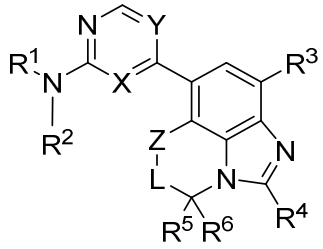
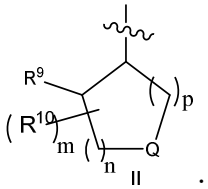
CLAIMS

1. A compound of formula I or a pharmaceutically acceptable salt thereof,



I

wherein R^1 is selected from the group consisting of H, C_{1-6} alkyl, C_{1-6} haloalkyl and C_{3-8} cycloalkyl; the C_{1-6} alkyl, C_{1-6} haloalkyl and C_{3-8} cycloalkyl are each independently and optionally substituted with one or more R^a;

R^2 is a structure of formula II:  ;

II

R^9 is OH;

each R^{10} is independently selected from the group consisting of OH, halogen, CN, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl; the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl are each independently and optionally substituted with one or more R^b;

Q is NR^{11} or O;

or Q is $CR^{12}R^{13}$, wherein R^{12} and R^{13}, together with the carbon atom to which they are attached, form a 3-12 membered heterocycloalkyl group containing N or O of NR^{11} as a ring atom; the heterocycloalkyl group is optionally substituted with one or more R^{10};

R^{11} SO_2R^c,;

m is 0, 1 or 2;

n is1;

p is 2;

X is N;

Y is CR^7;

R^7 is selected from the group consisting of H, F, Cl, CN, C_{1-6} alkyl and C_{1-6} alkoxy; the C_{1-6} alkyl and C_{1-6} alkoxy are each independently and optionally substituted with one or more R^a;

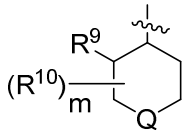
R^3 is selected from the group consisting of H, F, Cl, CN, CH_2F, CHF_2 and CF_3;

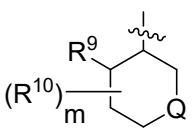
R^4 is selected from the group consisting of H, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl; the C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl are each independently and optionally substituted with

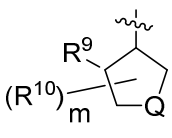
one or more R^b or deuterium atoms;
Z is O or CHR^8; R^8 is selected from the group consisting of hydrogen, deuterium and halogen;
L is $-(CH_2)_q-$;
q is 1;
R^5 and R^6 are each independently selected from the group consisting of H, deuterium, CN, halogen, C_{1-6} alkyl, C_{3-8} cycloalkyl, C_{1-6} alkoxy and 3-12 membered heterocycloalkyl; the C_{1-6} alkyl, C_{3-8} cycloalkyl, C_{1-6} alkoxy and 3-12 membered heterocycloalkyl are each optionally and independently substituted with one or more R^b or deuterium atoms;
R^a and R^b are each independently selected from the group consisting of H, OH, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-8} cycloalkyl, 3-12 membered heterocycloalkyl and $NR^{a'}R^{a''}$; the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl are each independently and optionally substituted with one or more substituents selected from the group consisting of NH_2, $NHCH_3$, $N(CH_3)_2$, halogen, OH, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl;
$R^{a'}$ and $R^{a''}$ are each independently selected from the group consisting of H, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl; the C_{1-6} alkyl, C_{1-6} haloalkyl, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl are each independently and optionally substituted with one or more substituents selected from the group consisting of NH_2, $NHCH_3$, $N(CH_3)_2$, halogen, OH, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl;
or $R^{a'}$ and $R^{a''}$, together with the N atom to which they are attached, form a 3-12 membered heterocycloalkyl group; the 3-12 membered heterocycloalkyl group is optionally substituted with one or more substituents selected from the group consisting of halogen, OH, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl;
R^c is CH_3.

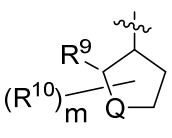
2. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^1 is H or C_{1-6} alkyl, preferably H.

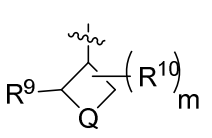
3. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^2 is selected from the group consisting of



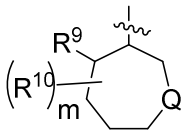
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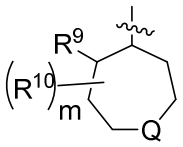
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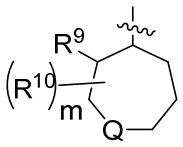
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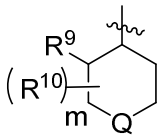
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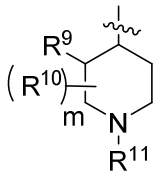


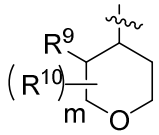
, 

and 

, preferably 

; R^9, R^{10}, m and Q are as defined in claim 1.

4. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 3, wherein R^2 is 

or 

; R^9, R^{10}, m and R^{11} are as defined in claim 1.

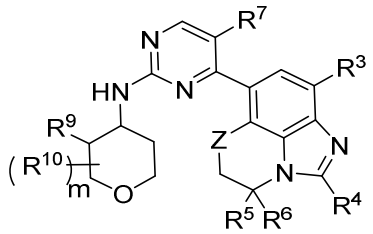
5. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^7 is selected from the group consisting of H, F, Cl and C_{1-6} alkyl, preferably F and Cl.

6. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^3 is selected from the group consisting of H, F and Cl, preferably F and Cl.

7. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^4 is selected from the group consisting of H, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl, the C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl are each independently and optionally substituted with one or more R^b or deuterium atoms, and R^b is selected from the group consisting of OH, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy and C_{3-8} cycloalkyl; preferably, R^4 is C_{1-6} alkyl, the C_{1-6} alkyl is optionally substituted with one or more R^b or deuterium atoms, and R^b is OH or halogen.

8. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^5 and R^6 are each independently selected from the group consisting of H, deuterium, CN, halogen, C_{1-6} alkyl and C_{3-8} cycloalkyl.

9. The compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1, being a compound of formula I-3 or a pharmaceutically acceptable salt thereof,



I-3

wherein R^9 is OH;
R^{10} are each independently selected from the group consisting of OH, halogen, CN, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl and C_{1-6} haloalkoxy;
m is 0, 1, or 2;
R^7 is selected from the group consisting of H, F, Cl and C_{1-6} alkyl;
R^3 is selected from the group consisting of H, F and Cl;
R^4 is selected from the group consisting of H, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl; the C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl and 3-12 membered heterocycloalkyl are each independently and optionally substituted with one or more R^b or deuterium atoms; R^b is selected from the group consisting of H, OH, CN and halogen;
R^5 and R^6 are each independently selected from the group consisting of H, deuterium, CN, halogen, C_{1-6} alkyl and C_{3-8} cycloalkyl;
Z is O or CHR^8; R^8 is selected from the group consisting of hydrogen, deuterium and halogen.

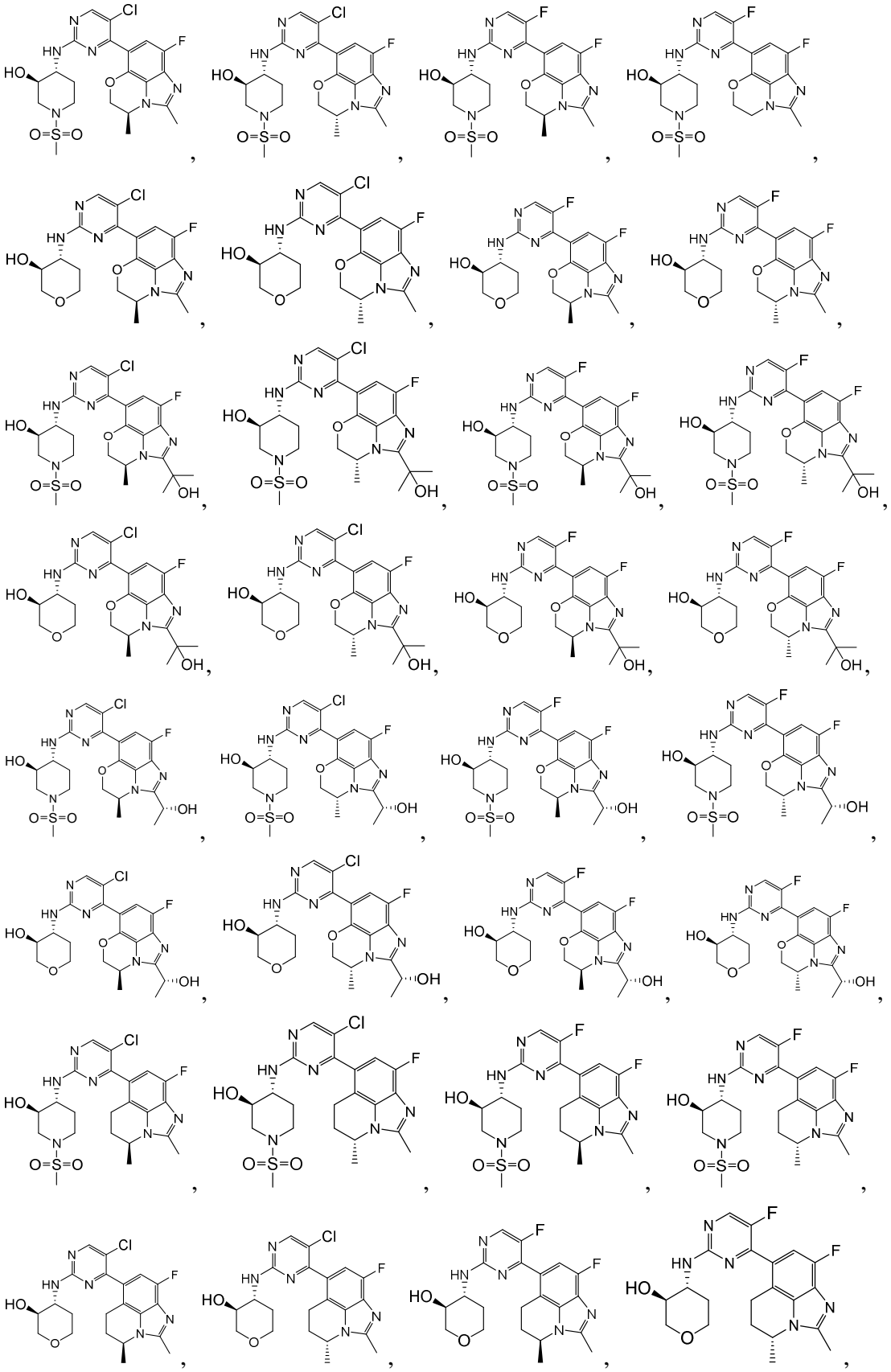
10. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 9, wherein Z is O.

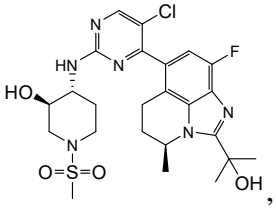
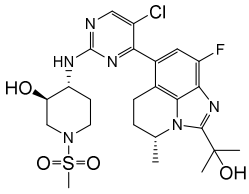
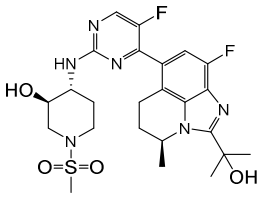
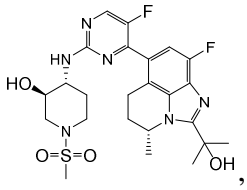
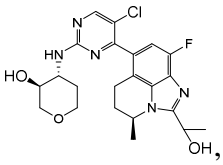
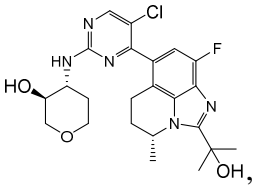
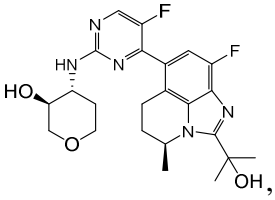
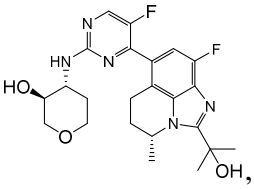
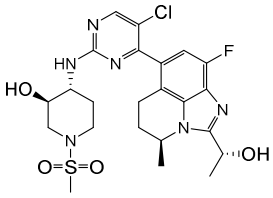
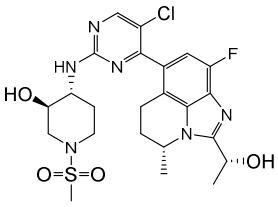
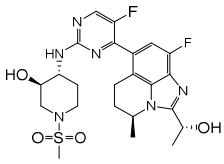
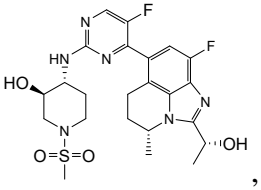
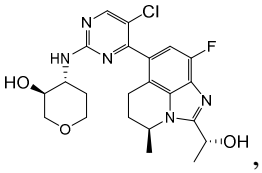
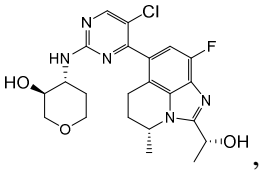
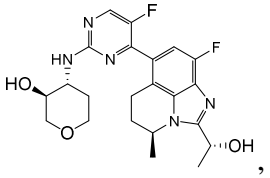
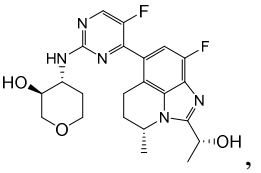
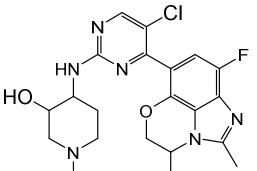
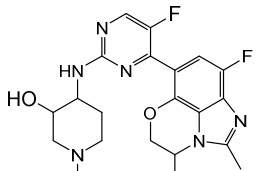
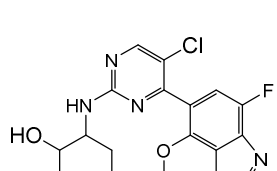
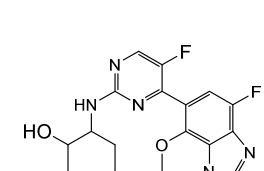
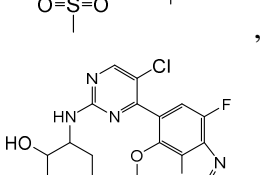
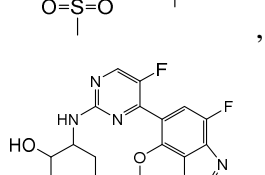
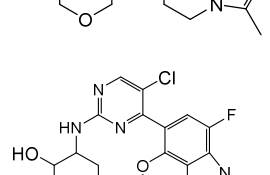
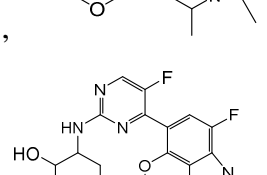
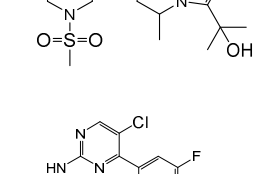
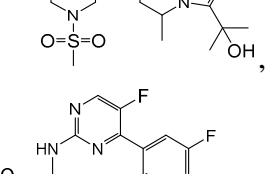
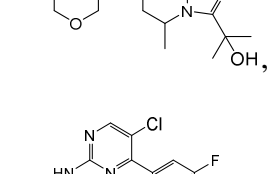
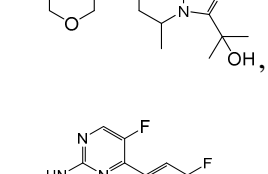
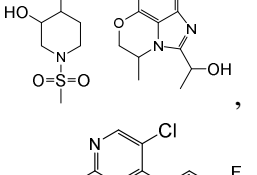
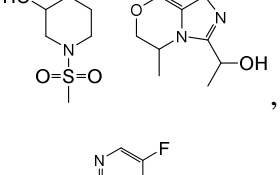
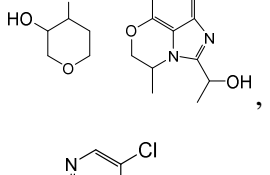
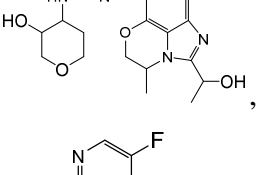
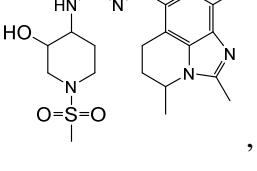
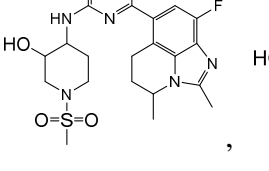
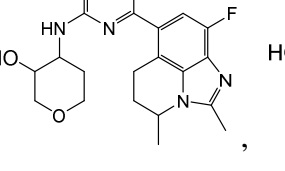
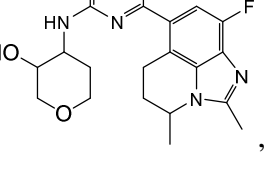
11. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 9, wherein Z is CHR^8; R^8 is selected from the group consisting of hydrogen, deuterium and halogen.

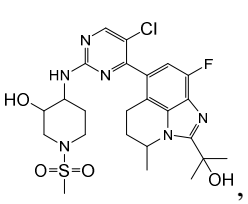
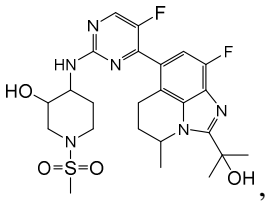
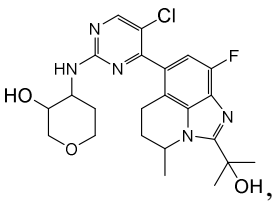
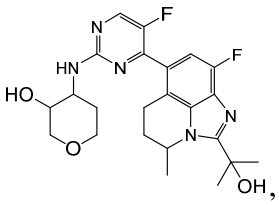
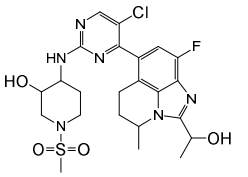
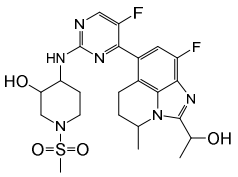
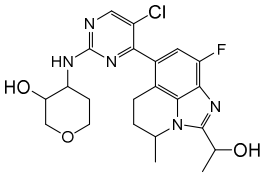
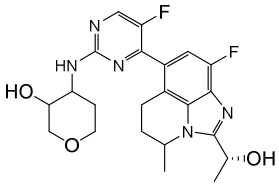
12. The compound of formula I or the pharmaceutically acceptable salt thereof according to claim 10 or 11,
wherein R^9 is OH;
m is 0;
R^7 is selected from the group consisting of H, F, Cl and C_{1-6} alkyl;
R^3 is selected from the group consisting of H, F and Cl;
R^4 is selected from the group consisting of H, C_{1-6} alkyl and C_{1-6} alkoxy; the C_{1-6} alkyl and C_{1-6} alkoxy are each independently and optionally substituted with one or more R^b or deuterium atoms; R^b is selected from the group consisting of H, OH, CN and halogen;
R^5 and R^6 are each independently selected from the group consisting of H, deuterium, CN, halogen and C_{1-6} alkyl;

preferably,
wherein R^9 is OH;
m is 0;
R^7 is F or Cl;
R^3 is F or Cl;
R^4 is H or C_{1-6} alkyl, the C_{1-6} alkyl is optionally substituted with one or more R^b or deuterium atoms; R^b is selected from the group consisting of OH, CN and halogen;
R^5 and R^6 are each independently H or C_{1-6} alkyl;
more preferably,
wherein R^9 is OH;
m is 0;
R^7 is F or Cl;
R^3 is F or Cl;
R^4 is H or C_{1-6} alkyl, the C_{1-6} alkyl is optionally substituted with one or more R^b or deuterium atoms; R^b is OH;
R^5 and R^6 are each independently selected from the group consisting of H, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl and tert-butyl;
even preferably,
wherein R^9 is OH;
m is 0;
R^7 is F or Cl;
R^3 is F or Cl;
R^4 is selected from the group consisting of H, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl and tert-butyl; the methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl and tert-butyl are each independently and optionally substituted with one or more R^b;
R^b is OH;
R^5 and R^6 are each independently selected from the group consisting of H, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl and tert-butyl;
particularly preferably,
wherein R^9 is OH;
m is 0;
R^7 is F or Cl;
R^3 is F or Cl;
R^4 is selected from the group consisting of H, methyl, ethyl, n-propyl and isopropyl;
R^5 and R^6 are each independently selected from the group consisting of H, methyl, ethyl, n-propyl and isopropyl.

13. The compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-15, being selected from the group consisting of

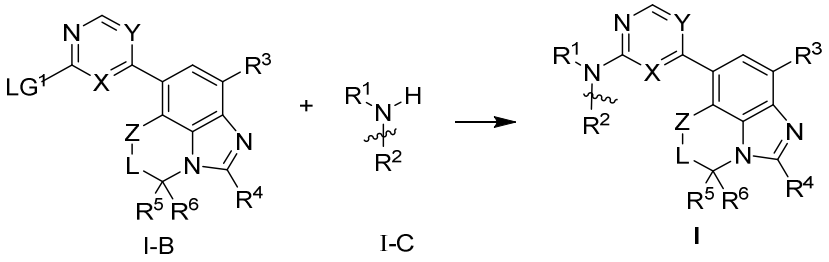


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and

, or the pharmaceutically acceptable salt thereof.

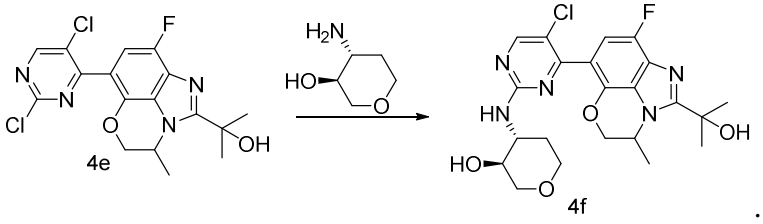
14. An isotopically substituted form of the compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-13, wherein preferably the isotopically substituted form is a deuterated form.

15. A method for preparing the compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-13, comprising a step of reacting a compound of formula I-B with a compound of formula I-C to form the compound of formula I,



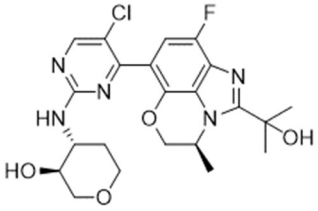
wherein LG^1 is a leaving group selected from the group consisting of halogen, sulfonate, boronic acid and borate;
X, Y, Z, L, R^1, R^2, R^3, R^4, R^5 and R^6 are as defined in claim 1.

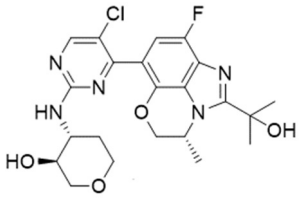
16. The method for preparing the compound of formula I or the pharmaceutically acceptable salt thereof according to 15, Includes the following steps,



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17. The method for preparing the compound of formula I or the pharmaceutically acceptable salt thereof according to claim 15 or 16, wherein the compound of formula I or the pharmaceutically acceptable salt is



or


, or the pharmaceutically acceptable salt thereof.

18. A pharmaceutical composition comprising the compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-13, or the isotopically substituted form according to claim 14, and a pharmaceutically acceptable excipient.

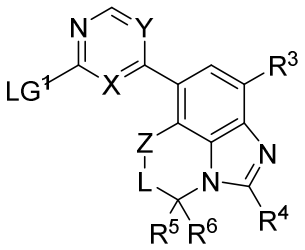
19. Use of the compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-13, or the isotopically substituted form according to claim 14, or the pharmaceutical composition according to claim 18 in the preparation of a medicament for preventing and/or treating cancer, wherein the cancer is selected from the group consisting of breast cancer, ovarian cancer, bladder cancer, uterine cancer, prostate cancer, lung cancer, esophageal cancer, head and neck cancer, intestinal cancer, kidney cancer, liver cancer, pancreatic cancer, gastric cancer and thyroid cancer.

20. The use according to claim 19, wherein the lung cancer is selected from the group consisting of non-small-cell lung cancer (NSCLC), small cell lung cancer (SCLC), squamous cell carcinoma or adenocarcinoma, wherein the kidney cancer is Renal cell carcinoma (RCC), wherein the liver cancer is Hepatocellular carcinoma (HCC).

21. The compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-13 or the isotopically substituted form according to claim14 as the cyclin-dependent kinase inhibitor, wherein the cyclin-dependent kinase inhibitor is CDK4.

22. The compound of formula I or the pharmaceutically acceptable salt thereof according to any one of claims 1-13 or the isotopically substituted form according to claim14 as a medicament.

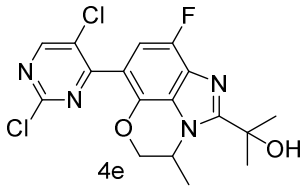
23. A compound of formula I-B or a pharmaceutically acceptable salt thereof,



I-B

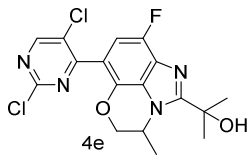
wherein LG^1 is a leaving group selected from the group consisting of halogen, sulfonate, boronic acid and borate; X, Y, Z, L, R^3, R^4, R^5 and R^6 are as defined in claim 1.

24. The compound of formula I-B or a pharmaceutically acceptable salt thereof according to claim 23, comprising a 4e compound of the following formula or a pharmaceutically acceptable salt thereof,

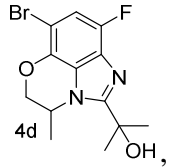


4e .

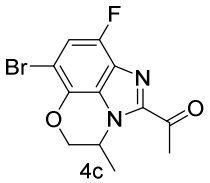
25. Compounds of the following formula:



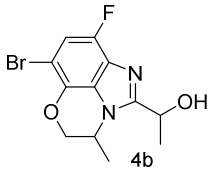
4e ,



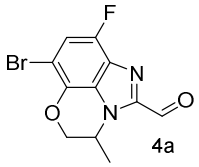
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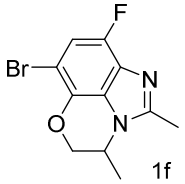
4c ,



4b ,



4a and



1f .