circ$  and  $28.7\pm 0.2^\circ$ ;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has an infrared absorption spectrum comprising characteristic peaks, vibrational modes, groups and absorption peak intensity shown in the following table;

| Absorption peak wave number ( $\text{cm}^{-1}$ ) | Vibrational mode                            | Group                                       | Absorption peak intensity |
|--------------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------|
| 3445                                             | -O-H stretching vibration                   | -OH                                         | m                         |
| 3246                                             | -N-H stretching vibration                   | -NH                                         | s                         |
| 3018, 3001, 2972, 2953, 2924, 2910, 2891, 2850   | -C-H stretching vibration                   | -CH <sub>3</sub> , -CH <sub>2</sub> -, -CH- | m                         |
| 1604, 1589, 1506, 1489                           | Aromatic ring skeleton vibration            | Aromatic ring                               | m                         |
| 1552                                             | -NH bending vibration                       | -NH<br>(methanesulfonamide)                 | s                         |
| 1458, 1365                                       | -C-H bending vibration                      | -CH <sub>3</sub> , -CH <sub>2</sub> -, -CH- | s                         |
| 1413                                             | -OH bending vibration<br>(tertiary alcohol) | -OH                                         | s                         |
| 1365                                             | -SO <sub>2</sub> - stretching vibration     | -SO <sub>2</sub> -                          | s                         |
| 1155                                             | -SO <sub>2</sub> - bending vibration        | -SO <sub>2</sub> -,                         | s                         |

|     |                                    |               |   |
|-----|------------------------------------|---------------|---|
| 775 | Aromatic ring bending<br>vibration | Aromatic ring | s |
|-----|------------------------------------|---------------|---|

;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has a thermogravimetric analysis graph substantially the same as shown in FIG. 3;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has a differential scanning calorimetry graph substantially the same as shown in FIG. 4;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has a dynamic vapor sorption graph substantially the same as shown in FIG. 5.

5. The crystal form I of the morpholino quinazoline compound represented by formula A of at least one of claims 1 to 4, wherein the crystal form I of the morpholino quinazoline compound represented by formula A has an X-ray powder diffraction pattern comprising diffraction peaks at the diffraction angles  $2\theta$  with peak height percentage shown in the following table:

| Number | $2\theta$ ( $\pm 0.2^\circ$ ) | Percentage of peak height (%) |
|--------|-------------------------------|-------------------------------|
| 1      | 7.239                         | 5.5                           |
| 2      | 7.666                         | 18.4                          |
| 3      | 9.732                         | 34.5                          |
| 4      | 10.962                        | 25.7                          |
| 5      | 11.318                        | 5.4                           |
| 6      | 12.385                        | 89.2                          |
| 7      | 15.377                        | 65.5                          |
| 8      | 17.404                        | 100.0                         |
| 9      | 17.971                        | 99.4                          |
| 10     | 18.382                        | 89.6                          |
| 11     | 19.516                        | 11.0                          |
| 12     | 20.111                        | 24.6                          |
| 13     | 21.795                        | 36.0                          |

|    |        |      |
|----|--------|------|
| 14 | 22.551 | 15.8 |
| 15 | 23.191 | 16.5 |
| 16 | 23.564 | 53.2 |
| 17 | 24.300 | 30.5 |
| 18 | 25.799 | 13.9 |
| 19 | 28.684 | 21.5 |

6. The crystal form I of the morpholino quinazoline compound represented by formula A of claim 5, wherein the crystal form I of the morpholino quinazoline compound represented by formula A has an X-ray powder diffraction pattern substantially expressed by angle  $2\theta$  substantially the same as shown in FIG. 1;

and/or, the crystal form I of the morpholino quinazoline compound represented by formula A has an infrared absorption spectrum substantially the same as shown in FIG. 2.

7. A method of preparing the crystal form I of the morpholino quinazoline compound represented by formula A of at least one of claims 1 to 6, wherein the method is method 1 or method 2:

method 1: forming the morpholino quinazoline compound represented by formula A in a solvent into a hot saturated solution, and then cooling; the solvent is one or more selected from acetonitrile, 2-methyltetrahydrofuran, acetone, ethyl acetate, ethanol and isopropanol;

method 2: mixing the morpholino quinazoline compound represented by formula A in solvent A and solvent B, dissolving and crystallizing;

the solvent A is one or more selected from tetrahydrofuran, 1,4-dioxane, ethanol, ethyl acetate, *N,N*-dimethylformamide, *N,N*-dimethylacetamide, and dimethyl sulfoxide; the solvent B is one or more selected from *n*-heptane, *n*-hexane, cyclohexane, cyclopentane, *n*-pentane, petroleum ether, and water.

8. The method of preparing the crystal form I of the morpholino quinazoline compound

represented by formula A of claim 7, wherein, in method 1, the cooling is performed by rapid cooling method or slow cooling method; when the cooling is performed by rapid cooling method, then the final temperature of the cooling is  $-15$  to  $-25$  °C; when the cooling is performed by slow cooling method, then the cooling is performed at a rate of 5 to 15 °C/h;

and/or, in method 2, when the solvent A is one or more selected from tetrahydrofuran, 1,4-dioxane, ethanol and ethyl acetate, then the solvent B is one or more selected from *n*-heptane, *n*-hexane, cyclohexane, cyclopentane, *n*-pentane and petroleum ether;

and/or, when the solvent A is one or more selected from *N,N*-dimethylformamide, *N,N*-dimethylacetamide and dimethyl sulfoxide (DMSO), then the solvent B is water;

and/or, the method 2 comprises dissolving the morpholino quinazoline compound represented by formula A in the solvent A to obtain a mixed solution, adding the solvent B to the mixed solution and crystallizing.

9. A use of the crystal form I of the morpholino quinazoline compound represented by formula A of at least one of claims 1 to 6 in the preparation of a PI3 kinase inhibitor.

10. A use of the crystal form I of the morpholino quinazoline compound represented by formula A of at least one of claims 1 to 6 in the preparation of a medicament for the prevention and/or treatment of a disease associated with PI3 kinase.

11. The use of claim 10, wherein the disease associated with PI3 kinase is one or more of: cancer, immune diseases, metabolic and/or endocrine disorders, cardiovascular diseases, viral infections and inflammation, and neurological diseases.

12. The use of claim 10, wherein the immune diseases are one or more of rheumatoid arthritis, psoriasis, ulcerative colitis, Crohn's disease, and systemic lupus erythematosus;

and/or, the cardiovascular diseases are hematologic neoplasms;

and/or, the viral infection and inflammation are asthma and/or atopic dermatitis.

13. A use of the crystal form I of the morpholino quinazoline compound represented by formula A of at least one of claims 1 to 6 in the preparation of a medicament for the prevention and/or treatment of a disease associated with PI3 kinase in combination with another therapeutic agent.

14. A pharmaceutical composition comprising the crystal form I of the morpholino quinazoline compound represented by formula A of at least one of claims 1 to 6, and a pharmaceutically acceptable carrier.