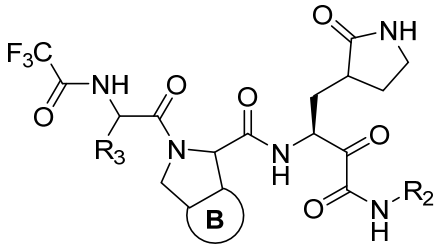
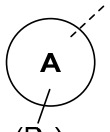
CLAIMS

1. A compound of formula (IV) or a pharmaceutically acceptable salt thereof,



(IV)

wherein,



R_3 is selected from and R_4;

R_1 is each independently selected from F, Cl, Br, I, OR_{11}, CN, $CH_3S(O)_m$- and NHR_{12}, and C_{1-3} alkyl, and the C_{1-3} alkyl is optionally substituted with 1, 2 or 3 F;

R_{11} is selected from H, C_{1-3} alkyl, $CH_3(OCH_2CH_2)_p$- and $H(OCH_2CH_2)_q$-, and the C_{1-3} alkyl is optionally substituted with 1, 2 or 3 F;

R_{12} is selected from C_{1-3} alkyl, CH_3CO- and CH_3SO_2-, and the C_{1-3} alkyl, CH_3CO- and CH_3SO_2- are optionally and independently substituted with 1, 2 or 3 F;

m is selected from 0, 1 and 2;

p and q are selected from 1, 2, 3, 4, 5, and 6;

n is selected from 0, 1, 2, 3, and 4;

R_2 is selected from C_{1-4} alkyl, C_{3-6} cycloalkyl and benzyl, and the C_{1-4} alkyl, C_{3-6} cycloalkyl and benzyl are optionally substituted with 1, 2 or 3 F;

R_4 is selected from C_{1-8} alkyl optionally and independently substituted with 1, 2 or 3 F;

ring A is selected from C_{3-10} cycloalkyl, 3-10-membered heterocycloalkyl and phenyl;

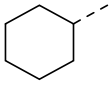
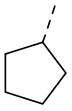
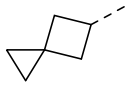
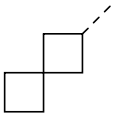
ring B is selected from C_{3-8} cycloalkyl and 5-membered heterocycloalkyl, and the C_{3-8} cycloalkyl and 5-membered heterocycloalkyl are optionally substituted with 1 or 2 R_a; and

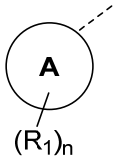
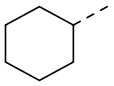
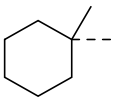
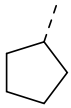
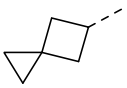
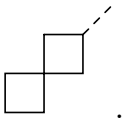
R_a is each independently selected from H and C_{1-3} alkyl.

2. The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein, R_1 is selected from F and methyl.

3. The compound or the pharmaceutically acceptable salt thereof according to claim 1,

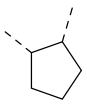
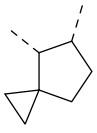
wherein, ring A is selected from C_{3-10} cycloalkyl.

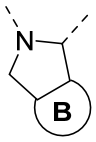
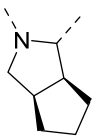
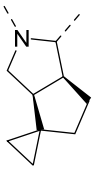
4. The compound or the pharmaceutically acceptable salt thereof according to claim 3, wherein, ring A is selected from the group consisting of , , , , and .

5. The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein, the structural unit  is selected from the group consisting of , , , , , and .

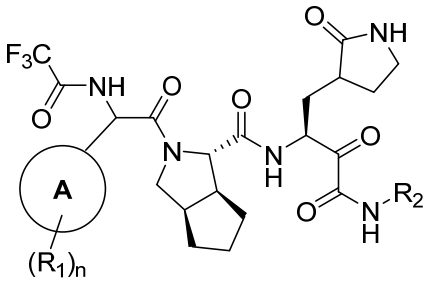
6. The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein, R_4 is selected from t-butyl.

7. The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein, R_a is selected from H and methyl.

8. The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein, ring B is selected from the group consisting of  and .

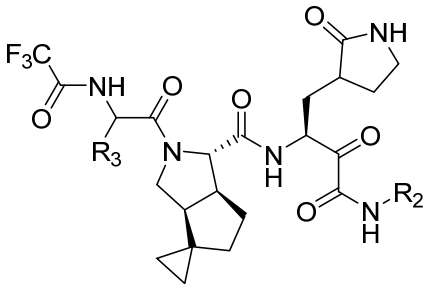
9. The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein, the structural unit  is selected from the group consisting of , , and .

10. The compound or the pharmaceutically acceptable salt thereof according to any one of claims 1-5, wherein, the compound is selected from structures of formulas (I-1), (IV-1) and (IV-2),



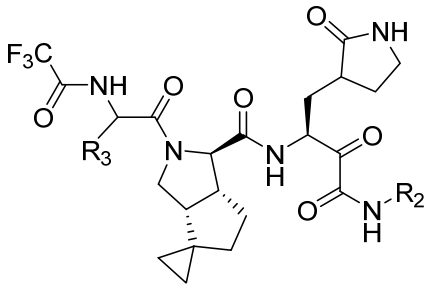
(I-1)

,



(IV-1)

, and

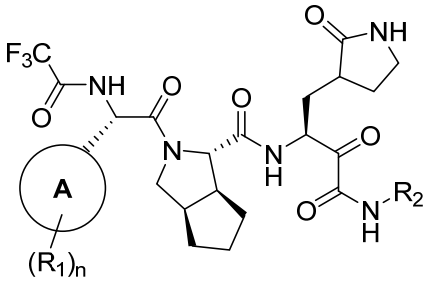


(IV-2)

,

wherein, R_1, R_2, R_3, n and ring A are as defined in any one of claims 1-5.

11. The compound or the pharmaceutically acceptable salt thereof according to claim 10, wherein, the compound is selected from structures of formulas (I-1a), (IV-1a) and (IV-2a),



(I-1a)

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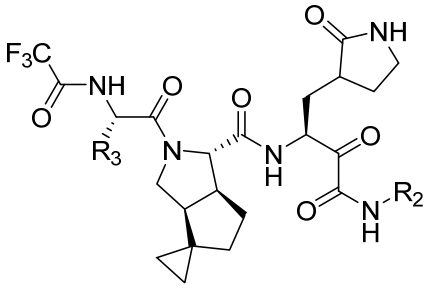

(IV-1a)

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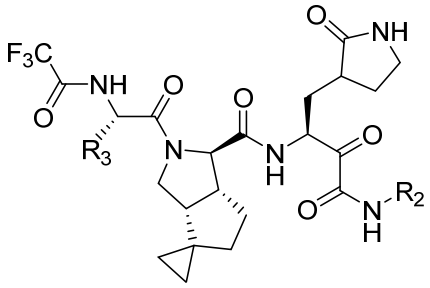

(IV-2a)

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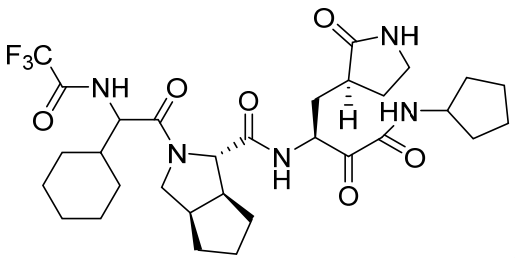
wherein, R_1, R_2, R_3, n and ring A are as defined in claim 10.

12. A compound selected from the group consisting of the following formulas, or a pharmaceutically acceptable salt thereof,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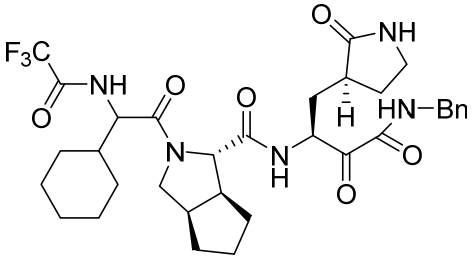
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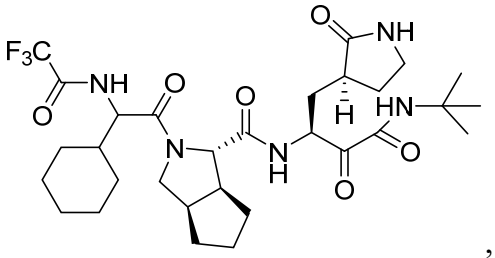
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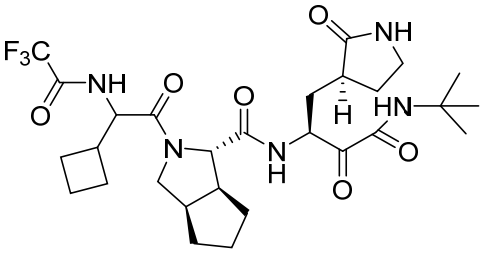
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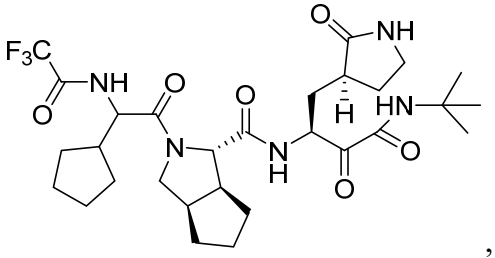
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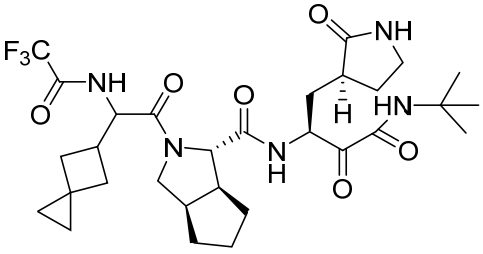
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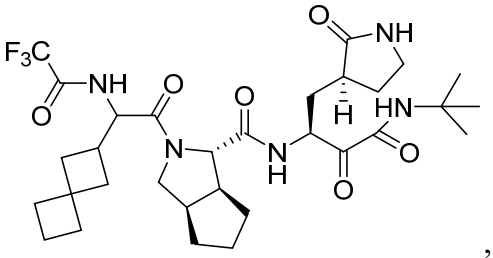
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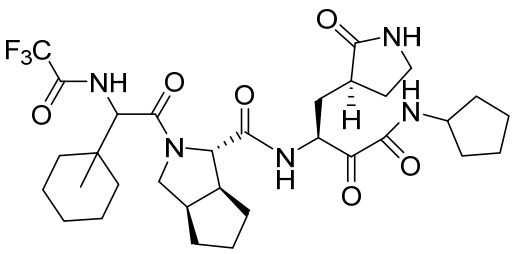
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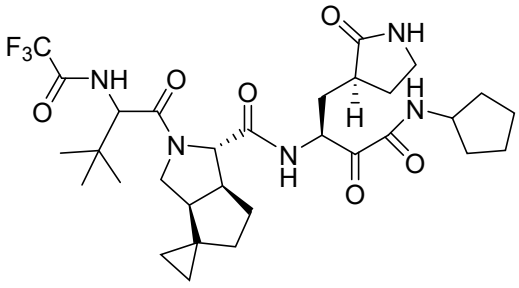
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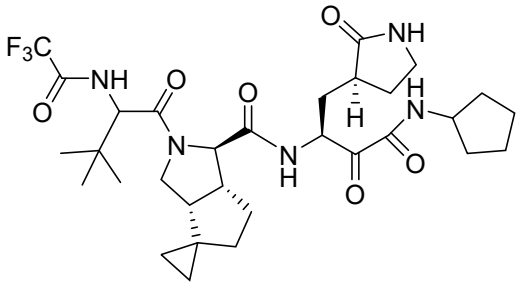
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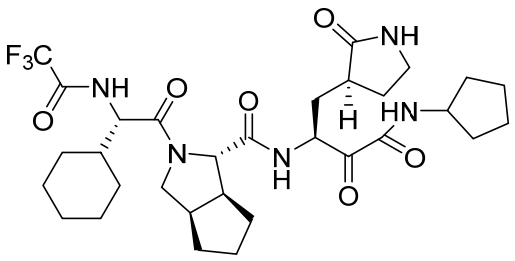
13. The compound or the pharmaceutically acceptable salt thereof according to claim 12, wherein, the compound is selected from the group consisting of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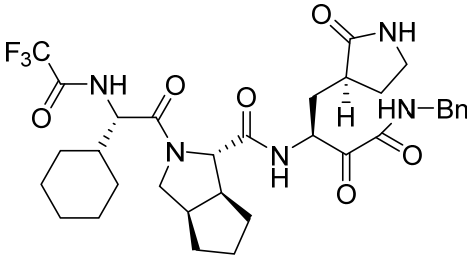
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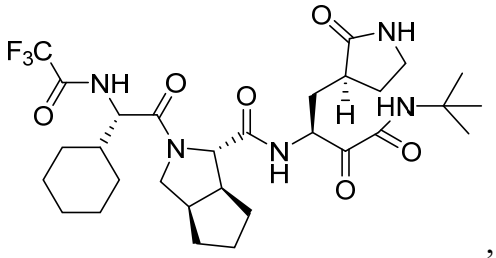
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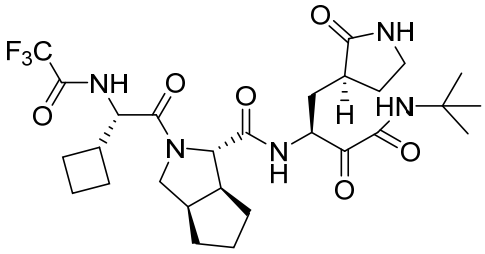
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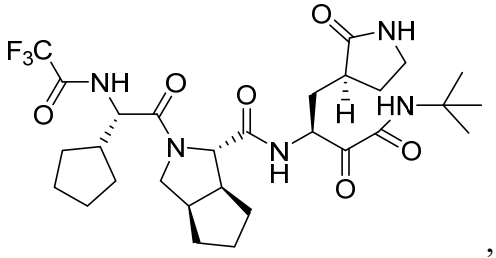
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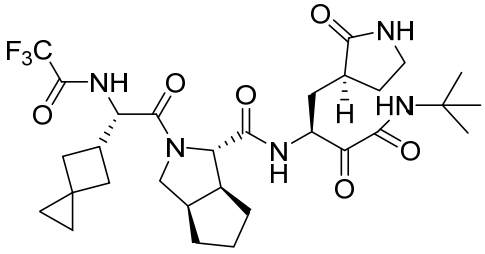
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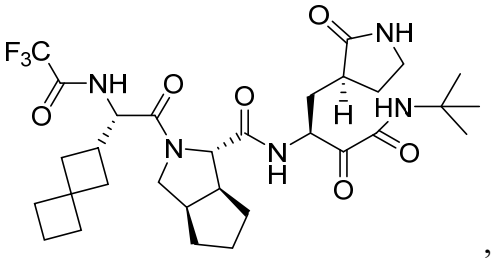
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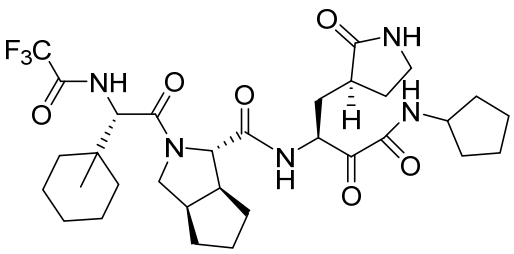
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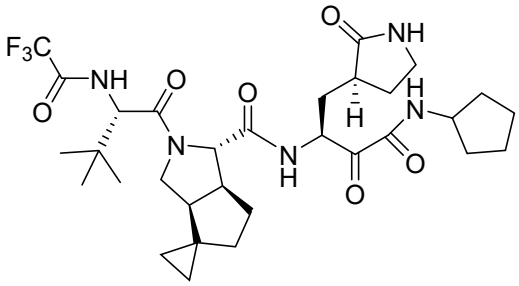
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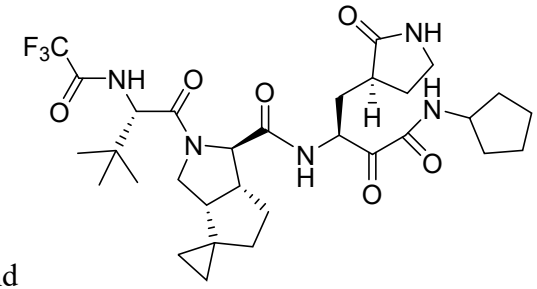
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14. Use of~~A method for treating a coronavirus infection, comprising administering to a subject in need thereof a therapeutically effective amount of~~ the compound or the pharmaceutically acceptable salt thereof according to any one of claims 1-13~~,~~ and a ~~therapeutically acceptable dosage of~~ further antiviral drug in the manufacture of a pharmaceutical composition for treating a coronavirus infection.

15. The use~~method~~ according to claim 14, wherein, the coronavirus infection is selected from

an infection of HCoV-229E, HCoV-OC43, HCoV-NL63, HCoV-HKU1, SARS-CoV, MERS-CoV or SARS-CoV-2, or a variant thereof.

16. The use~~method~~ according to claim 14, wherein, the further antiviral drug is selected from the group consisting of Ritonavir, Indinavir, Nelfinavir, Saquinavir, Amprenavir or Lopinavir.