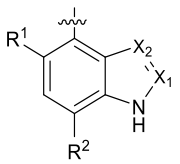
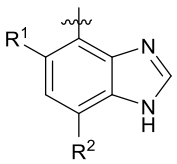
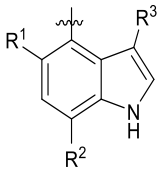
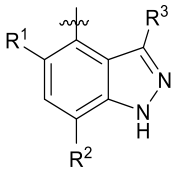
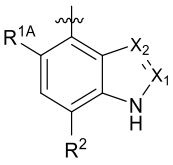
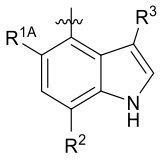
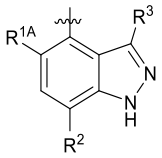
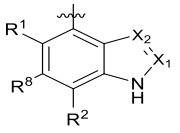
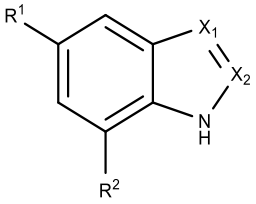
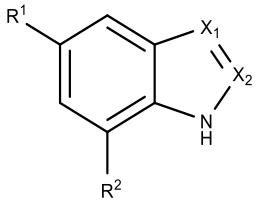
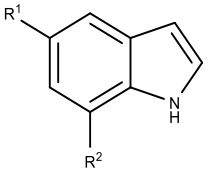
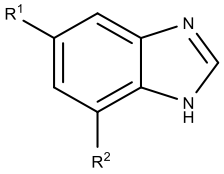
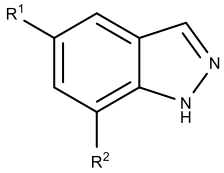
in some embodiments,  is selected from ,  , or ;

in some embodiments,  is selected from  or ;

in some embodiments,  is selected from , and

 is selected from , , or ;

in some embodiments, each R^3 is independently selected from H, halogen, cyano, C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, $-CH_2C(=O)R^{1c}$, $-S(=O)_pC_{1-6}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl,

C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

in some embodiments, each R^3 is independently selected from H, halogen, cyano, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, $-CH_2C(=O)R^{1c}$, $-S(=O)_pC_{1-4}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl, wherein the heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

in some embodiments, each R^3 is independently selected from H, F, Cl, Br, I, cyano, methyl, ethyl, propyl, isopropyl, $-CH_2C(=O)OH$, or $-CH_2C(=O)NH_2$, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

in some embodiments, each R^3 is independently selected from H, F, Cl, Br, I, cyano, methyl, ethyl, propyl, isopropyl, $-CH_2C(=O)OH$, or $-CH_2C(=O)NH_2$, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, or cyano;

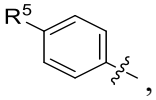
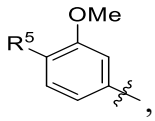
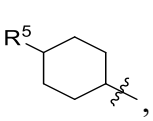
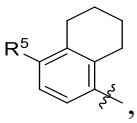
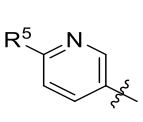
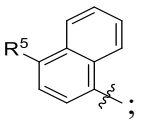
in some embodiments, each R^3 is independently selected from H, methyl, or ethyl;

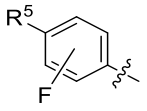
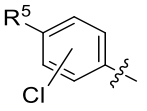
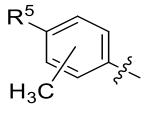
in some embodiments, R^2 is selected from halogen, C_{1-6} alkyl or C_{1-6} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, cyano or NH_2;

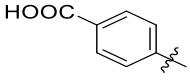
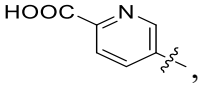
in some embodiments, R^2 is selected from halogen, C_{1-4} alkyl or C_{1-4} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, cyano or NH_2;

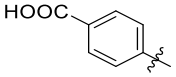
in some embodiments, R^2 is selected from F, Cl, Br, I, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy is optionally further substituted with 0 to 4 substituents selected from H, D, F, Cl, Br, I, OH, cyano or NH_2;

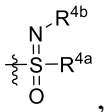
benzocyclohexyl, benzocyclopentyl, phenyl, naphthyl, pyridyl, pyrazolyl, pyrimidinyl or naphthyridinyl is optionally further substituted with 0 to 4 R^5;

in some embodiments, each R^4 is independently selected from , , , ,  or ;

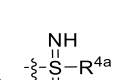
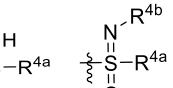
in some embodiments, R^4 is selected from , , or ;

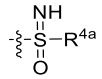
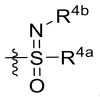
in some embodiments, R^4 is selected from , or , wherein the R^4 is optionally substituted with 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, methyl, ethyl, methoxy or ethoxy;

in some embodiments, R^4 is selected from , wherein the R^4 is optionally further substituted with 0, 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, methyl, ethyl, methoxy or ethoxy;

in some embodiments, each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-10} cycloalkyl or 4- to 12-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

in some embodiments, each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^4C(=O)NR^{4e}R^{4f}$,

-S(=O)$_2$NHC(=O)R^{4e}, -S(=O)$_2$NR^{4e}R^{4f}, -P(O)R^{4c}R^{4d}, , , C$_{1-4}$ alkyl, C$_{1-4}$ alkoxy, C$_{2-4}$ alkenyl, C$_{2-4}$ alkynyl, C$_{3-8}$ cycloalkyl or 4 to 10-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH$_2$, C$_{1-4}$ alkyl, C$_{1-4}$ alkoxy, halogen-substituted C$_{1-4}$ alkyl, hydroxy-substituted C$_{1-4}$ alkyl, cyano-substituted C$_{1-4}$ alkyl or C$_{3-6}$ cycloalkyl , wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

in some embodiments, each R^5 is independently selected from H, halogen, OH, cyano, -C(=O)R^{4e}, -S(=O)$_2$R^{4e}, -CH$_2$C(=O)R^{4e}, -C(=O)NHS(=O)$_2$R^{4e}, -C(=O)NR^{4e}R^{4f}, -S(=O)$_2$NHC(=O)R^{4e}, -S(=O)$_2$NR^{4e}R^{4f}, -P(O)R^{4c}R^{4d}, , , C$_{1-4}$ alkyl, C$_{1-4}$ alkoxy, C$_{2-4}$ alkenyl, C$_{2-4}$ alkynyl, C$_{3-6}$ cycloalkyl or 4 to 6-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH$_2$, C$_{1-4}$ alkyl, C$_{1-4}$ alkoxy, halogen-substituted C$_{1-4}$ alkyl, hydroxy-substituted C$_{1-4}$ alkyl, cyano-substituted C$_{1-4}$ alkyl or C$_{3-6}$ cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

in some embodiments, each R^5 is independently selected from H, F, Cl, Br, I, OH, cyano, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, -COOH, -CH$_2$OH, -S(=O)$_2$NH$_2$, -S(=O)$_2$NHCH$_3$, -S(=O)$_2$OH, , , , -C(=O)NH$_2$, -C(=O)NHOH, -S(=O)$_2$NHC(=O)CH$_3$, -C(=O)NHS(=O)$_2$CH$_3$, pyrazolyl, tetrazolyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, pyrazolyl, or tetrazolyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH$_2$, methyl, ethyl, methoxy, ethoxy, CF$_3$, -CH$_2$F, -CH$_2$OH, cyclopropyl or cyclobutyl;

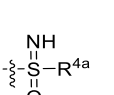
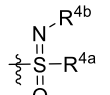
in some embodiments, R^{1c} is selected from OH, NH$_2$, C$_{1-6}$ alkoxy, NHC$_{1-4}$ alkyl or N(C$_{1-4}$ alkyl)$_2$;

$CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl , wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1c} is selected from OH, NH_2, C_{1-6} alkoxy, NHC_{1-4} alkyl or $N(C_{1-4}$ alkyl$)_2$;

R is selected from H, or C_{1-6} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, or cyano-substituted C_{1-6} alkyl;

R^4 is selected from C_{5-12} carbocyclyl, 5- to 12-membered heterocyclyl, C_{6-12} aryl or 5- to 12-membered heteroaryl, wherein the carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally further substituted with 0 to 4 R^5, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-10} cycloalkyl or 4- to 12-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

R^{4a} and R^{4b} are each independently selected from H, OH, cyano, $-NR^{1a}R^{1b}$, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} carbocyclyl, 4- to 10-membered heterocyclyl, C_{6-10} aryl or 5 to 10 membered heteroaryl, wherein the alkyl, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to

each R^9 or R^{10} is independently selected from H, halogen, OH, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylthio, C_{3-8} carbocyclyl or 3- to 10-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, alkylthio, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

when Y is selected from $C(R^7)_2$, R^7 is selected from H, OH, $-NR^{1a}R^{1b}$, unsubstituted C_{1-6} alkyl, hydroxy C_{1-6} alkyl, cyano C_{1-6} alkyl or unsubstituted C_{1-6} alkoxy, and the two R^7 and the carbon atom to which they are attached do not form 3- to 6-membered heterocyclyl together, one of the following conditions must be met:

1) R^1 is selected from C_{2-6} alkynyl, C_{3-6} cycloalkyl substituted C_{1-6} alkyl, 3 to 8 membered heterocyclyl substituted C_{1-6} alkyl, -W-C_{3-8} carbocyclyl or -W-4- to 10-membered heterocyclyl, wherein the alkynyl, alkyl, carbocyclyl, or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkynyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

2) R^6 and R^7 at adjacent positions form a double bond;

3) two R^6 together with the atom to which they are attached form C_{3-6} cycloalkyl or 3- to 6-membered heterocyclyl, wherein the cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, or cyano-substituted C_{1-6} alkyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

4) X_2 is selected from N.

As a second embodiment of the present invention, the compound represented by the aforementioned general formula (I) or a stereoisomer, a deuterate, a solvate, a prodrug, a metabolite, a pharmaceutically acceptable salt or a co-crystal thereof is provided,

8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

alternatively, R^6 and R^7 at adjacent positions can form a double bond;

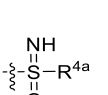
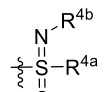
alternatively, two R^6 together with the atom to which they are attached form C_{3-6} cycloalkyl or 3- to 6-membered heterocyclyl, wherein the cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^3 is independently selected from H, halogen, cyano, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, $-CH_2C(=O)R^{1c}$, $-S(=O)_pC_{1-4}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl, wherein the heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1c} is selected from OH, NH_2, C_{1-4} alkoxy, NHC_{1-4} alkyl or $N(C_{1-4}$ alkyl$)_2$;

R is selected from H, or C_{1-4} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R^4 is selected from C_{5-7} monocyclic carbocyclyl, C_{5-12} fused carbocyclyl, C_{5-12} spiro carbocyclyl, C_{5-12} bridged carbocyclyl, 5- to 7-membered monocyclic heterocyclyl, 5- to 12-membered fused heterocyclyl, 5- to 12-membered spiro heterocyclyl or 5- to 12-membered bridged heterocyclyl, C_{6-10} aryl or 5- to 10-membered heteroaryl, wherein the carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally further substituted with 0 to 4 R^5, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-4} alkyl, C_{1-}

$_4$ alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{3-8} cycloalkyl or 4- to 10-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

R^{4a} and R^{4b} are each independently selected from H, OH, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} carbocyclyl, 4- to 8-membered heterocyclyl, C_{6-10} aryl or 5 to 6 membered heteroaryl, wherein the alkyl, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

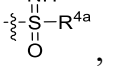
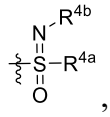
R^{4c} and R^{4d} are each independently selected from H, OH, C_{1-4} alkyl, C_{1-4} alkoxy, $-NR^{1a}R^{1b}$, $-OR^{1d}$, C_{3-6} carbocyclyl, 4- to 8-membered heterocyclyl, C_{6-10} aryl or 5 to 10 membered heteroaryl, wherein the alkyl, alkoxy, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{4e} and R^{4f} are each independently selected from H, OH, $-NR^{1a}R^{1b}$, C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} cycloalkyl, or 5- to 10-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1a} and R^{1b} are each independently selected from H, or C_{1-4} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

each R^{1d} is independently selected from H, C_{1-4} alkyl, C_{3-6} carbocyclyl or 4- to 8-membered heterocyclyl, wherein the alkyl, carbocyclyl or heterocyclyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-

optionally further substituted with 0 to 4 R^5, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{3-6} cycloalkyl or 4 to 6-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

R^{4a}, R^{4b}, R^{4c} and R^{4d} are each independently selected from H, OH, NH_2, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1a} and R^{1b} are each independently selected from H, methyl, ethyl, propyl or isopropyl, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R^{4e} and R^{4f} are each independently selected from H, OH, NH_2, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl;

each R^{1d} is independently selected from H, methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, oxacyclobutyl, azacyclobutyl, pyrrolidinyl or phenyl, wherein the methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, oxacyclobutyl, azacyclobutyl, pyrrolidinyl or phenyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4}

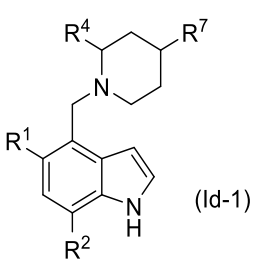
cycloalkyl is optionally further substituted with 0 to 4 substituents selected from F, ethynyl or propargyl; ;

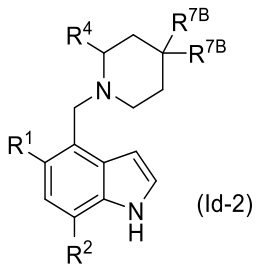
R^2 is selected from F, Cl, Br, I, or C_{1-4} alkyl;

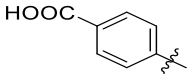
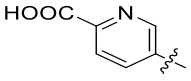
R^7 is selected from methoxymethyl, methoxyethyl, C_{2-4} alkynyl, C_{3-6} cycloalkyl or 4- to 7-membered heterocycle, the alkynyl, cycloalkyl, or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, CF_3, OH, =O, cyano, NH_2, methyl, or methoxy;

two R^{7B} together with the carbon to which they are attached form the following 4- to 7-membered heterocycle, preferably 4- to 6-membered heterocycle, which heterocycle is optionally further substituted with 0 to 2 =O.

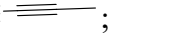
As a eighth embodiment of the present invention, the compound represented by the aforementioned general formula (Id) or a stereoisomer, a deuterate, a solvate, a prodrug, a metabolite, a pharmaceutically acceptable salt or a co-crystal thereof is provided, the compound of general formula (Id) is selected from the compound represented by general formula (Id-1) or general formula (Id-2),


(Id-1)


(Id-2)

R^4 is selected from , or , wherein the R^4 is optionally further substituted with 0, 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, methyl, ethyl, methoxy or ethoxy;

R^1 is selected from H, F, Cl, Br, I, $-OCD_3$, CD_3, methyl, ethyl, propyl, methoxy, ethoxy, isopropoxy, cyclopropyl, $-CH_2$-cyclopropyl or -O-cyclopropyl;

or each R^1 is independently selected from $-OCH_2F$, $-OCHF_2$, $-OCF_3$, , or ;

R^2 is selected from F, Cl, Br, I, methyl, ethyl, propyl, or isopropyl;

or each R^2 is independently selected from CD_3, CHD_2, or CH_2D;

R^7 is selected from methoxymethyl, methoxyethyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azacyclobutyl, azacyclopentyl, azacyclohexyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, ethynyl, propynyl or propargyl,

0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N.

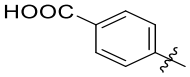
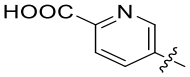
In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^3 is independently selected from H, halogen, cyano, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, $-CH_2C(=O)R^{1c}$, $-S(=O)_pC_{1-4}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl , wherein the heteroaryl contains 1 to 4 heteroatoms selected from O, S or N.

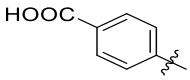
In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^3 is independently selected from H, F, Cl, Br, I, cyano, methyl, ethyl, propyl, isopropyl, $-CH_2C(=O)OH$, or $-CH_2C(=O)NH_2$, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^3 is independently selected from H, F, Cl, Br, I, cyano, methyl, ethyl, propyl, isopropyl, $-CH_2C(=O)OH$, or $-CH_2C(=O)NH_2$, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, or cyano.

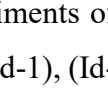
In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^3 is independently selected from H, methyl or ethyl.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), R^2 is selected from halogen, C_{1-6} alkyl or C_{1-6} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, cyano or NH_2.

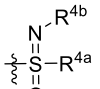
In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), R^4 is selected from  or , wherein the R^4 is optionally further substituted with 0, 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, methyl, ethyl, methoxy or ethoxy.

In some embodiments of the present invention involving general formula (Id-1), (Id-2), (Id-3), or (Id-4), R^4 is selected from , wherein the R^4 is optionally further substituted with 0, 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, C_{1-4} alkyl, or C_{1-4} alkoxy.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-10} cycloalkyl or 4- to 12-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{3-8} cycloalkyl or 4 to 10-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-}

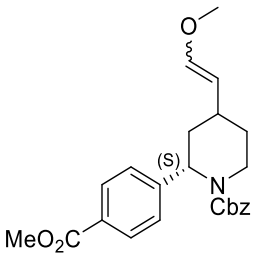
$_{4}$ alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{3-6} cycloalkyl or 4 to 6-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), each R^5 is independently selected from H, F, Cl, Br, I, OH, cyano, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, -COOH, $-CH_2OH$, $-S(=O)_2NH_2$, $-S(=O)_2NHCH_3$, $-S(=O)_2OH$, , , , $-C(=O)NH_2$, $-C(=O)NHOH$, $-S(=O)_2NHC(=O)CH_3$, $-C(=O)NHS(=O)_2CH_3$, pyrazolyl, tetrazolyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, pyrazolyl, or tetrazolyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl, methoxy, ethoxy, CF_3, $-CH_2F$, $-CH_2OH$, cyclopropyl or cyclobutyl.

In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), R^{1c} is selected from OH, NH_2, C_{1-6} alkoxy, NHC_{1-4} alkyl or $N(C_{1-4}$ alkyl$)_2$.

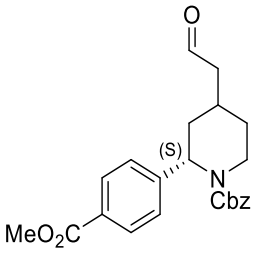
In some embodiments of the present invention involving general formula (I), (Ia), (Ib), (Ic), (Id), (Id-1), (Id-2), (Id-3), (Id-4), (Ie) or (If), R^{1c} is selected from OH, NH_2, C_{1-4} alkoxy, NHC_{1-4} alkyl or $N(C_{1-4}$ alkyl$)_2$.



(methoxymethyl)triphenylphosphine chloride (3.4 g, 9.92 mmol) was added to 80 mL of anhydrous tetrahydrofuran, the mixture was cooled to 0°C, and solid potassium tert-butoxide (1.1 g, 9.80 mmol) was added and reacted at room temperature 1 h. Benzyl (2S)-4-formyl-2-(4-(methoxycarbonyl)phenyl)piperidine-1-carboxylate (10a) (2.9 g, 7.6 mmol) was added and reacted at room temperature 16 h. 100 mL saturated ammonium chloride solution was added to the reaction liquid, the mixture was extracted with 100 mL of ethyl acetate, and the organic phase was dried over anhydrous sodium sulfate and concentrated under reduced pressure. The crude product was separated and purified with silica gel chromatographic column (petroleum ether/ethyl acetate (v/v) = 4 : 1) to afford benzyl (2S)-2-(4-(methoxycarbonyl)phenyl)-4-(2-methoxyvinyl)piperidine-1-carboxylate (13a) (1.6 g, yield: 51%).

LCMS m/z = 410.1 $[M+1]^+$

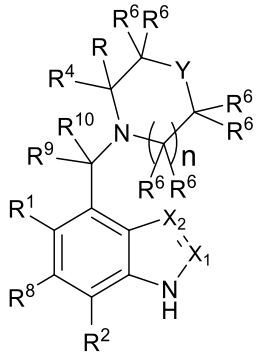
Step 2: benzyl (2S)-2-(4-(methoxycarbonyl)phenyl)-4-(2-oxoethyl)piperidine-1-carboxylate (13b)



Benzyl (2S)-2-(4-(methoxycarbonyl)phenyl)-4-(2-methoxyvinyl)piperidine-1-carboxylate (13a) (1.6 g, 3.91 mmol) was added to 40 mL of methanol, 40 mL of 2 mol/L aqueous hydrochloric acid solution was added, and the mixture was reacted at reflux for 5 h. The reaction liquid was cooled to room temperature and concentrated under reduced pressure, the pH was adjusted to 12 with 5 mol/L aqueous sodium hydroxide solution, 100 mL of dichloromethane was added for extraction, the organic phase was separated, dried over anhydrous sodium sulfate, and concentrated under reduced pressure to afford crude benzyl (2S)-2-(4-(methoxycarbonyl)phenyl)-4-(2-oxoethyl)piperidine-1-carboxylate (13b) (1.2 g).

CLAIMS

1. A compound or a stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof, characterized in that the compound is selected from a compound of general formula (I),



(I)

R^1 is selected from H, halogen, OH, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, $-C(=O)C_{1-6}$ alkyl, $-S(=O)_pC_{1-6}$ alkyl, -W-R^{1d}, $-CH_2NHC(O)C_{1-4}$ alkyl, $-CH_2C(=O)R^{1c}$, $-OCH_2C(=O)R^{1c}$, C_{3-8} carbocyclyl or 3- to 10-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkynyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 10-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

p is selected from 0, 1 or 2;

n is selected from 0, 1 or 2;

W is selected from O or S;

R^2 is selected from halogen, C_{1-6} alkyl or C_{1-6} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, cyano or NH_2;

X_1 and X_2 are each independently selected from N or CR^3;

Y is selected from NR^7 or $C(R^7)_2$;

each R^6 is independently selected from H, halogen, OH, $-NR^{1a}R^{1b}$, C_{1-6} alkyl or C_{1-6} alkoxy, wherein the alkyl and alkoxy are optionally further substituted with 0

to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^7 is independently selected from H, halogen, OH, $-NR^{1a}R^{1b}$, C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, C_{3-8} carbocyclyl or 3- to 10-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 10-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

alternatively, two R^7 together with the carbon atom to which they are attached form 3- to 6-membered heterocyclyl, wherein the heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 6-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

alternatively, R^6 and R^7 at adjacent positions can form a double bond;

alternatively, two R^6 together with the atom to which they are attached form C_{3-6} cycloalkyl or 3- to 6-membered heterocyclyl, wherein the cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, or cyano-substituted C_{1-6} alkyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

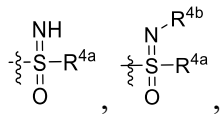
each R^3 is independently selected from H, halogen, cyano, C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, $-CH_2C(=O)R^{1c}$, $-S(=O)_pC_{1-6}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl,

hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl , wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1c} is selected from OH, NH_2, C_{1-6} alkoxy, NHC_{1-4} alkyl or $N(C_{1-4}$ alkyl$)_2$;

R is selected from H or C_{1-6} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, or cyano-substituted C_{1-6} alkyl;

R^4 is selected from C_{5-12} carbocyclyl, 5- to 12-membered heterocyclyl, C_{6-12} aryl or 5- to 12-membered heteroaryl, wherein the carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally further substituted with 0 to 4 R^5, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-10} cycloalkyl or 4- to 12-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl or C_{3-6} cycloalkyl , wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

R^{4a} and R^{4b} are each independently selected from H, OH, cyano, $-NR^{1a}R^{1b}$, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} carbocyclyl, 4- to 10-membered heterocyclyl, C_{6-10} aryl or 5- to 10-membered heteroaryl, wherein the alkyl, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 10-membered heterocyclyl, 3- to 8-membered heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{4c} and R^{4d} are each independently selected from H, OH, C_{1-6} alkyl, C_{1-6} alkoxy, $-NR^{1a}R^{1b}$, $-OR^{1d}$, $-C_{3-8}$ carbocyclyl, 4- to 10-membered heterocyclyl, C_{6-10} aryl or 5-

to 10-membered heteroaryl, wherein the alkyl, alkoxy, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 10-membered heterocyclyl, 3- to 8-membered heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{4e} and R^{4f} are each independently selected from H, OH, $-NR^{1a}R^{1b}$, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-8} cycloalkyl, or 5- to 12-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1a} and R^{1b} are each independently selected from H or C_{1-6} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^{1d} is independently selected from H, C_{1-6} alkyl, C_{3-8} carbocyclyl or 4- to 10-membered heterocyclyl, wherein the alkyl, carbocyclyl or heterocyclyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 10-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^8 is selected from H, halogen, OH, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, $-S(=O)_pC_{1-6}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-8} carbocyclyl or 3- to 10-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 10-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^9 or R^{10} is independently selected from H, halogen, OH, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylthio, C_{3-8} carbocyclyl or 3-

to 10-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, alkylthio, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 10-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

when Y is selected from $C(R^7)_2$, R^7 is selected from H, OH, $-NR^{1a}R^{1b}$, unsubstituted C_{1-6} alkyl, hydroxy C_{1-6} alkyl, cyano C_{1-6} alkyl or unsubstituted C_{1-6} alkoxy, and two R^7 together with the carbon atom to which they are attached do not form 3- to 6-membered heterocyclyl, one of the following conditions must be met:

1) R^1 is selected from C_{2-6} alkynyl, C_{3-6} cycloalkyl substituted C_{1-6} alkyl, 3 to 8 membered heterocyclyl substituted C_{1-6} alkyl, -W-C_{3-8} carbocyclyl or -W-4- to 10-membered heterocyclyl, wherein the alkynyl, alkyl, carbocyclyl, or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{2-6} alkynyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, cyano-substituted C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 10-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

2) R^6 and R^7 at adjacent positions form a double bond;

3) two R^6 together with the atom to which they are attached form C_{3-6} cycloalkyl or 3- to 6-membered heterocyclyl, wherein the cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-6} alkyl, C_{1-6} alkoxy, halogen-substituted C_{1-6} alkyl, hydroxy-substituted C_{1-6} alkyl, or cyano-substituted C_{1-6} alkyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

4) X_2 is selected from N.

2. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 1, characterized in that

R^1 is selected from H, halogen, OH, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkoxy, -C(=O)C_{1-4} alkyl, -S(=O)pC_{1-4} alkyl, -W-R^{1d}, -CH_2NHC(O)C_{1-4} alkyl, -CH_2C(=O)R^{1c}, -OCH_2C(=O)R^{1c}, C_{3-6} carbocyclyl or 4- to 8-membered

heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 8-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^2 is selected from halogen, C_{1-4} alkyl or C_{1-4} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, cyano or NH_2;

X_1 and X_2 are each independently selected from N or CR^3;

each R^6 is independently selected from H, halogen, OH, $-NR^{1a}R^{1b}$, C_{1-4} alkyl or C_{1-4} alkoxy, wherein the alkyl, and alkoxy are optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^7 is independently selected from H, halogen, OH, $-NR^{1a}R^{1b}$, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, C_{3-6} carbocyclyl or 3- to 8-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 8-membered heterocyclyl each contains 1 to 4 heteroatoms selected from O, S or N;

alternatively, two R^7 together with the carbon atom to which they are attached form a 3- to 6-membered heterocyclyl, wherein the heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 6-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

alternatively, R^6 and R^7 at adjacent positions can form a double bond;

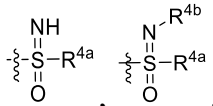
alternatively, two R^6 together with the atom to which they are attached form C_{3-6} cycloalkyl or 3- to 6-membered heterocyclyl, wherein the cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^3 is independently selected from H, halogen, cyano, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, $-CH_2C(=O)R^{1c}$, $-S(=O)_pC_{1-4}$ alkyl, $-CH_2NHC(O)C_{1-4}$ alkyl, $-OCH_2C(=O)R^{1c}$, C_{3-6} carbocyclyl or 5- to 6-membered heteroaryl, wherein the alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, carbocyclyl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl, wherein the heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1c} is selected from OH, NH_2, C_{1-4} alkoxy, NHC_{1-4} alkyl or $N(C_{1-4}$ alkyl$)_2$;

R is selected from H, or C_{1-4} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R^4 is selected from C_{5-7} monocyclic carbocyclyl, C_{5-12} fused carbocyclyl, C_{5-12} spiro carbocyclyl, C_{5-12} bridged carbocyclyl, 5- to 7-membered monocyclic heterocyclyl, 5- to 12-membered fused heterocyclyl, 5- to 12-membered spiro heterocyclyl or 5- to 12-membered bridged heterocyclyl, C_{6-10} aryl or 5- to 10-membered heteroaryl, wherein the carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally further substituted with 0 to 4 R^5, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{3-8} cycloalkyl or 4- to 10-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl

is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

R^{4a} and R^{4b} are each independently selected from H, OH, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} carbocyclyl, 4- to 8-membered heterocyclyl, C_{6-10} aryl or 5 to 6 membered heteroaryl, wherein the alkyl, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 8-membered heterocyclyl or 3- to 8-membered heterocyclyl or the heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{4c} and R^{4d} are each independently selected from H, OH, C_{1-4} alkyl, C_{1-4} alkoxy, $-NR^{1a}R^{1b}$, $-OR^{1d}$, C_{3-6} carbocyclyl, 4- to 8-membered heterocyclyl, C_{6-10} aryl or 5 to 10 membered heteroaryl, wherein the alkyl, alkoxy, carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 8-membered heterocyclyl or 3- to 8-membered heterocyclyl or the heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

R^{4e} and R^{4f} are each independently selected from H, OH, $-NR^{1a}R^{1b}$, C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} cycloalkyl, or 5- to 10-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^{1a} and R^{1b} are each independently selected from H, or C_{1-4} alkyl, wherein the alkyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

each R^{1d} is independently selected from H, C_{1-4} alkyl, C_{3-6} carbocyclyl or 4- to 8-membered heterocyclyl, wherein the alkyl, carbocyclyl or heterocyclyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-

membered heterocyclyl, wherein the 4- to 8-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^8, R^9 or R^{10} is independently selected from H, halogen, OH, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkoxy, or C_{1-4} alkylthio, wherein the alkyl, alkenyl, alkynyl, alkoxy, and alkylthio are optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

when Y is selected from $C(R^7)_2$, R^7 is selected from H, OH, $-NR^{1a}R^{1b}$, unsubstituted C_{1-4} alkyl, hydroxy C_{1-4} alkyl, cyano C_{1-4} alkyl or unsubstituted C_{1-4} alkoxy, and the two R^7 and the carbon atom to which they are attached do not form 3- to 6-membered heterocyclyl together, one of the following conditions must be met:

1) R^1 is selected from C_{2-4} alkynyl, C_{3-6} cycloalkyl substituted C_{1-4} alkyl, 3 to 8 membered heterocyclyl substituted C_{1-4} alkyl, -W-C_{3-6} carbocyclyl or -W-4- to 8-membered heterocyclyl, wherein the alkynyl, alkyl, carbocyclyl, or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 8-membered heterocyclyl or 4- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

2) R^6 and R^7 at adjacent positions form a double bond;

3) two R^6 together with the atom to which they are attached form C_{3-6} cycloalkyl or 3- to 6-membered heterocyclyl, wherein the cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

4) X_2 is selected from N.

3. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 2, characterized in that

R^1 is selected from H, halogen, OH, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkoxy, C_{1-4} alkylthio, -W-R^{1d}, C_{3-6} carbocyclyl or 4- to 8-membered heterocyclyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, alkylthio, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 4- to 8-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

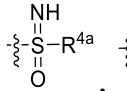
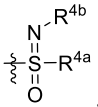
R^2 is selected from F, Cl, Br, I, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy is optionally further substituted with 0 to 4 substituents selected from H, D, F, Cl, Br, I, OH, cyano or NH_2;

each R^3 is independently selected from H, F, Cl, Br, I, cyano, methyl, ethyl, propyl, isopropyl, -$CH_2C(=O)OH$, or -$CH_2C(=O)NH_2$, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

each R^6 is independently selected from H, F, Cl, Br, I, OH, NH_2, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R is selected from H, methyl, ethyl, propyl or isopropyl, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl or CF_3;

R^4 is selected from C_{5-6} monocyclic carbocyclyl, C_{5-10} fused carbocyclyl, C_{5-11} spiro carbocyclyl, C_{5-12} bridged carbocyclyl, 5- to 6-membered monocyclic heterocyclyl, 5- to 10-membered fused heterocyclyl, 5- to 11-membered spiro heterocyclyl, 5- to 12-membered bridged heterocyclyl, C_{6-10} aryl or 5- to 10-membered heteroaryl, wherein the carbocyclyl, heterocyclyl, aryl or heteroaryl is optionally further substituted with 0 to 4 R^5, wherein the heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

each R^5 is independently selected from H, halogen, OH, cyano, $-C(=O)R^{4e}$, $-S(=O)_2R^{4e}$, $-CH_2C(=O)R^{4e}$, $-C(=O)NHS(=O)_2R^{4e}$, $-C(=O)NR^{4e}R^{4f}$, $-S(=O)_2NHC(=O)R^{4e}$, $-S(=O)_2NR^{4e}R^{4f}$, $-P(O)R^{4c}R^{4d}$, , , C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{3-6} cycloalkyl or 4 to 6-membered heterocyclyl, wherein the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl or C_{3-6} cycloalkyl, wherein the heterocyclyl contains 1 to 5 heteroatoms selected from O, S or N;

R^{4a}, R^{4b}, R^{4c} and R^{4d} are each independently selected from H, OH, NH_2, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

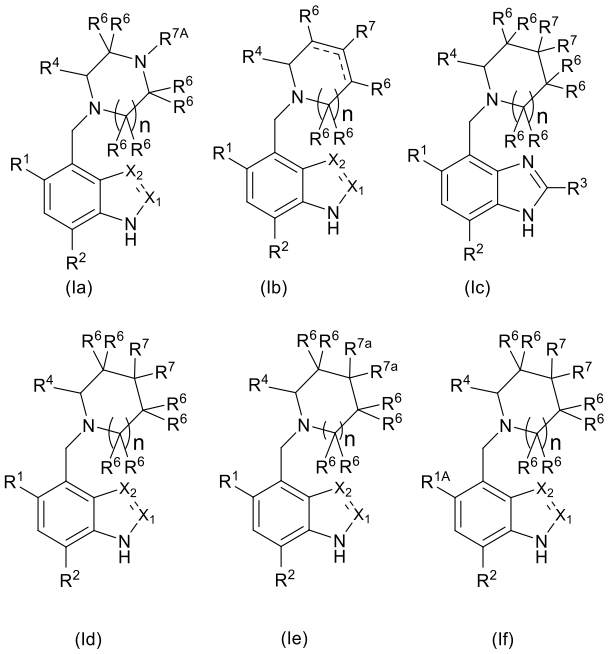
R^{1a} and R^{1b} are each independently selected from H, methyl, ethyl, propyl or isopropyl, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R^{4e} and R^{4f} are each independently selected from H, OH, NH_2, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl;

each R^{1d} is independently selected from H, methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, oxacyclobutyl, azacyclobutyl, pyrrolidinyl or phenyl, wherein the methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, oxacyclobutyl, azacyclobutyl, pyrrolidinyl or phenyl is optionally substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^8, R^9 or R^{10} is independently selected from H, F, Cl, Br, I, OH, cyano, CF_3, NH_2, methyl, or ethyl.

4. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 3, characterized in that the compound is selected from a compound of general formula (Ia), (Ib), (Ic), (Id), (Ie) or (If),



each n is independently selected from 0, 1 or 2;

each R^3 is independently selected from H, F, Cl, Br, I, cyano, methyl, ethyl, propyl, isopropyl, $-CH_2C(=O)OH$, or $-CH_2C(=O)NH_2$, wherein the methyl, ethyl, propyl or isopropyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, or cyano;

each R^6 is independently selected from H, F, Cl, Br, I, OH, NH_2, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy or isopropoxy is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl, methoxy, ethoxy, CF_3, $-CH_2F$ or $-CH_2OH$;

each R^7 is independently selected from H, F, Cl, Br, I, OH, NH_2, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl, propargyl, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl,

furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl, propargyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^{7A} is selected from H, F, Cl, Br, I, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, cyclopropyl, cyclobutyl, cyclopentyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^{7a} is independently selected from R^d, F, Cl, Br, I, vinyl, ethynyl, propynyl, propargyl, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl, wherein the vinyl, ethynyl, propynyl, propargyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl,

oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^d is independently selected from methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, or isopropoxy, the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, and isopropoxy is further substituted with 1 to 3 substituents selected from halogen, ethynyl, C_{2-4} alkynyl, C_{1-4} alkoxy, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl;

$\equiv$ in (Ib) represents a single bond or a double bond, and (Ib) contains only one double bond;

in (Id), alternatively, two R^7 together with the carbon atom to which they are attached form oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl, wherein the oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

or in (Id), two R^6 together with the atom to which they are attached form cyclobutyl, cyclopentyl, cyclohexyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl;

R^{1A} is selected from ethynyl, propynyl, propargyl, $-CH_2$-cyclopropyl, $-CH_2$-cyclobutyl, $-CH_2$-cyclopentyl, $-CH_2$-oxacyclobutyl, $-CH_2$-azacyclobutyl, $-CH_2$-pyrrolidinyl, -O-cyclopropyl, -O-cyclobutyl, or -O-cyclopentyl, the ethynyl, propynyl, propargyl, -O-cyclopropyl, -O-cyclobutyl, -O-cyclopentyl or $-CH_2$- is optionally further substituted with 0 to 2 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl,

hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^1 is independently selected from H, F, Cl, Br, I, OH, cyano, NH_2, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl, propargyl, methylthio, ethylthio, cyclopropyl, cyclobutyl or -W-R^{1d}, wherein the methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl, propargyl, methylthio, ethylthio, cyclopropyl, or cyclobutyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{2-4} alkynyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

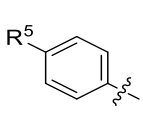
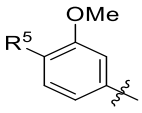
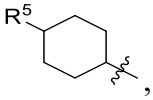
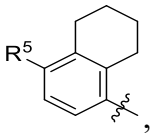
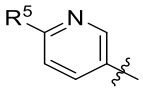
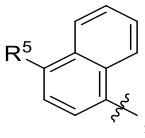
each R^4 is independently selected from cyclopentyl, cyclohexyl, benzocyclohexyl, benzocyclopentyl, phenyl, naphthyl, pyridyl, pyrazolyl, pyrimidinyl or naphthyridinyl, the cyclopentyl, cyclohexyl, benzocyclohexyl, benzocyclopentyl, phenyl, naphthyl, pyridyl, pyrazolyl, pyrimidinyl or naphthyridinyl is optionally further substituted with 0 to 4 R^5;

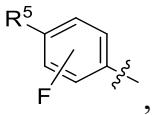
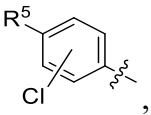
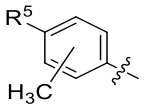
R^{4a}, R^{4b}, R^{4c} and R^{4d} are each independently selected from H, OH, NH_2, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, cyclopropyl or cyclobutyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl or CF_3;

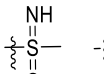
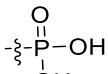
and each R^{1d} is independently selected from H, methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, oxacyclobutyl, azacyclobutyl, pyrrolidinyl or phenyl, wherein the methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, oxacyclobutyl, azacyclobutyl, pyrrolidinyl or phenyl is optionally substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl, methoxy, ethoxy, CF_3, -CH_2F, -CH_2OH, cyclopropyl, cyclobutyl, azacyclobutyl or pyrrolidinyl.

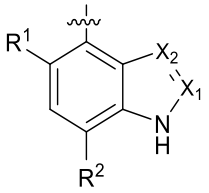
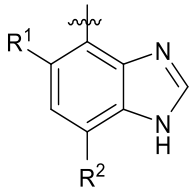
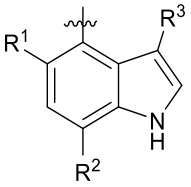
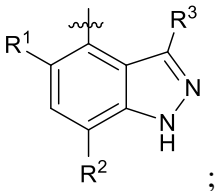
5. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim

4, characterized in that the compound is selected from the compound of general formula (Id),

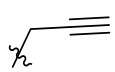
each R^4 is independently selected from , , , ,  or ;

or each R^4 is independently selected from , , ;

each R^5 is independently selected from H, F, Cl, Br, I, OH, cyano, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, -COOH, $-CH_2OH$, $-S(=O)_2NH_2$, $-S(=O)_2NHCH_3$, $-S(=O)_2OH$, , , , $-C(=O)NH_2$, $-C(=O)NHOH$, $-S(=O)_2NHC(=O)CH_3$, $-C(=O)NHS(=O)_2CH_3$, pyrazolyl, tetrazolyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, pyrazolyl, or tetrazolyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl, methoxy, ethoxy, CF_3, $-CH_2F$, $-CH_2OH$, cyclopropyl or cyclobutyl;

 is selected from ,  or ;

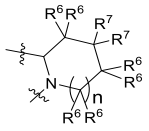
each R^1 is independently selected from H, F, Cl, Br, I, OH, cyano, NH_2, $-OCD_3$, CD_3, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, cyclopropyl, ethynyl, $-CH_2$-cyclopropyl or -O-cyclopropyl;

or each R^1 is independently selected from $-OCH_2F$, $-OCHF_2$, $-OCF_3$, , or ;

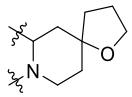
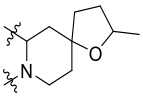
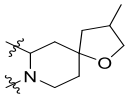
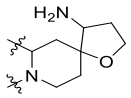
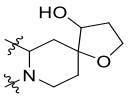
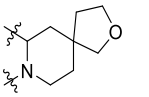
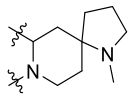
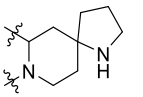
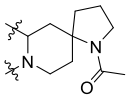
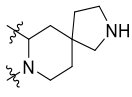
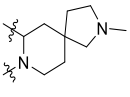
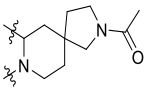
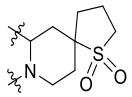
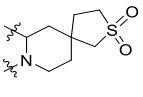
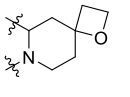
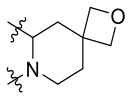
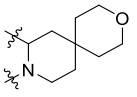
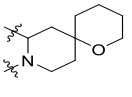
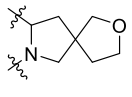
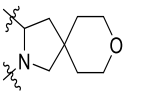
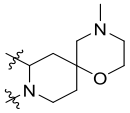
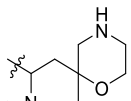
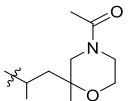
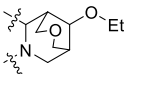
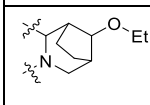
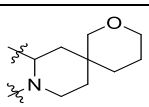
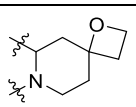
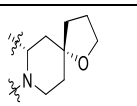
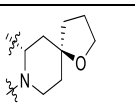
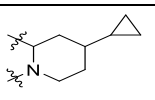
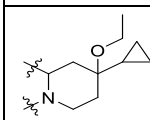
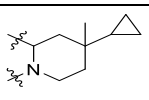
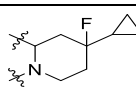
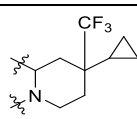
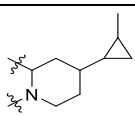
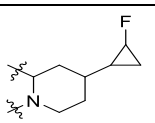
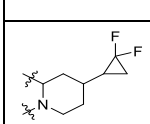
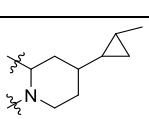
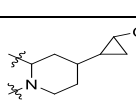
each R^2 is independently selected from F, Cl, Br, I, methyl, ethyl, propyl, isopropyl;

or each R^2 is independently selected from CD_3, CHD_2, or CH_2D;

each R^3 is independently selected from H, methyl or ethyl;

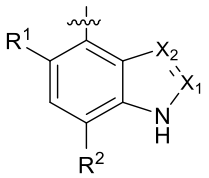
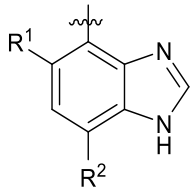
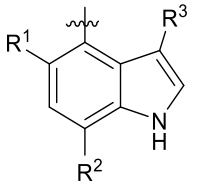
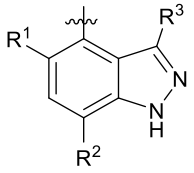


is selected from the fragments in the following table which are connected to R^4 at the upper part

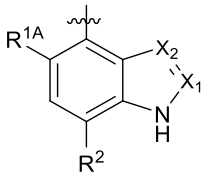
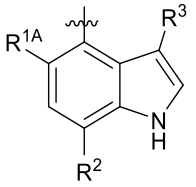
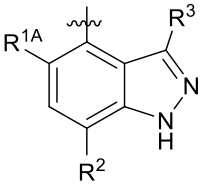
					
					
					
					
					
					
					
					.

6. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim

4, characterized in that the compound is selected from a compound of general formula (Ia), (Ib), (Ic), (Ie) or (If),

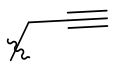
is selected from , , or ;

is selected from or ;

R^{1A} is selected from ethynyl, propynyl, propargyl, -CH_2-cyclopropyl, -CH_2-cyclobutyl, -CH_2-cyclopentyl, -CH_2-oxacyclobutyl, -CH_2-azacyclobutyl, -CH_2-pyrrolidinyl, -O-cyclopropyl, -O-cyclobutyl, or -O-cyclopentyl, the ethynyl, propynyl, propargyl, -O-cyclopropyl, -O-cyclobutyl, -O-cyclopentyl or -CH_2- is optionally further substituted with 0 to 2 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl, ethynyl, methoxy, ethoxy, CF_3, -CH_2F, -CH_2OH, cyclopropyl, cyclobutyl, azacyclobutyl or pyrrolidinyl;

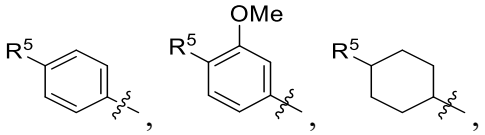
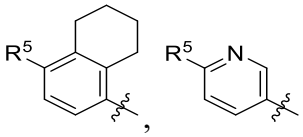
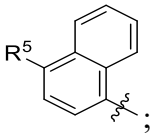
each R^1 is independently selected from H, F, Cl, Br, I, OH, cyano, NH_2, -OCD_3, CD_3, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, cyclopropyl, ethynyl, -CH_2-cyclopropyl or -O-cyclopropyl;

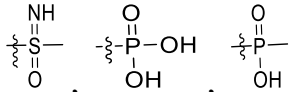
or each R^1 is independently selected from -OCH_2F, -$OCHF_2$, -OCF_3, , or ;

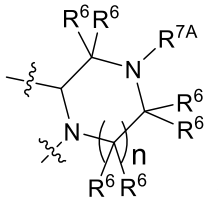
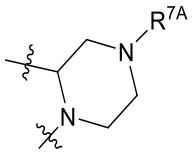
each R^2 is independently selected from F, Cl, Br, I, methyl, ethyl, propyl, isopropyl;

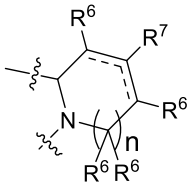
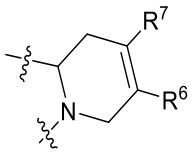
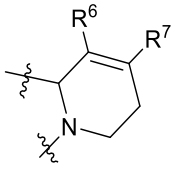
or each R^2 is independently selected from CD_3, CHD_2, or CH_2D;

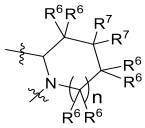
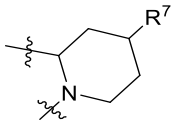
each R^3 is independently selected from H, methyl or ethyl;

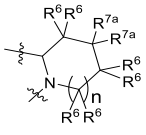
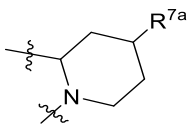
each R^4 is independently selected from , , or ;

each R^5 is independently selected from H, F, Cl, Br, I, OH, cyano, methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, -COOH, $-CH_2OH$, $-S(=O)_2NH_2$, $-S(=O)_2NHCH_3$, $-S(=O)_2OH$, , $-C(=O)NH_2$, $-C(=O)NHOH$, $-S(=O)_2NHC(=O)CH_3$, $-C(=O)NHS(=O)_2CH_3$, pyrazolyl, tetrazolyl, wherein the methyl, ethyl, propyl, isopropyl, methoxy, ethoxy, propoxy, isopropoxy, pyrazolyl, or tetrazolyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, cyano, NH_2, methyl, ethyl, methoxy, ethoxy, CF_3, $-CH_2F$, $-CH_2OH$, cyclopropyl or cyclobutyl;

in (Ia),  is selected from  which is connected to R^4 at the upper part;

in (Ib),  is selected from  or  which is connected to R^4 at the upper part;

in (Ic) or (If),  is selected from  which is connected to R^4 at the upper part;

in (Ie),  is selected from  which is connected to R^4 at the upper part;

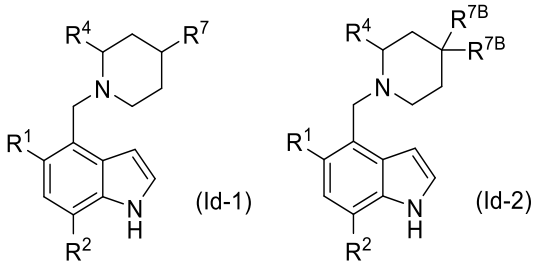
each R^6 is independently selected from H, F, Cl, Br, I, OH, NH_2, methyl, ethyl, propyl, or isopropyl;

each R^7 is independently selected from H, F, Cl, Br, I, OH, NH_2, methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl, propargyl, $-CH_2$-propynyl, $-CH_2$-cyclopropyl, $-CH_2$-cyclobutyl, $-CH_2$-azacyclobutyl, $-CH_2OCH_3$, $-OCH_2CH_2OCH_3$, $-CH_2CH_2OCH_3$, $-CH_2CF_3$, $-OCH_2$-cyclopropyl, $-C(=O)CH_3$, -C(=O)-cyclopropyl, -C(=O)-phenyl, $-S(=O)_2CH_3$, $-S(=O)_2CH_2CH_3$, $-S(=O)_2$-cyclopropyl, $-S(=O)_2-CH_2$-cyclopropyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl;

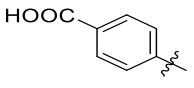
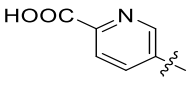
R^{7A} is selected from F, Cl, Br, I, methyl, ethyl, propyl, isopropyl, tert-butyl, $-CH_2$-cyclopropyl, $-CH_2$-cyclobutyl, $-CH_2$-azacyclobutyl, $-CH_2OCH_3$, $-CH_2CH_2OCH_3$, $-CH_2CF_3$, $-C(=O)CH_3$, -C(=O)-cyclopropyl, -C(=O)-phenyl, $-S(=O)_2CH_3$, $-S(=O)_2$-cyclopropyl, $-S(=O)_2-CH_2$-cyclopropyl, cyclopropyl, cyclobutyl, cyclopentyl or imidazolyl;

R^{7a} is selected from F, Cl, Br, I, CF_3, $-CH_2F$, vinyl, ethynyl, propynyl, propargyl, $-CH_2$-propynyl, $-CH_2$-cyclopropyl, $-CH_2$-cyclobutyl, $-CH_2$-azacyclobutyl, $-CH_2OCH_3$, $-OCH_2CH_2OCH_3$, $-CH_2CH_2OCH_3$, $-CH_2CF_3$, $-OCH_2$-cyclopropyl, $-C(=O)CH_3$, -C(=O)-cyclopropyl, -C(=O)-phenyl, $-S(=O)_2CH_3$, $-S(=O)_2CH_2CH_3$, $-S(=O)_2$-cyclopropyl, $-S(=O)_2-CH_2$-cyclopropyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl.

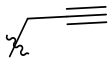
7. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 4, characterized in that the compound of general formula (Id) is selected from the compound represented by general formula (Id-1) or general formula (Id-2),


(Id-1)

(Id-2)

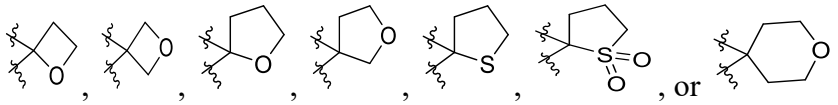
R^4 is selected from , or , wherein the R^4 is optionally further substituted with 0, 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, methyl, ethyl, methoxy or ethoxy;

R^1 is selected from H, F, Cl, Br, I, $-OCD_3$, CD_3, methyl, ethyl, propyl, methoxy, ethoxy, isopropoxy, cyclopropyl, $-CH_2$-cyclopropyl or -O-cyclopropyl;

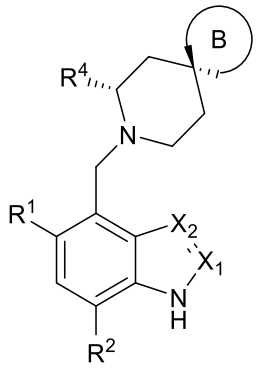
or each R^1 is independently selected from $-OCH_2F$, $-OCHF_2$, $-OCF_3$, , or ; R^2 is selected from F, Cl, Br, I, methyl, ethyl, propyl, or isopropyl;

or each R^2 is independently selected from CD_3, CHD_2, or CH_2D;

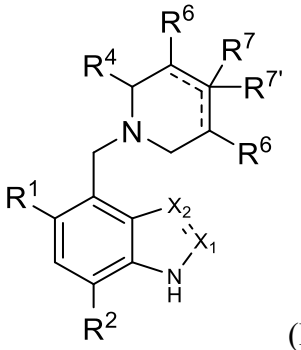
R^7 is selected from methoxymethyl, methoxyethyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azacyclobutyl, azacyclopentyl, azacyclohexyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, ethynyl, propynyl or propargyl, wherein the cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azacyclobutyl, azacyclopentyl, azacyclohexyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, ethynyl, propynyl or propargyl is optionally further substituted with 0 to 4 substituents selected from H, D, F, Cl, Br, CF_3, OH, =O, cyano, NH_2, methyl, or methoxy;

two R^{7B} together with the carbon to which they are attached form the following ring: .

8. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 2, characterized in that the compound of general formula (I) is selected from the compound represented by general formula (Id-3) or general formula (Id-4),



(Id-3)



(Id-4)

 is selected from a single bond or a double bond, when it is selected from a double bond, $R^{7'}$ does not exist, and at most 1 in the general formula (Id-4) is selected from a double bond;

ring B is selected from 3- to 6-membered heterocyclyl, wherein the heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, $-C(=O)R^{1d}$, $-S(=O)_2R^{1d}$, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 6-membered heterocyclyl or 3- to 8-membered heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^6 is independently selected from H, halogen, OH, NH_2, C_{1-4} alkyl or C_{1-4} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R^7 is selected from C_{2-4} alkynyl, C_{3-6} carbocyclyl, or 3- to 8-membered heterocyclyl, $R^{7'}$ is selected from H, halogen, OH, $-NR^{1a}R^{1b}$, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, $-C(=O)R^{1d}$, or $-S(=O)_2R^{1d}$, wherein the alkyl, alkenyl, alkynyl, alkoxy, carbocyclyl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the 3- to 8-membered heterocyclyl each contains 1 to 4 heteroatoms selected from O, S or N.

9. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 8, characterized in that

X_1 is selected from N or CH, X_2 is selected from N or CH, wherein the CH is optionally substituted with 1 methyl or ethyl;

ring B is selected from 3- to 6-membered heterocycloalkyl, wherein the heterocycloalkyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, -C(=O)C_{1-4} alkyl, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl or heterocycloalkyl contains 1 to 4 heteroatoms selected from O, S or N;

R^7 is selected from C_{2-4} alkynyl, phenyl, C_{3-6} cycloalkyl, 3- to 8-membered heterocycloalkyl or 5- to 6-membered heteroaryl, $R^{7'}$ is selected from H, halogen, OH, -NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, -C(=O)C_{1-4} alkyl, or -S(=O)$_2C_{1-4}$ alkyl, wherein the alkyl, alkenyl, alkynyl, alkoxy, phenyl, cycloalkyl, heteroaryl, or heterocycloalkyl is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocycloalkyl, heterocyclyl or heteroaryl contains 1 to 4 heteroatoms selected from O, S or N;

preferably,

ring B is selected from oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl, wherein the oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl is optionally further substituted with 0 to 4 substituents selected from H, halogen, OH, =O, cyano, NH_2, -C(=O)C_{1-4} alkyl, C_{1-4} alkyl, C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, or cyano-substituted C_{1-4} alkyl;

R^7 is selected from one of the following substituted or unsubstituted groups: ethynyl, propynyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl,

isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl, $R^{7'}$ is selected from H, F, OH, or NH_2, or one of the following substituted or unsubstituted groups: methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl or propargyl, R^7 or $R^{7'}$, when substituted, is optionally further substituted with 0 to 4 substituents selected from H, D, halogen, OH, =O, cyano, NH_2, C_{1-4} alkyl, C_{1-4} alkoxy, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkyl substituted C_{2-4} alkenyl, C_{1-4} alkyl substituted C_{2-4} alkynyl, C_{1-4} alkyloxy substituted C_{1-4} alkoxy, halogen-substituted C_{1-4} alkyl, hydroxy-substituted C_{1-4} alkyl, cyano-substituted C_{1-4} alkyl, C_{3-6} cycloalkyl or 3- to 8-membered heterocyclyl, wherein the heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

each R^6 is independently selected from H, F, Cl, Br, CF_3, methyl or ethyl;

R^1, R^2, or R^4 has the same definition as in claim 5.

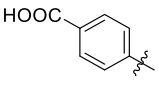
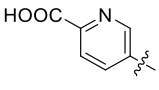
10. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 9, characterized in that

ring B is selected from oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl, wherein the oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, thiocyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, CF_3, OH, =O, cyano, NH_2, -C(=O)CH_3, methyl, ethyl, methoxy or ethoxy;

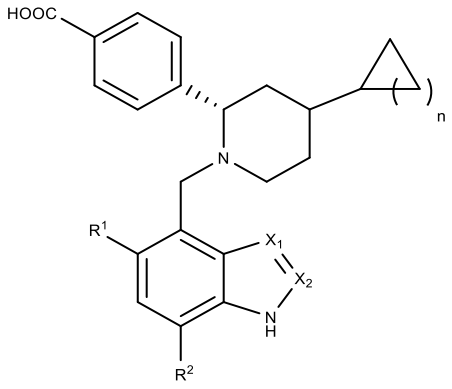
R^7 is selected from one of the following substituted or unsubstituted groups: ethynyl, propynyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl, piperazinyl, oxacyclobutyl, oxacyclopentyl, oxacyclohexyl, pyrazolyl, pyrrolyl, imidazolyl, furanyl, thienyl, thiazolyl, oxazolyl, isoxazolyl, triazolyl, 1,2,4-oxadiazolyl, pyridyl, pyridazinyl, pyrazinyl or pyrimidinyl, $R^{7'}$ is selected from H, F, OH, or NH_2, or one of the following substituted or unsubstituted groups: methyl, ethyl, propyl, isopropyl, tert-butyl, methoxy, ethoxy, isopropoxy, vinyl, ethynyl, propynyl or propargyl, R^7 or $R^{7'}$, when substituted, is optionally further substituted with 0 to 4 substituents selected from H, D, F, Cl, Br, CF_3, OH, =O, cyano, NH_2, methyl, ethyl, methoxy, ethoxy, ethynyl, propynyl, propargyl, cyclopropyl, cyclobutyl, cyclopentyl, azacyclobutyl, pyrrolidinyl, piperidinyl, morpholinyl or piperazinyl;

R^1, R^2, or R^4 has the same definition as in claim 6.

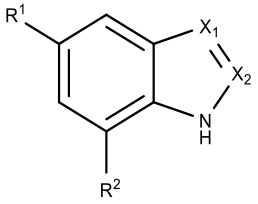
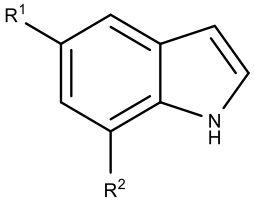
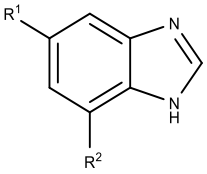
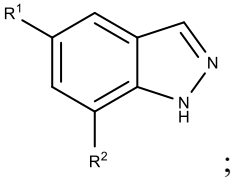
11. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 8, characterized in that

R^4 is selected from , or , wherein the R^4 is optionally substituted with 1, 2 or 3 substituents selected from F, Cl, Br, I, OH, cyano, methyl, ethyl, methoxy or ethoxy.

12. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 10, characterized in that the compound is selected from the compound of general formula (Id-5),



(Id-5)

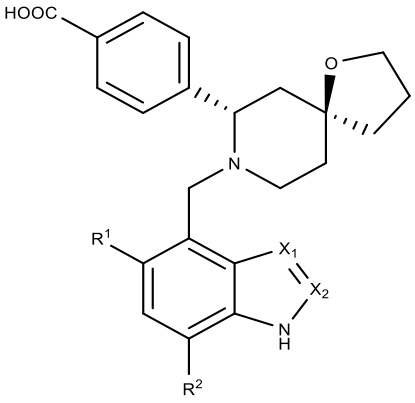
 is selected from , , or ;

R^1 is selected from $-OCH_3$ or $-OCD_3$; R^2 is selected from $-CH_3$ or $-CD_3$;

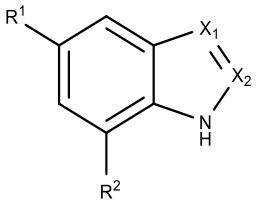
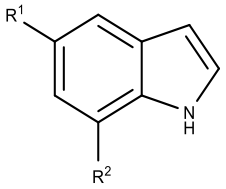
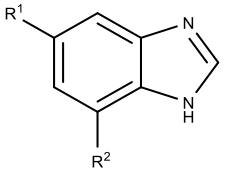
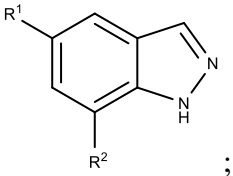
and n is selected from 1, 2 or 3.

13. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim

10, characterized in that the compound is selected from the compound of general formula (Id-6),

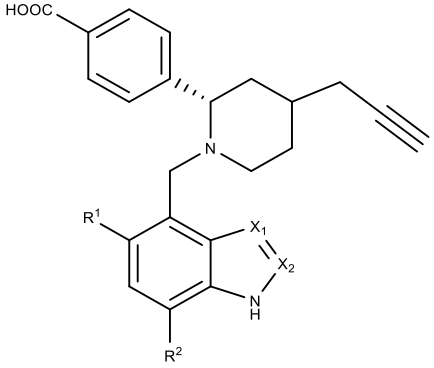


(Id-6)

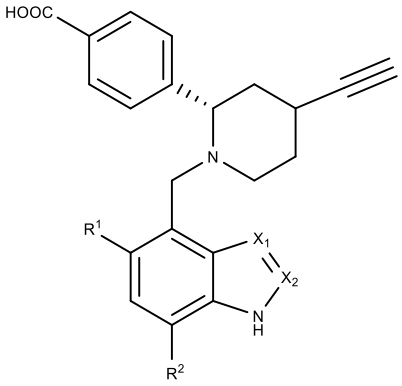

is selected from , , or ;

R^1 is selected from -OCH_3 or -OCD_3; and R^2 is selected from -CH_3 or -CD_3.

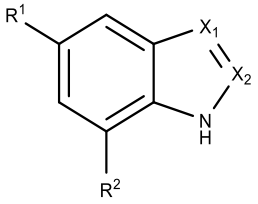
14. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 2, characterized in that the compound is selected from the compound represented by general formula (Id-7) or general formula (Id-8),

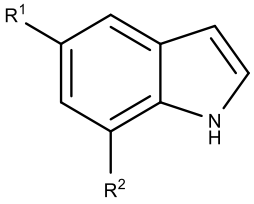


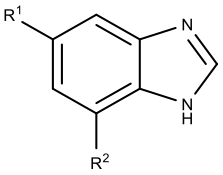
(Id-7)

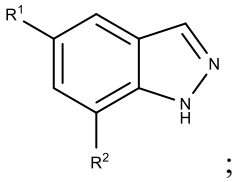


(Id-8)



is selected from


,


,


or ;

R^1 is selected from -OCH_3 or -OCD_3; and R^2 is selected from -CH_3 or -CD_3.

15. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to claim 1, characterized in that the compound is selected from one of the structures shown in Table E-1.

16. A pharmaceutical composition, characterized in that the pharmaceutical composition comprises the compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to any one of claims 1 to 15, and a pharmaceutically acceptable carrier.

17. A pharmaceutical composition or pharmaceutical preparation, characterized in that the pharmaceutical composition or pharmaceutical preparation comprises 1-600 mg of the compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to any one of claims 1 to 15, and a pharmaceutically acceptable excipient.

18. The compound or the stereoisomer, deuterate, solvate, prodrug, metabolite, pharmaceutically acceptable salt or co-crystal thereof according to any one of claims 1 to 15, or the pharmaceutical composition according to claim 16 or 17 for use in the preparation of a drug for treating a disease associated with the activity or expression quantity of complement factor B.

19. The use according to claim 18, characterized in that the disease is selected from a kidney disease.