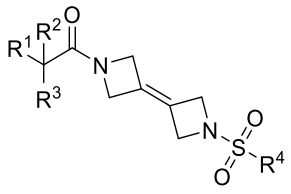
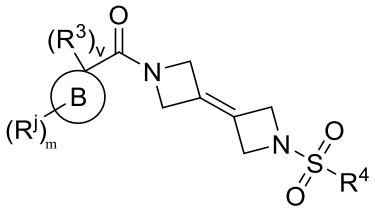
What is claimed is:

1. Use of a pharmaceutical composition in the preparation of a medicament for preventing or treating anemia-related disease, wherein the pharmaceutical composition comprises an active ingredient and a pharmaceutically acceptable excipient, the active ingredient is a compound of the following formula I or II, or an isomer, pharmaceutically acceptable salt or solvate thereof, and the content of the active ingredient in the pharmaceutical composition is 0.05 mg to 1000 mg:



(I),



(II);

wherein,

R^1, R^2 and R^3 are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_2-C_6)$alkenyl, $-(C_2-C_6)$alkynyl, $-(C_3-C_8)$cycloalkyl, $-(C_4-C_8)$cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, $-OR^b$, $-SR^b$, $-NR^cR^d$, $-S(O)_2R^e$, $-S(O)_2NR^cR^d$, $-S(O)R^e$, $-S(O)NR^cR^d$, $-NR^cS(O)_2R^e$, $-NR^cS(O)R^e$, $-C(O)R^f$ or $-C(O)OR^g$, wherein each of the alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, $-R^a$, $-OR^b$, $-SR^b$, $-NO_2$, $-NR^cR^d$, $-S(O)_2R^e$, $-S(O)_2NR^cR^d$, $-S(O)R^e$, $-S(O)NR^cR^d$, $-NR^cS(O)_2R^e$, $-NR^cS(O)R^e$, $-C(O)R^f$ and $-C(O)OR^g$;

or, R^1 and R^2, R^1 and R^3, or R^2 and R^3 together with atoms to which they are attached optionally bind to form $-(C_3-C_8)$cycloalkyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, $-(C_5-C_8)$spirocyclyl, 5-8 membered spiroheterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, or 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S;

R^4 is $-NH_2$, $-(C_1-C_6)$alkyl, $-(C_2-C_6)$alkenyl, $-(C_2-C_6)$alkynyl, $-(C_3-C_8)$cycloalkyl, $-(C_4-C_8)$cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, $-OR^b$, $-SR^b$, $-NR^cR^d$, $-S(O)_2R^e$, $-S(O)_2NR^cR^d$, $-S(O)R^e$, $-S(O)NR^cR^d$, $-NR^cS(O)_2R^e$, $-NR^cS(O)R^e$, $-C(O)R^f$, $-C(O)OR^g$ or $-NR^c(CR^hR^i)_t-R^a$, wherein each of the alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl, or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, $-R^a$, $-OR^b$, $-SR^b$, $-NO_2$, $-NR^cR^d$, $-S(O)_2R^e$, $-S(O)_2NR^cR^d$, $-S(O)R^e$, $-S(O)NR^cR^d$, $-NR^cS(O)_2R^e$, $-NR^cS(O)R^e$, $-C(O)R^f$ and $-C(O)OR^g$;

t is 0, 1, 2 or 3;

R^a, R^b, R^c, R^d, R^e, R^f, R^g, R^h and R^i at each occurrence are independently -H, halogen, -OH, $-NH_2$, -

CN, -NO_2, -(C_1-C_6)alkyl, -(C_2-C_6)alkenyl, -(C_2-C_6)alkynyl, -(C_3-C_8)cycloalkyl, -(C_4-C_8)cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, -SH, -$S(O)_2H$, -$S(O)_2NH_2$, -S(O)H, -$S(O)NH_2$, -$NHS(O)_2H$, -NHS(O)H, -$S(O)_2OH$, -S(O)OH, -$NHS(O)_2OH$, -NHS(O)OH, -C(O)H or -C(O)OH, wherein each of the alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, -OH, -SH, -NO_2, -NH_2, -$S(O)_2H$, -$S(O)_2NH_2$, -S(O)H, -$S(O)NH_2$, -$NHS(O)_2H$, -NHS(O)H, -C(O)H, -C(O)OH, -(C_1-C_6)alkyl, -(C_3-C_8)cycloalkyl, and 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S;

or, any two groups on adjacent atoms selected from R^a, R^b, R^c, R^d, R^e, R^f, R^g, R^h and R^i together with atoms to which they are attached optionally bind to form C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, (C_3-C_8)cycloalkyl, or 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, which is optionally substituted by one or more R^a;

wherein in formula II:

each R^j is independently -H, halogen, -OH, -NH_2, -CN, =O, -NO_2, -(C_1-C_6)alkyl, -(C_1-C_6)alkoxy, -(C_2-C_6)alkenyl, -(C_2-C_6)alkynyl, -(C_3-C_8)cycloalkyl, -(C_4-C_8)cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, -SH, -$S(O)_2H$, -$S(O)_2NH_2$, -S(O)H, -$S(O)NH_2$, -$NHS(O)_2H$, -NHS(O)H, -$S(O)_2OH$, -S(O)OH, -$NHS(O)_2OH$, -NHS(O)OH, -C(O)H or -C(O)OH, wherein each of the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: -H, =O, halogen, -CN, -OH, -SH, -NO_2, -NH_2, -$S(O)_2H$, -$S(O)_2NH_2$, -S(O)H, -$S(O)NH_2$, -$NHS(O)_2H$, -NHS(O)H, -$S(O)_2OH$, -S(O)OH, -$NHS(O)_2OH$, -NHS(O)OH, -C(O)H, -C(O)OH, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, or 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S;

m is independently selected from 0, 1, 2, 3, 4, 5 or 6;

v is 0 or 1;

ring B is (C_3-C_8)cycloalkyl, (C_4-C_8)cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S.

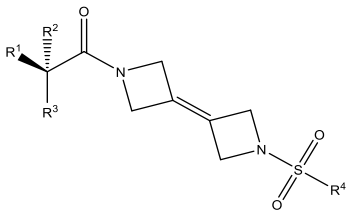
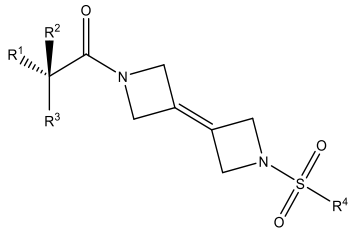
2. The use according to claim 1, wherein the anemia-related disease is pyruvate kinase deficiency (PKD); or

wherein the anemia-related disease comprises myelodysplastic syndrome (MDS), hemoglobinopathy, sickle cell anemia (SCD), β-thalassemia, hereditary non-spherocytic hemolytic anemia, hemolytic anemia, hereditary spherocytosis, hereditary elliptocytosis, abetalipoproteinemia, paroxysmal nocturnal hemoglobinuria, acquired hemolytic anemia, congenital anemia or anemia of chronic disease; or

wherein the anemia-related disease is sickle cell anemia (SCD), β-thalassemia or lower-risk myelodysplastic syndrome (LR-MDS); or

wherein a unit dose of the pharmaceutical composition comprises 0.05 mg to 1000 mg of active ingredient.

3. The use according to claim 1, wherein the compound of formula I has the structure shown in formula I-1 or I-2:


(I-1),

(I-2).

4. The use according to claim 1, wherein

R^1 and R^2 are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_2-C_6)$alkenyl, $-(C_2-C_6)$alkynyl, $-(C_3-C_8)$cycloalkyl, $-(C_4-C_8)$cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, $-OR^b$ or $-NR^cR^d$, wherein each of the alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, $-R^a$, $-OR^b$, $-NO_2$, and $-NR^cR^d$;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form $-(C_3-C_8)$cycloalkyl or 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S;

R^a, R^b, R^c, and R^d at each occurrence are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_2-C_6)$alkenyl, $-(C_2-C_6)$alkynyl, $-(C_3-C_8)$cycloalkyl, $-(C_4-C_8)$cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, -OH, $-NO_2$, $-NH_2$, $-(C_1-C_6)$alkyl, $-(C_3-C_8)$cycloalkyl, and 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S.

5. The use according to claim 4, wherein

R^1 and R^2 are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_3-C_6)$cycloalkyl, 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_8 aryl, 5-8 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, $-OR^b$ or $-NR^cR^d$, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, $-R^a$, $-OR^b$, $-NO_2$, and $-NR^cR^d$;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form $-(C_3-C_8)$cycloalkyl or 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S;

R^a, R^b, R^c, and R^d at each occurrence are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_3-C_6)$cycloalkyl, 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_8 aryl, 5-8 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, -OH, $-NO_2$, $-NH_2$, $-(C_1-C_6)$alkyl, $-(C_3-C_6)$cycloalkyl, and 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S.

6. The use according to claim 5, wherein

R^1 and R^2 are independently -H, -F, -Cl, -Br, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$ linear alkyl, $-(C_1-C_6)$ branched alkyl, $-(C_3-C_6)$cycloalkyl, 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_8 aryl, 7-14 membered bicyclic or tricyclic fused ring group containing 0-4 heteroatoms independently selected from O, N and S, $-OR^b$ or $-NR^cR^d$, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, $-R^a$, $-OR^b$, and $-NR^cR^d$;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form $-(C_3-C_8)$cycloalkyl or 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S;

R^a, R^b, R^c, and R^d at each occurrence are independently -H, -F, -Cl, -Br, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_3-C_6)$cycloalkyl, 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_8 aryl, or 5-8 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, -OH, $-NO_2$, $-NH_2$, and $-(C_1-C_6)$alkyl.

7. The use according to claim 6, wherein

R^1 and R^2 are independently -H, -F, -Cl, -Br, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$ linear alkyl, $-(C_1-C_6)$ branched alkyl, $-(C_3-C_6)$cycloalkyl, or 3-6 membered heterocyclyl containing 1-4 heteroatoms

independently selected from O, N and S, wherein each of the alkyl, cycloalkyl or heterocyclyl is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, -R^a, -OR^b, and -NR^cR^d;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form -(C_3-C_8)cycloalkyl or 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S;

R^a, R^b, R^c, and R^d at each occurrence are independently -H, -F, -Cl, -Br, -OH, -NH_2, -CN, -NO_2, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, or 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl or heterocyclyl is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, -OH, -NO_2, -NH_2, and -(C_1-C_6)alkyl.

8. The use according to claim 7, wherein

R^2 is -H, -F, -Cl or -Br;

R^1 is -H, -F, -Cl, -Br, -OH, -NH_2, -$(CH_2)_qCH_3$, -$(CH_2)_qOH$, -$CH(OH)(CH_2)_qCH_3$, -$C(OH)((CH_2)_qCH_3)_2$, , -$(CH_2)_qNH_2$, -$(CH_2)_qNH(CH_2)_qCH_3$, -$(CH_2)_qN((CH_2)_qCH_3)_2$, 3-6 membered heterocycloalkyl containing 1 N atom, or -(C_1-C_6)alkyl substituted by 3-6 membered heterocycloalkyl containing 1 N atom;

q at each occurrence is independently 0, 1, 2, 3 or 4;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form a cyclopropane ring, a cyclobutane ring, a cyclopentane ring, a cyclohexane ring, tetrahydrofuran, tetrahydropyran, morpholine, dioxane, 2,3-dihydrobenzofuran ring, or tetrahydro-2H-pyran.

9. The use according to claim 6, wherein

R^2 is -H, -F, -Cl or -Br;

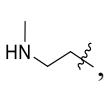
R^1 is -H, -F, -Cl, -Br, -OH, -NH_2, -CH_3, -$CH(OH)CH_3$, -$(CH_2)_qCH_3$, -$(CH_2)_qOH$, -$CH(OH)(CH_2)_qCH_3$, -$C(OH)((CH_2)_qCH_3)_2$, -$C(OH)((CH_2)_qCH_3)(CH_3)$, -$C(OH)(CH_3)_2$, , , -CH_2F, -CHF_2, -$(CH_2)_qCH_2F$, -$(CH_2)_qCHF_2$, -CH_2Cl, -$CHCl_2$, -$(CH_2)_qCH_2Cl$, -$(CH_2)_qCHCl_2$, -$(CH_2)_qNH_2$, -$NHCH_3$, -$NH(CH_2)_qCH_3$, -$(CH_2)_qNHCH_3$, -$(CH_2)_qNH(CH_2)_qCH_3$, -$N(CH_3)_2$, -$N((CH_2)_qCH_3)_2$, -$(CH_2)_qN(CH_3)((CH_2)_qCH_3)$, -$(CH_2)_q N(CH_3)_2$, -$(CH_2)_qN((CH_2)_qCH_3)_2$, 3-6 membered heterocycloalkyl containing 1 N atom, or -(C_1-C_6)alkyl substituted by 3-6 membered heterocycloalkyl containing 1 N atom;

q at each occurrence is independently 1, 2, 3 or 4;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form a cyclopropane ring, a cyclobutane ring, a cyclopentane ring, a cyclohexane ring, oxetane, tetrahydrofuran, tetrahydropyran, morpholine, dioxane, 2,3-dihydrobenzofuran ring, or tetrahydro-2H-pyran.

10. The use according to claim 4, wherein

R^2 is -H, -F, -Cl or -Br;

R^1 is -H, -F, -Cl, -Br, -OH, $-NH_2$, , , , , , , , , ,  or ;

or, R^1 and R^2 together with atoms to which they are attached optionally bind to form ,  or .

11. The use according to any one of claims 1-10, wherein

R^3 is -H, halogen, -(C_1-C_6)alkyl, -(C_3-C_8)cycloalkyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl , heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, $-R^a$, $-OR^b$, $-NO_2$, and $-NR^cR^d$;

R^a, R^b, R^c, and R^d at each occurrence are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, -(C_1-C_6)alkyl, -(C_2-C_6)alkenyl, -(C_2-C_6)alkynyl, -(C_3-C_8)cycloalkyl, -(C_4-C_8)cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, -OH, $-NO_2$, $-NH_2$, -(C_1-C_6)alkyl, -(C_3-C_8)cycloalkyl, and 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S.

12. The use according to claim 11, wherein

R^3 is -H, halogen, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_8 aryl, 5-8 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered bicyclic or tricyclic fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl , heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, $-R^a$, $-OR^b$, $-NO_2$, and $-NR^cR^d$;

R^a, R^b, R^c, and R^d at each occurrence are independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, -(C_1-C_6)alkyl, -(C_3-C_8)cycloalkyl, 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_8 aryl, 5-8 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents

selected from: =O, halogen, -CN, -OH, -NO_2, -NH_2, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, and 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S.

13. The use according to claim 12, wherein

R^3 is -H, -F, -Cl, -Br, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, C_6-C_8 aryl, or 7-14 membered bicyclic fused ring group containing 0-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl, aryl or fused ring group is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, -R^a and -OR^b;

R^a and R^b at each occurrence are independently -H, halogen, -OH, -NH_2, -CN, -NO_2, -(C_1-C_6)alkyl, -(C_3-C_8)cycloalkyl, or 3-6 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, wherein each of the alkyl, cycloalkyl or heterocyclyl is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, -OH, -NO_2, -NH_2, and -(C_1-C_6)alkyl.

14. The use according to claim 11, wherein

R^3 is -H, -F, -Cl, -Br, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, pyridyl, phenyl, naphthyl, benzothiazolyl, benzomorpholinyl, benzopyrrolidinyl or 

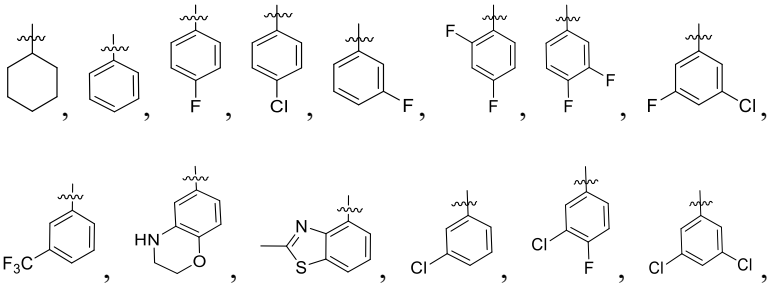
, wherein the pyridyl, phenyl, benzothiazolyl, benzomorpholinyl, benzopyrrolidinyl, or 

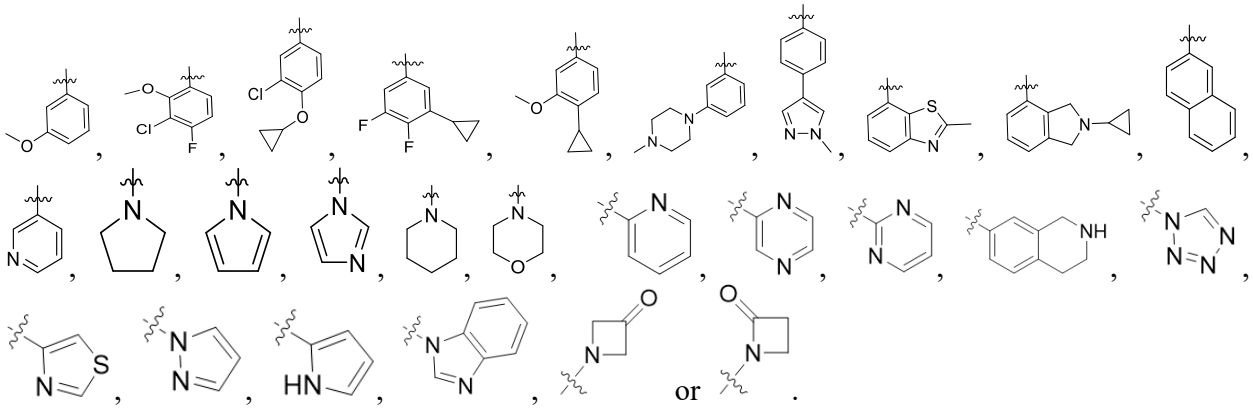
is optionally substituted by one or more substituents selected from: -F, -Cl, -Br, -CN, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, -O-(C_1-C_6)alkyl, -O-(C_3-C_6)cycloalkyl, -(C_1-C_6)haloalkyl, -(C_3-C_6)halocycloalkyl, -O-(C_1-C_6)haloalkyl, -O-(C_3-C_6)halocycloalkyl, pyrazolyl, pyrazolyl substituted by any number of halogen or -(C_1-C_6)alkyl, piperazinyl, piperazinyl substituted by any number of halogen or -(C_1-C_6)alkyl;

the ring 

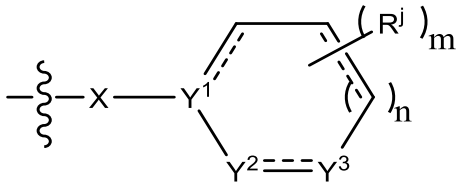
is 3-6 membered saturated or unsaturated N-containing heterocyclyl connected through an N atom, and in addition to the N atom, the heterocyclyl optionally contains 1-2 heteroatoms independently selected from O, N and S;

or,

R^3 is -H, -F, -Cl, -Br, -CH_3, -CH_2CH_3, 



15. The use according to any one of claims 1-14, wherein

R^4 is  ;

X is a chemical bond, $-(CR^hR^i)_t-$, $-NR^c(CR^hR^i)_t-$ or -O-;

 represents a single bond or double bond;

Y^1 is N, C or CH;

Y^2 and Y^3 are each independently N, CH_2 or CH, and Y^2 and Y^3 are not both N at the same time;

each R^j is independently -H, halogen, -OH, $-NH_2$, -CN, $-NO_2$, $-(C_1-C_6)$alkyl, $-(C_1-C_6)$alkoxy, $-(C_2-C_6)$alkenyl, $-(C_2-C_6)$alkynyl, $-(C_3-C_8)$cycloalkyl, $-O-(C_3-C_6)$cycloalkyl, $-(C_4-C_8)$cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, -SH, $-S(O)_2H$, $-S(O)_2NH_2$, -S(O)H, $-S(O)NH_2$, $-NHS(O)_2H$, -NHS(O)H, $-S(O)_2OH$, -S(O)OH, $-NHS(O)_2OH$, -NHS(O)OH, -C(O)H, or -C(O)OH, wherein each of the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: -H, =O, halogen, -CN, -OH, -SH, $-NO_2$, $-NH_2$, $-S(O)_2H$, $-S(O)_2NH_2$, -S(O)H, $-S(O)NH_2$, $-NHS(O)_2H$, -NHS(O)H, $-S(O)_2OH$, -S(O)OH, $-NHS(O)_2OH$, -NHS(O)OH, -C(O)H, -C(O)OH, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, or 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S;

m is selected from 0, 1, 2, 3, 4, 5 or 6;

n is 0, 1 or 2,

R^c, R^h, R^i and t are as defined in any one of claims 1-14.

16. The use according to claim 15, wherein

X is a chemical bond, -CH_2-, -CH_2CH_2-, -$NHCH_2$-, -$NHCH_2CH_2$- or -O-;

------ represents a single bond or double bond;

Y^1 is N, C or CH;

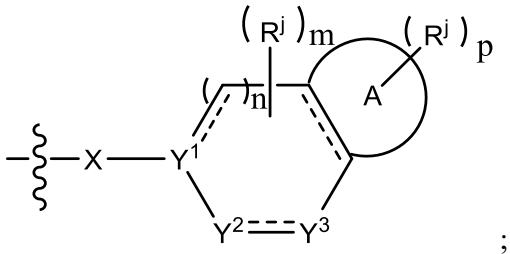
Y^2 and Y^3 are each independently N, CH_2 or CH, and Y^2 and Y^3 are not both N at the same time;

each R^j is independently -H, halogen, -OH, -NH_2, -CN, -(C_1-C_6)alkyl, -(C_3-C_6)cycloalkyl, -(C_1-C_6)alkoxy, -O-(C_3-C_6)cycloalkyl, -(C_1-C_6)alkyl substituted by any number of halogen, -(C_1-C_6)alkoxy substituted by any number of halogen, -(C_3-C_6)cycloalkyl substituted by any number of halogen, -O-(C_3-C_6)cycloalkyl substituted by any number of halogen, oxazolyl, thiazolyl and triazolyl;

m is selected from 0, 1, 2, 3, 4, 5 or 6;

n is 0, 1 or 2.

17. The use according to any one of claims 1-14, wherein

R^4 is ;

X is a chemical bond, -(CR^hR^i)$_t$-, -NR^c(CR^hR^i)$_t$- or -O-;

------ represents a single bond or double bond;

Y^1 is N, C or CH;

Y^2 and Y^3 are each independently N, CH_2 or CH, and Y^2 and Y^3 are not both N at the same time;

each R^j is independently -H, halogen, -OH, =O, -NH_2, -CN, -NO_2, -(C_1-C_6)alkyl, -(C_1-C_6)alkoxy, -(C_2-C_6)alkenyl, -(C_2-C_6)alkynyl, -(C_3-C_8)cycloalkyl, -(C_4-C_8)cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S, -SH, -S(O)$_2$H, -S(O)$_2$$NH_2$, -S(O)H, -S(O)$NH_2$, -NHS(O)$_2$H, -NHS(O)H, -S(O)$_2$OH, -S(O)OH, -NHS(O)$_2$OH, -NHS(O)OH, -C(O)H, or -C(O)OH, wherein each of the alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, heteroaryl or fused ring group is optionally substituted by one or more substituents selected from: =O, halogen, -CN, -OH, -SH, -NO_2, -NH_2, -S(O)$_2$H, -S(O)$_2$$NH_2$, -S(O)H, -S(O)$NH_2$, -NHS(O)$_2$H, -NHS(O)H, -C(O)H, -C(O)OH, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, or 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S;

m and p are independently selected from 0, 1, 2, 3, 4, 5 or 6;

n is 0, 1 or 2;

ring A is (C_3-C_8)cycloalkyl, (C_4-C_8)cycloalkenyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered fused ring group containing 0-4 heteroatoms independently selected from O, N and S;

R^c, R^h, R^i and t are as defined in any one of claims 1-14.

18. The use according to claim 17, wherein

X is a chemical bond, -CH_2-, -CH_2CH_2-, -$NHCH_2$-, -$NHCH_2CH_2$- or -O-;

------ represents a single bond or double bond;

Y^1 is N, C or CH;

Y^2 and Y^3 are each independently N, CH_2 or CH, and Y^2 and Y^3 are not both N at the same time;

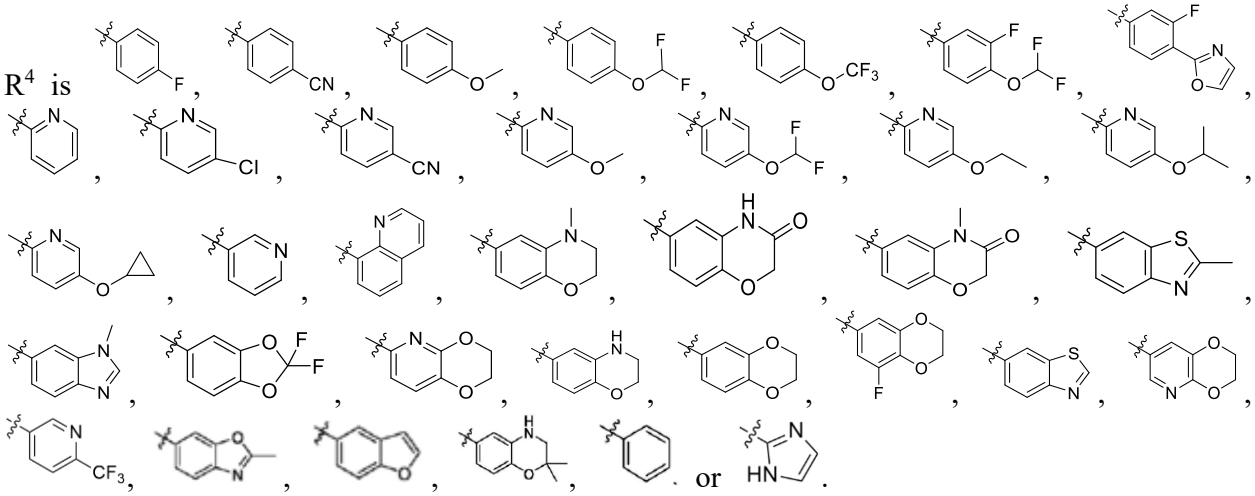
each R^j is independently -H, halogen, -OH, -NH_2, -CN, =O, -(C_1-C_6)alkyl, -(C_1-C_6)alkoxy, -(C_1-C_6)alkyl substituted by any number of halogen, -(C_1-C_6)alkoxy substituted by any number of halogen, oxazolyl, thiazolyl, or triazolyl;

m and p are independently selected from 0, 1, 2, 3, 4, 5 or 6;

n is 0, 1 or 2;

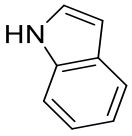
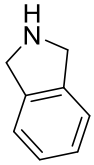
the ring A is furan, thiophene, oxazole, thiazole, triazole, piperidine, pyridine, pyran, thiopyran, morpholine, 1,4-dioxane, piperazine, pyrazine, triazine, 4,5-dihydro-1H-imidazole, or 1,3-dioxolane.

19. The use according to claim 1, wherein

R^4 is .

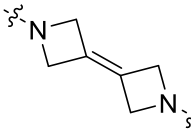
20. The use according to claim 1, wherein in formula II,

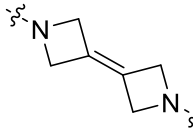
each R^j is independently -H, halogen, -OH, $-NH_2$, -CN, =O, $-(C_1-C_6)$alkyl, $-(C_1-C_6)$alkoxy, $-(C_1-C_6)$alkyl substituted by any number of halogen, $-(C_1-C_6)$alkoxy substituted by any number of halogen, oxazolyl, thiazolyl, or triazolyl;

the ring B is (C_3-C_8)cycloalkyl, 3-14 membered heterocyclyl containing 1-4 heteroatoms independently selected from O, N and S, C_6-C_{14} aryl, 5-14 membered heteroaryl containing 1-4 heteroatoms independently selected from O, N and S, or 7-14 membered bicyclic or tricyclic fused ring group containing 0-4 heteroatoms independently selected from O, N and S; or, the ring B is 3-7 membered oxacycloalkyl or 8-10 membered azabicyclic fused heteroaryl; or, the ring B is oxacycloheptane, oxacyclohexane, tetrahydrofuran, oxetane, oxacyclopropane, 1H-indole or isoindoline; or, the ring B is , , ,  or .

21. The use according to any one of claims 1-20, wherein

any one or more H in the compound of formula I or II are substituted by D; or

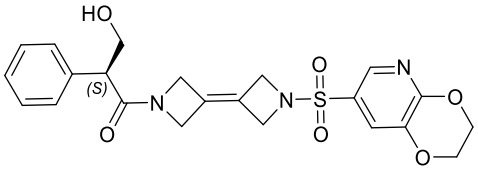
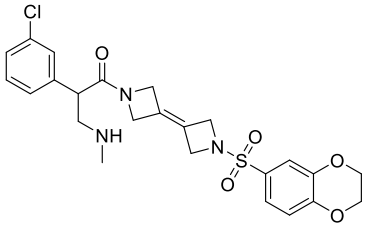
in the compound of formula I or II, any one or more H in the structure "" are substituted by D, or any one or more H in R^4 are substituted by D; or

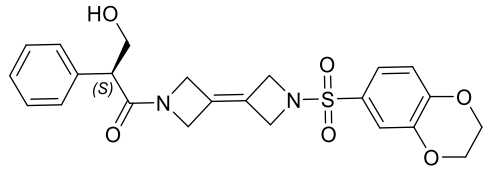
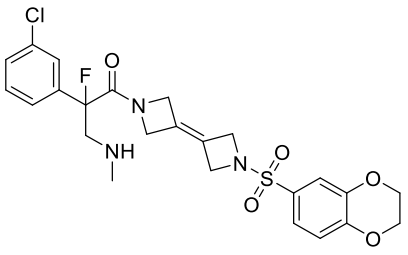
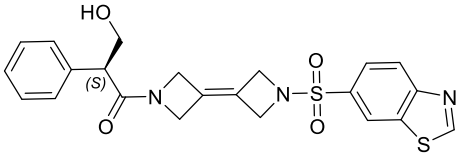
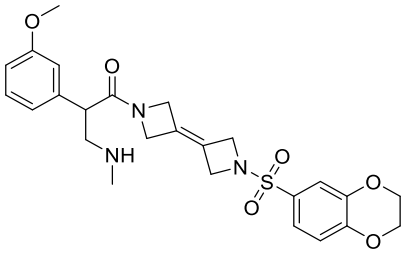
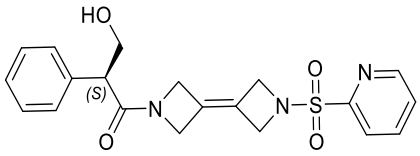
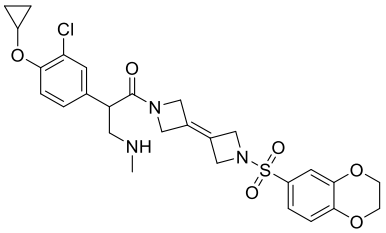
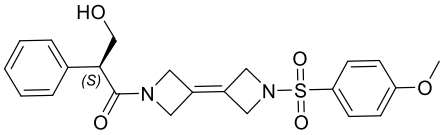
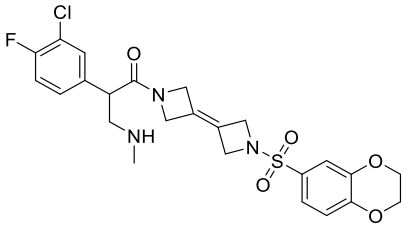
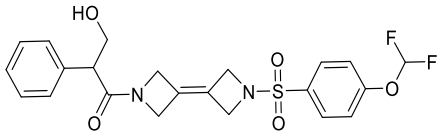
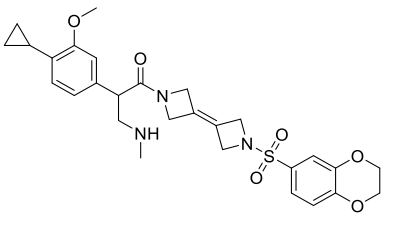
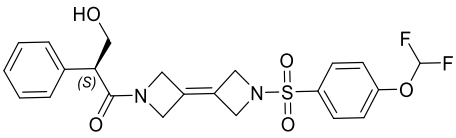
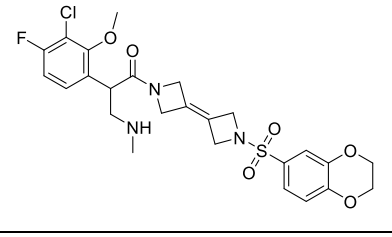
in the compound of formula I or II, all H in the structure "" are substituted by D.

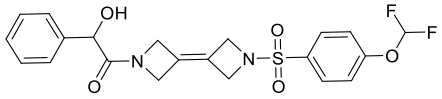
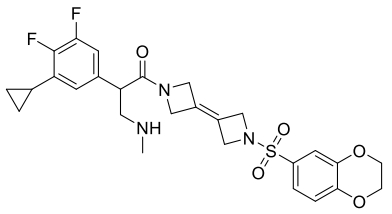
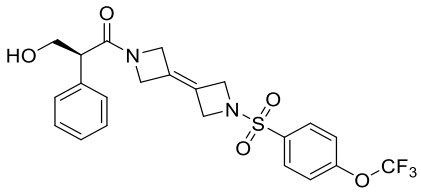
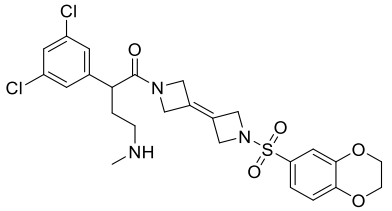
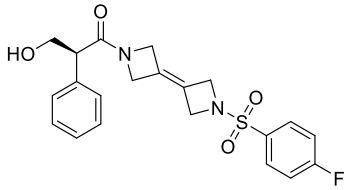
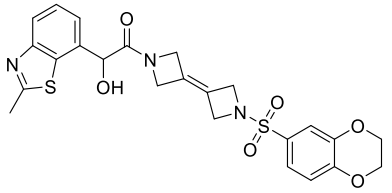
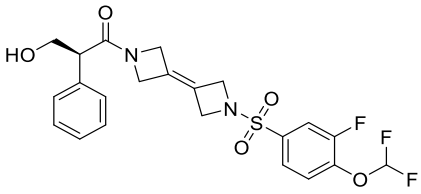
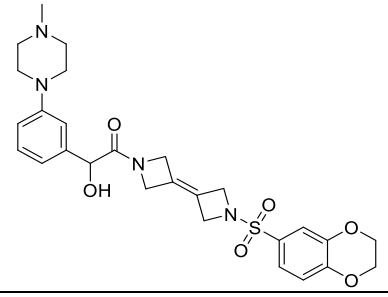
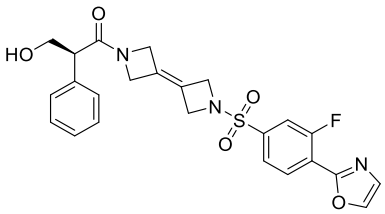
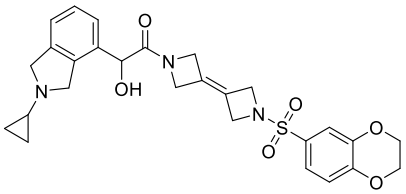
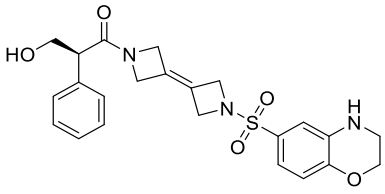
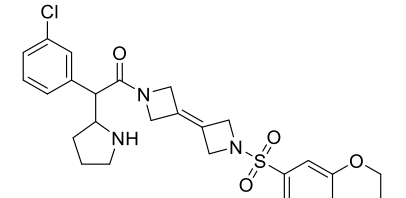
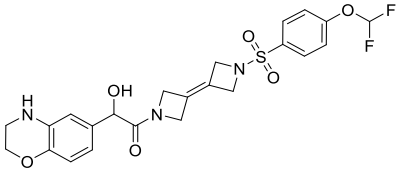
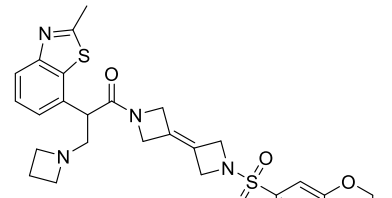
22. The use according to claim 21, wherein

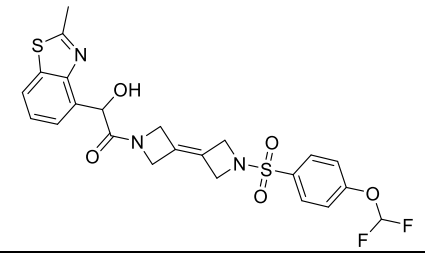
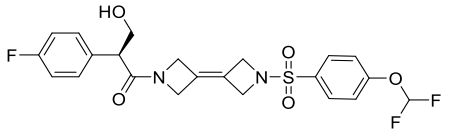
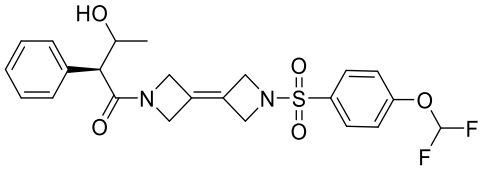
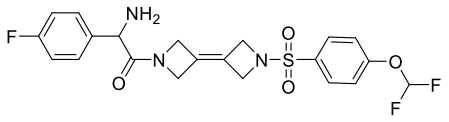
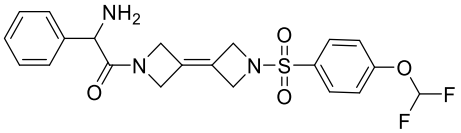
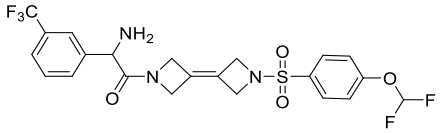
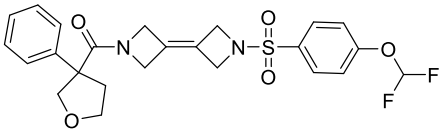
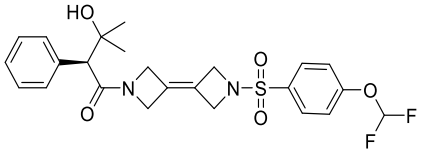
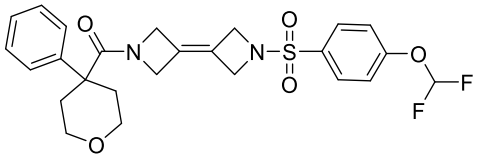
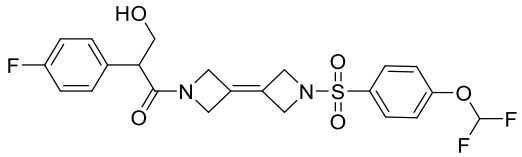
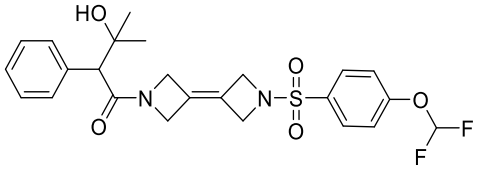
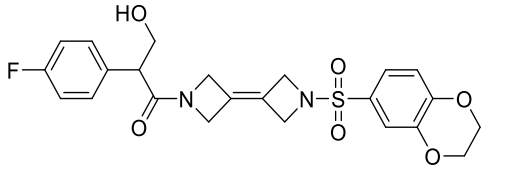
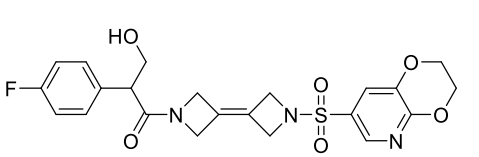
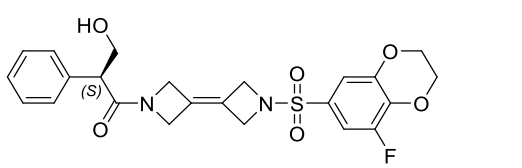
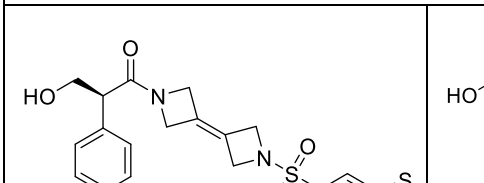
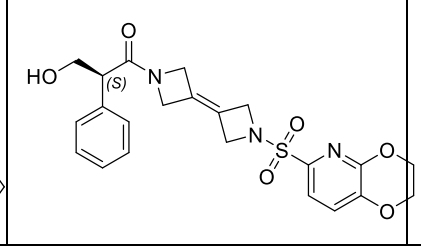
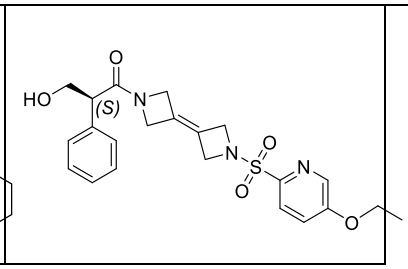
R^1, R^2 or R^3 is independently and optionally substituted by D when being selected as H.

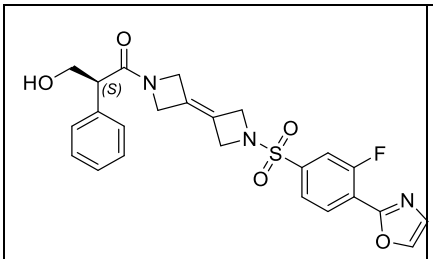
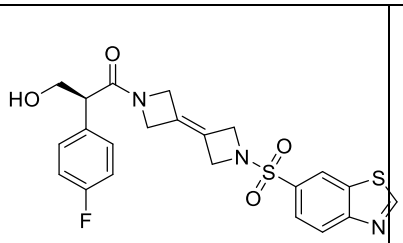
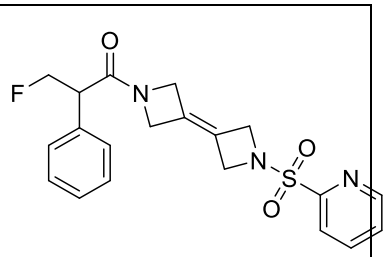
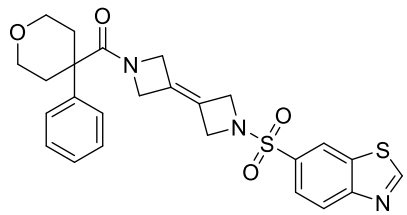
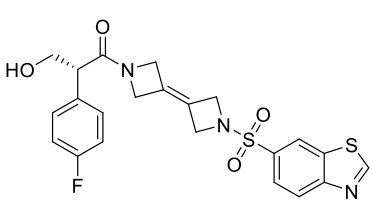
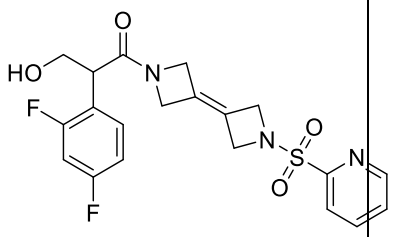
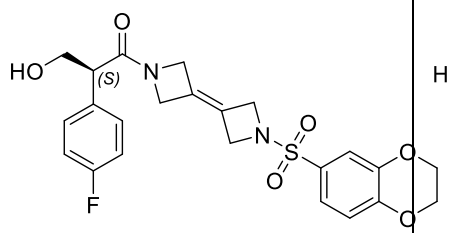
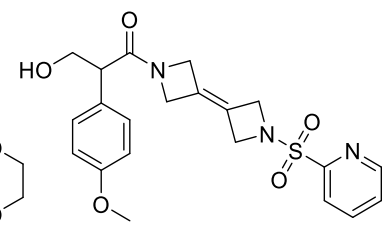
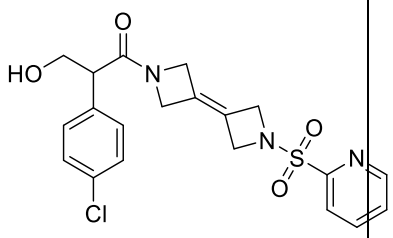
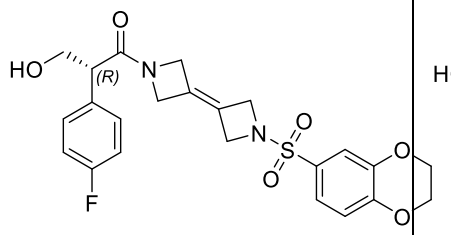
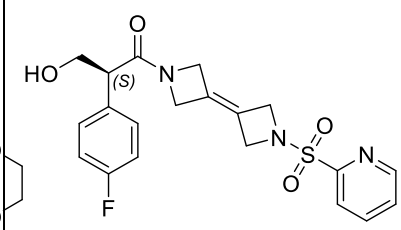
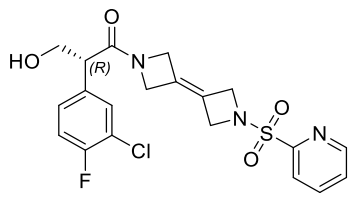
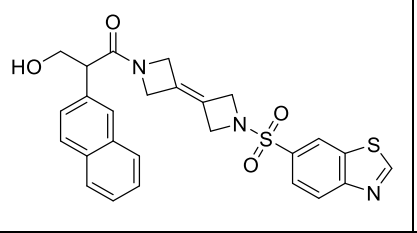
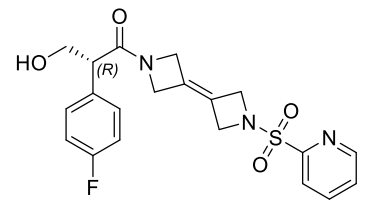
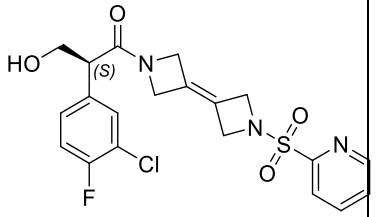
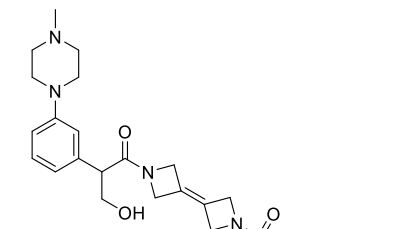
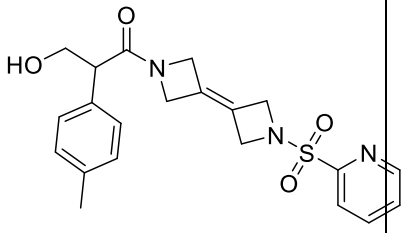
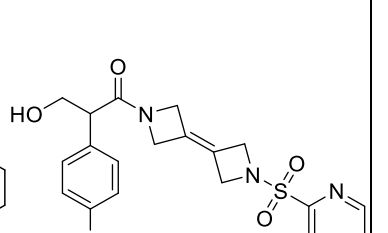
23. The use according to claim 1, wherein the compound is selected from:

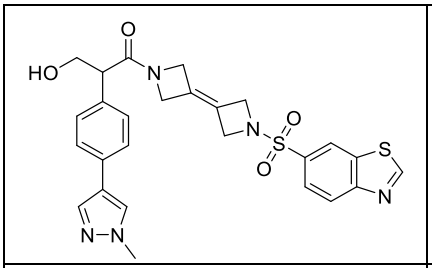
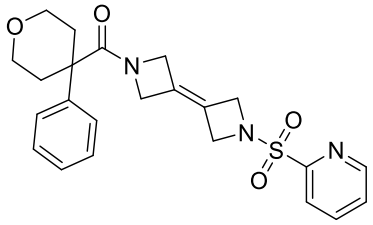
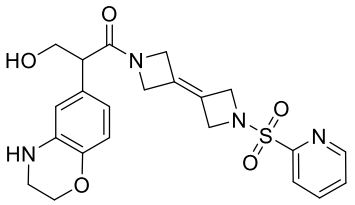
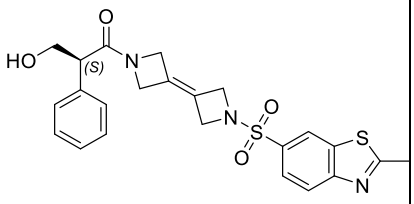
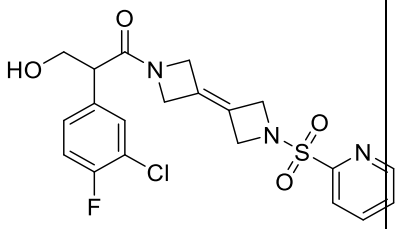
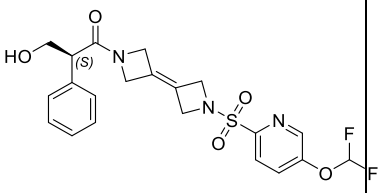
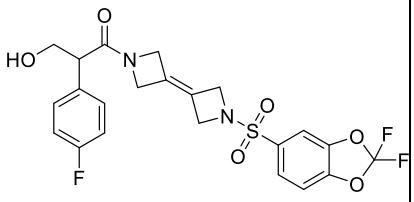
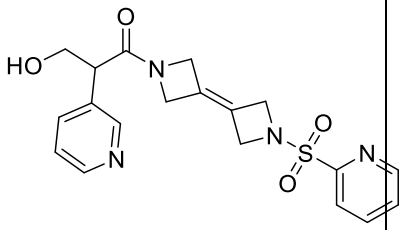
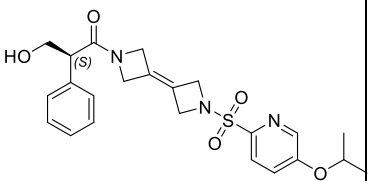
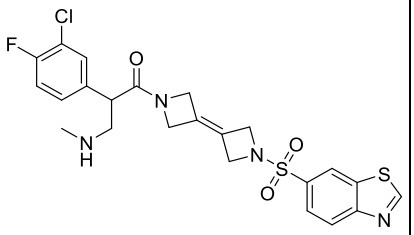
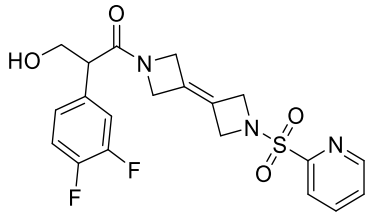
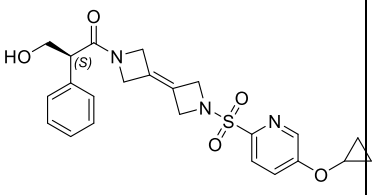
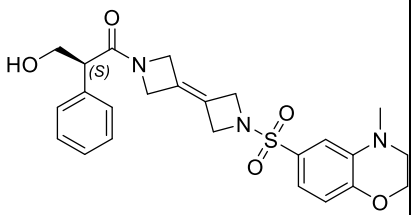
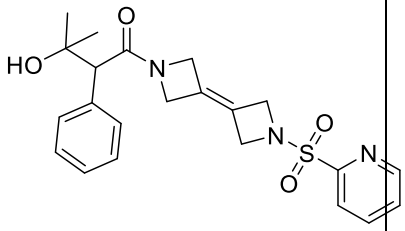
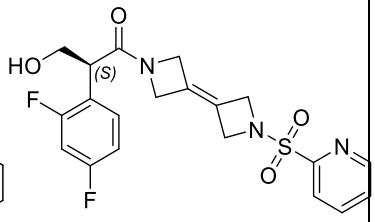
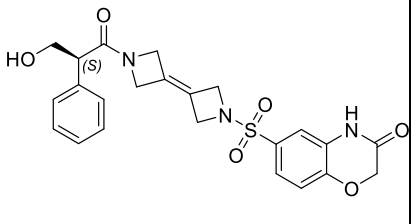
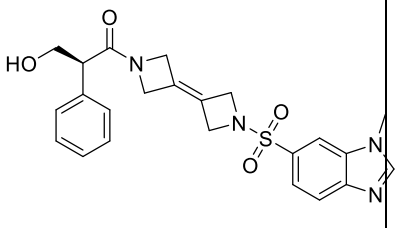
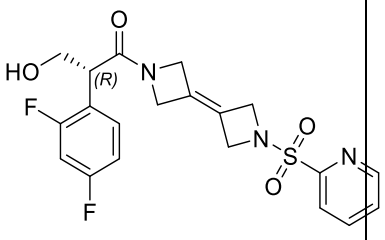
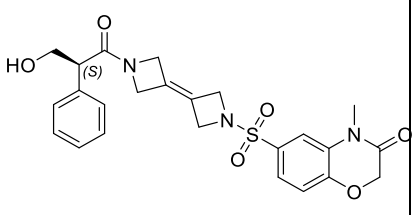
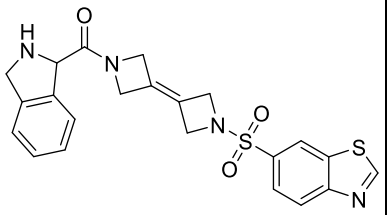
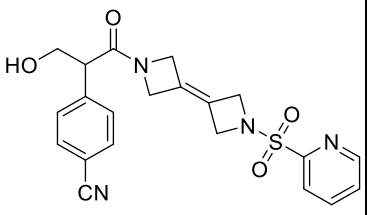
	

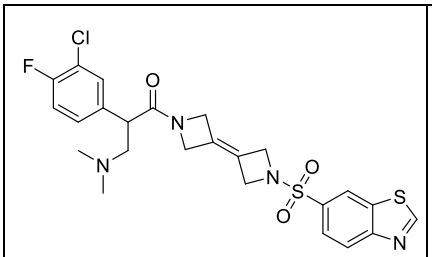
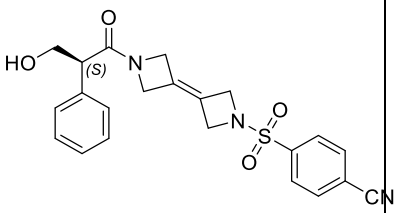
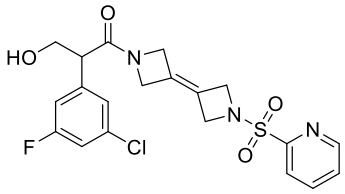
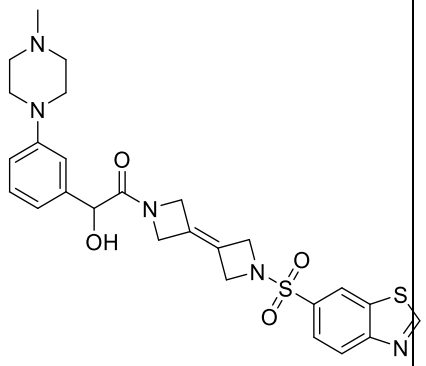
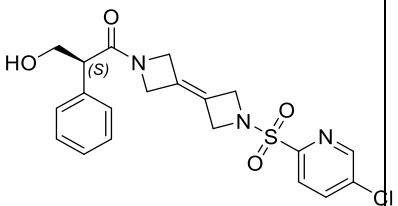
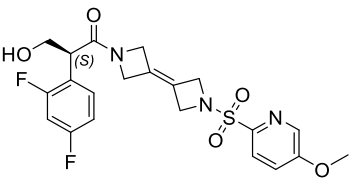
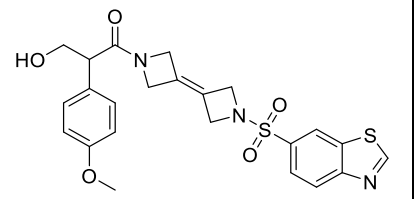
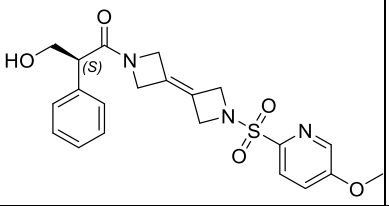
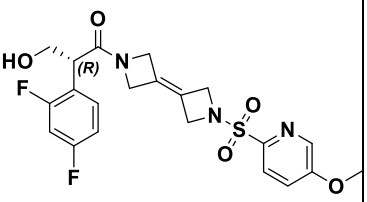
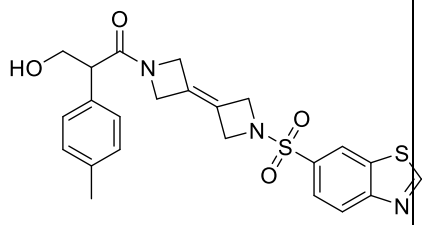
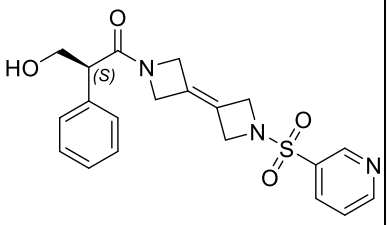
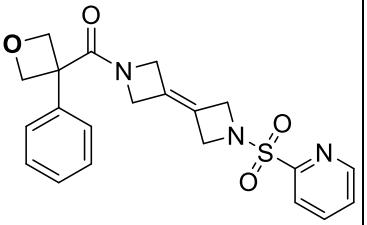
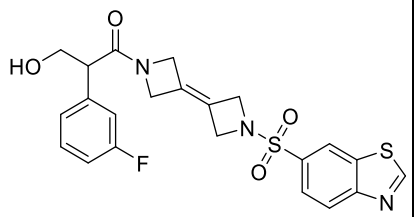
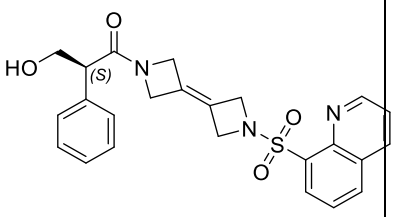
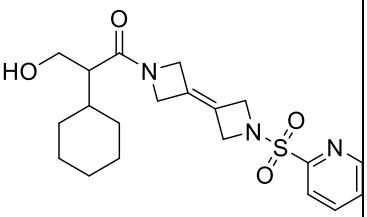
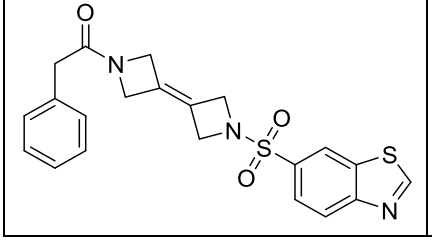
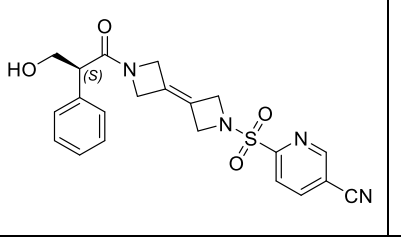
	
	
	
	
	
	

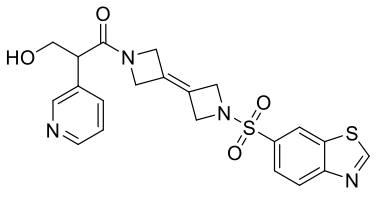
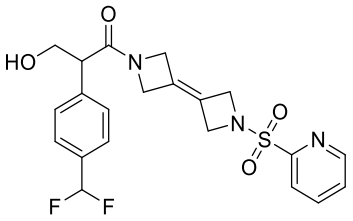
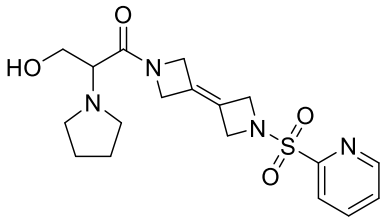
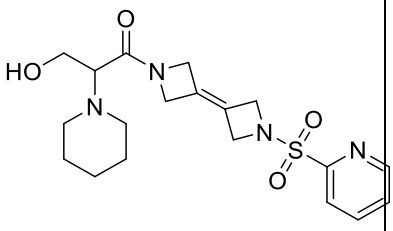
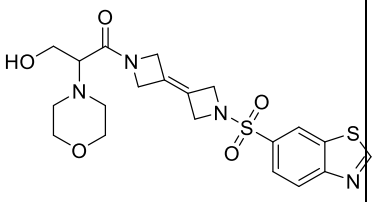
	
	
	
	
	
	
	

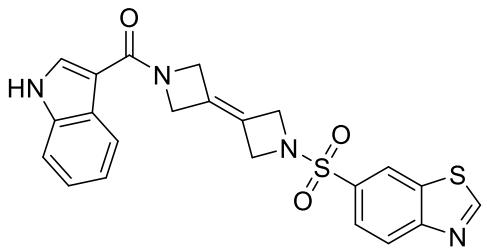
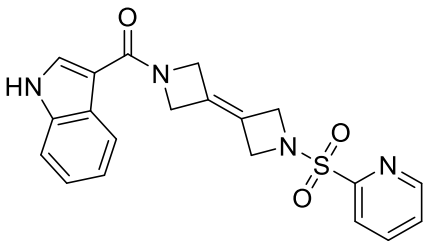
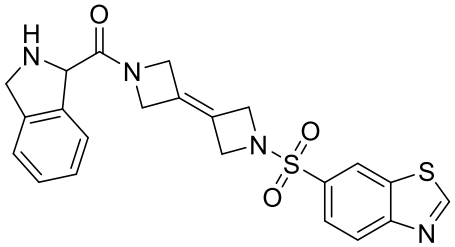
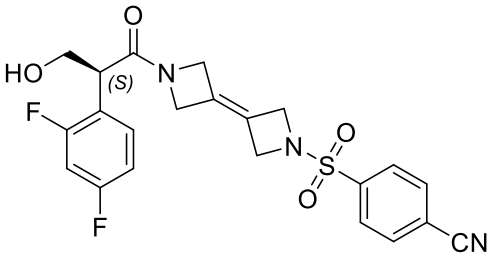
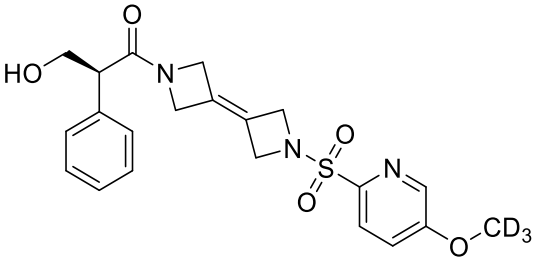
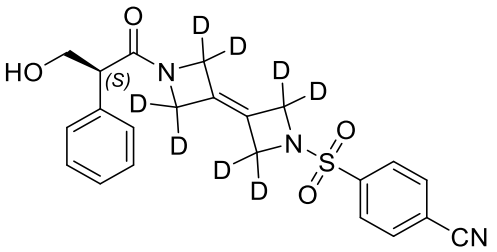
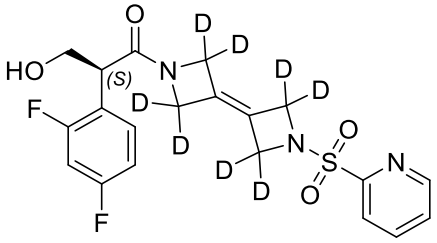
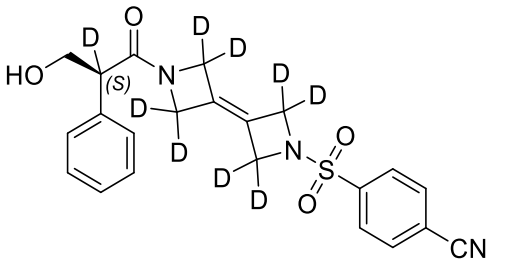
	
	
	
	
	
	
	
	
	
	

.

24. The use according to any one of claims 1-23, wherein the pharmaceutical composition is presented in a dosage form of tablet, capsule, granule, pill, paste, powder, tincture, film, patch, liniment, implant, injection, lozenge, drop, spray, aerosol, nebulized inhaler, gel, suppository or ointment; and/or

wherein the pharmaceutical composition is administered in an administration route of oral, intravenous, rectal, parenteral, topical, transdermal, ocular, nasal, buccal or pulmonary (inhalation).