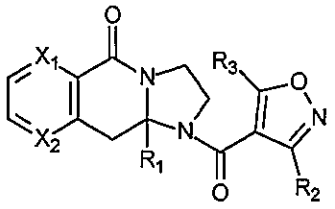
CLAIMS

1. A compound of formula (I), racemates, isomers and/or salts thereof:



(I)

wherein

X_1 and X_2 are independently selected from CH and N wherein at least one of X_1 or X_2 is N;

R_1 is optionally substituted and is selected from a carbocyclic, heterocyclic and aromatic ring;

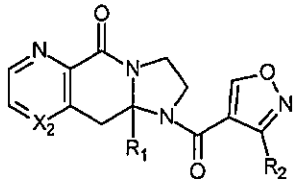
R_2 is selected from C_{1-6}alkyl, haloC_{1-3}alkyl and C_{1-3}alkoxy; and

R_3 is H or an optional substituent.

2. A compound according to claim 1, racemates, isomers and/or salts thereof wherein R_3 is H.

3. A compound according to claim 1 or claim 2, racemates, isomers and/or salts thereof wherein X_1 is N.

4. A compound according to claim 1 of formula (Ia), racemates, isomers and/or salts thereof:



(Ia)

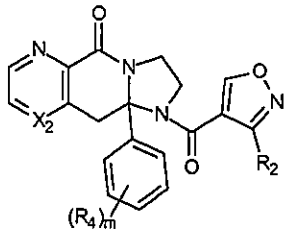
wherein

X_2, R_1 and R_2 are as defined in claim 1.

5. A compound according to any one of claims 1 to 4, racemates, isomers and/or salts thereof wherein R_1 is optionally substituted and is selected from a 3-10 membered carbocyclic ring; a 9-10 membered membered fused bicyclic carbocyclic ring; a 5-6 membered monocyclic heterocyclyl; a 9-10 membered fused bicyclic heterocyclyl; and a 6-membered aromatic ring.

6. A compound according to any one of claims 1 to 5, racemates, isomers and/or salts thereof wherein R_1 is optionally substituted and is selected from a C_6cycloalkyl, phenyl, a 5-6 membered heterocyclyl and a 9-membered fused bicyclic heterocyclyl.

7. A compound according to claim 1 of formula (Ib), racemates, isomers and/or salts thereof:



(Ib)

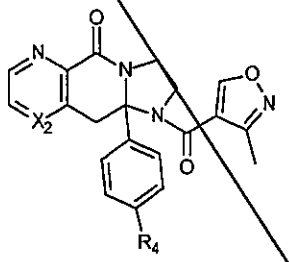
wherein

X_2 and R_2 are as defined in claim 1;

m is an integer selected from 0, 1, 2 or 3; and

R_4 is an optional substituent.

8. A compound according to claim 1 of formula (Ic), racemates, isomers and/or salts thereof:



(Ic)

wherein

X_2 is as defined in claim 1; and

R_4 is an optional substituent.

9. A compound according to claim 7 or claim 8, racemates, isomers and/or salts thereof wherein R_4 is selected from the group consisting of C_{1-3}alkyl, haloC_{1-3}alkyl, halo and C_{1-3}alkoxy.

10. A compound according to claim 1, racemates, isomers and/or salts thereof selected from the group consisting of:

(1) 5a-(4-chlorophenyl)-6-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-5a,6,7,8-tetrahydroimidazo[1',2':1,6]pyrido[3,4-b]pyrazin-10(5H)-one;

(2) 10a-(4-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(3) 10a-(4-methoxyphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(4) 10a-(4-fluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(5) 5a-(4-fluorophenyl)-6-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-5a,6,7,8-tetrahydroimidazo[1',2':1,6]pyrido[3,4-b]pyrazin-10(5H)-one;

(6) 10a-(4-fluoro-3-methylphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(7) 10a-(3,4-difluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(8) 5a-(3,4-difluorophenyl)-6-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-5a,6,7,8-tetrahydroimidazo[1',2':1,6]pyrido[3,4-b]pyrazin-10(5H)-one;

(9) 5a-(4-fluoro-3-methylphenyl)-6-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-5a,6,7,8-tetrahydroimidazo[1',2':1,6]pyrido[3,4-b]pyrazin-10(5H)-one;

(10) 10a-(2-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(11) 10a-cyclohexyl-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

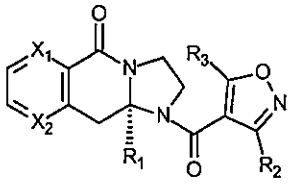
(12) 10a-(4,4-difluorocyclohexyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(13) 10a-(4-chlorophenyl)-1-{[3-(trifluoromethyl)-1,2-oxazol-4-yl]carbonyl}-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one; and

(14) 10a-(2,3-dihydro-1-benzofuran-5-yl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one.

11. A compound according to any one of claims 1 to 10 or salts thereof in a single stereoisomeric form.

12. A compound according to claim 11 of formula (I-i) or salts thereof:

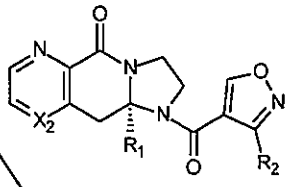


(I-i)

wherein

X_1, X_2, R_1, R_2 and R_3 are as defined in claim 1.

13. A compound according to claim 4 of formula (Ia-i) or salts thereof:

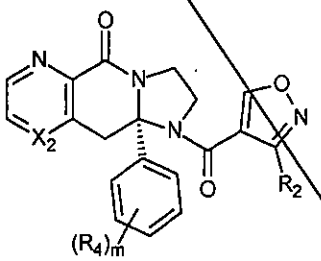


(Ia-i)

wherein

X_2, R_1 and R_2 are as defined in claim 1.

14. A compound according to claim 7 of formula (Ib-i) or salts thereof:



(Ib-i)

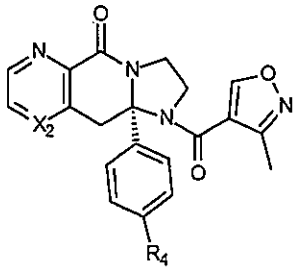
wherein

X_2 and R_2 are as defined in claim 1;

m is an integer selected from 0, 1, 2 or 3; and

R_4 is an optional substituent.

15. A compound according to claim 8 of formula (Ic-i) or salts thereof:



(Ic-i)

wherein

X_2 is as defined in claim 1; and

R_4 is an optional substituent.

16. A compound according to claim 11 or its salts thereof selected from the group consisting of:

(1A) (5aS)-5a-(4-chlorophenyl)-6-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-5a,6,7,8-tetrahydroimidazo[1',2':1,6]pyrido[3,4-b]pyrazin-10(5H)-one;

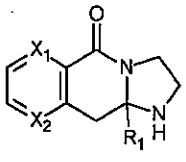
(2A) (10aS)-10a-(4-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(4A) (10aS)-10a-(4-fluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one

(5A) (5aS)-5a-(4-fluorophenyl)-6-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-5a,6,7,8-tetrahydroimidazo[1',2':1,6]pyrido[3,4-b]pyrazin-10(5H)-one; and

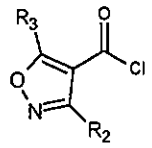
(6A) (10aS)-10a-(4-fluoro-3-methylphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one.

17. A process for preparing the compound of formula (I) according to claim 1, racemates, isomers and/or salts thereof comprising the step of reacting a compound of formula II:



(II)

with a compound of formula III:



(III)

under acylation conditions;

wherein

X_1, X_2, R_1, R_2 and R_3 are as defined according to claim 1.

18. A process according to claim 17 further comprising the step of forming an enantiomer of a compound of formula (II) by chiral HPLC resolution or by diastereomeric salt formation with a chiral acid.

19. An RSV antiviral agent comprising a compound, racemate, isomer and/or salt thereof as defined in any one of claims 1 to 16.

20. A pharmaceutical composition comprising a compound, racemate, isomer and/or salt thereof as defined in any one of claims 1 to 16 and a pharmaceutically acceptable carrier.

21. A method of treating an RSV infection, comprising the step of administering a compound, racemate, isomer and/or salt thereof as defined in any one of claims 1 to 16; the antiviral agent as defined in claim 19 or the pharmaceutical composition as defined in claim 20 to a subject in need thereof.

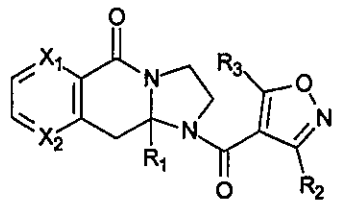
22. A method of treating an RSV disease, comprising the step of administering a compound, racemate, isomer and/or salt thereof as defined in any one of claims 1 to 16;, the antiviral agent as defined in claim 19 or the pharmaceutical composition as defined in claim 20 to a subject in need thereof.

23. A method of reducing exacerbation of an underlying or pre-existing respiratory disease wherein RSV infection is a cause of said exacerbation, comprising the step of administering a compound, racemate, isomer and/or salt thereof as defined in any one of claims 1 to 16;, the antiviral agent as defined in claim 19 or the pharmaceutical composition as defined in claim 20 to a subject in need thereof.

CLAIMS

The invention claimed is:

1. A compound of formula (I), racemates, stereoisomers and/or salts thereof:



(I)

wherein

X_1 is N and X_2 is CH;

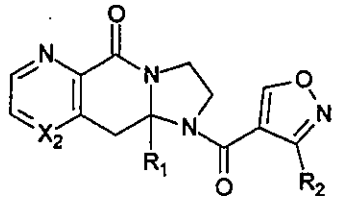
R_1 is selected from a carbocyclic ring, a heterocyclic ring, an aromatic ring, a substituted carbocyclic ring, a substituted heterocyclic ring, and a substituted aromatic ring, wherein the substituent is one or more groups selected from C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, aryl, halogen, halo C_{1-6}alkyl, haloC_{2-6}alkenyl, haloC_{2-6}alkynyl, haloaryl, hydroxyl, C_{1-6}alkylhydroxy, C_{1-6}alkoxy, -OC_{1-6}alkylhydroxy, -OC_{1-6}alkylC_{1-6}alkoxy, C_{2-6}alkenyloxy, aryloxy, benzyloxy, haloC_{1-6}alkoxy, haloC_{2-6}alkenyloxy, haloaryloxy, nitro, nitroC_{1-6}alkyl, nitroC_{2-6}alkenyl, nitroC_{2-6}alkynyl, nitroaryl, nitroheterocyclyl, amino, C_{1-6}alkylamino, C_{1-6}dialkylamino, C_{2-6}alkenylamino, C_{2-6}alkynylamino, arylamino, diarylamino, benzylamino, dibenzylamino, acyl, C_{2-6}alkenylacyl, C_{2-6}alkynylacyl, arylacyl, acylamino, diacylamino, acyloxy, alkylsulphonyloxy, arylsulphonyloxy, heterocyclyl, heterocyclyloxy, heterocyclylamino, haloheterocyclyl, alkylsulphonyl, arylsulphonyl, mercapto, C_{1-6}alkylthio, benzylthio, and acylthio;

R_2 is selected from C_{1-6}alkyl, haloC_{1-3}alkyl and C_{1-3}alkoxy; and

R_3 is H, C_{1-6}alkyl, .C_{2-6}alkenyl, C_{2-6}alkynyl, aryl, ,halogen, haloC_{1-6}alkyl, haloC_{2-6}alkenyl, haloC_{2-6}alkynyl, haloaryl, hydroxy, C_{1-6}alkylhydroxy, C_{1-6}alkoxy, -OC_{1-6}alkylhydroxy, -OC_{1-6}alkylC_{1-6}alkoxy, C_{2-6}alkenyloxy, aryloxy, benzyloxy, haloC_{1-6}alkoxy, haloC_{2-6}alkenyloxy, haloaryloxy, nitro, nitroC_{1-6}alkyl, nitroC_{1-6}alkenyl, nitroC_{1-6}alkynyl, nitroC2-6alkenyl, nitroC2-6alkynyl, nitroaryl, nitroheterocyclyl, amino, C_{1-6}alkylamino, C_{1-6}dialkylamino, C_{2-6}alkenylamino, C_{2-6}alkynylamino, arylamino, diarylamino, benzylamino, dibenzylamino, acyl, C_{2-6}alkenylacyl, C2-6alkynylacyl, arylacyl, acylamino, diacylamino, acyloxy, alkylsulphonyloxy,

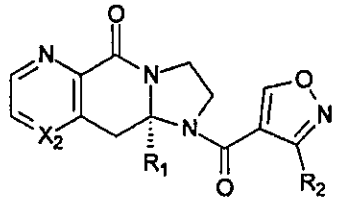
arylsulphonyloxy, heterocyclyl, heterocyclyloxy, heterocyclylamino, haloheterocyclyl, alkylsulphonyl, arylsulphonyl, mercapto, C_{1-6}alkylthio, benzylthio, or acylthio.

2. The compound according to claim 1 of formula (Ia), racemates, stereoisomers and/or salts thereof:



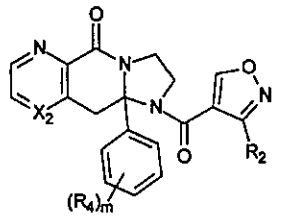
(Ia).

3. The compound according to claim 2 of formula (Ia-i) or salts thereof:



(Ia-i).

4. The compound according to claim 1 of formula (Ib), racemates, stereoisomers and/or salts thereof:



(Ib)

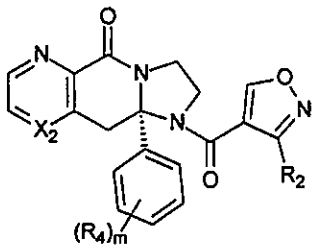
wherein

m is an integer selected from 0, 1, 2 or 3; and

R_4 is C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, aryl, halogen, haloC_{1-6}alkyl, haloC_{2-6}alkenyl, haloC_{2-6}alkynyl, haloaryl, hydroxyl, C_{1-6}alkylhydroxy, C_{1-6}alkoxy, -OC_{1-6}alkylhydroxy, -OC_{1-6}alkylC_{1-6}alkoxy, C_{2-6}alkenyloxy, aryloxy, benzyloxy, haloC_{1-6}alkoxy, haloC_{2-6}alkenyloxy, haloaryloxy, nitro, nitroC_{1-6}alkyl, nitroC_{2-6}alkenyl, nitroC_{2-6}alkynyl, nitroaryl, nitroheterocyclyl, amino, C_{1-6}alkylamino, C_{1-6}dialkylamino, C_{2-6}alkenylamino, C_{2-6}alkynylamino, arylamino,

diarylamino, benzylamino, dibenzylamino, acyl, C_{2-6}alkenylacyl, C_{2-6}alkynylacyl, arylacyl, acylamino, diacylamino, acyloxy, alkylsulphonyloxy, arylsulphonyloxy, heterocyclyl, heterocyclyloxy, heterocyclylamino, haloheterocyclyl, alkylsulphonyl, arylsulphonyl, mercapto, C_{1-6}alkylthio, benzylthio, or acylthio.

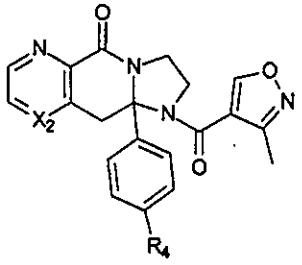
5. The compound according to claim 4 of formula (Ib-i) or salts thereof:



(Ib-i).

6. The compound according to claim 4, racemates, stereoisomers and/or salts thereof wherein R_4 is selected from the group consisting of C_{1-3}alkyl, haloC_{1-3}alkyl, halogen and C_{1-3}alkoxy.

7. The compound according to claim 1 of formula (Ic), racemates, stereoisomers and/or salts thereof:



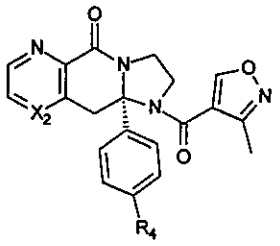
(Ic)

wherein

R_4 is C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, aryl, halogen, halo C_{1-6}alkyl , haloC_{2-6}alkenyl, haloC_{2-6}alkynyl, haloaryl, hydroxyl, C_{1-6}alkylhydroxy, C_{1-6}alkoxy, -OC_{1-6}alkylhydroxy, -OC_{1-6}alkylC_{1-6}alkoxy, C_{2-6}alkenyloxy, aryloxy, benzyloxy, haloC_{1-6}alkoxy, haloC_{2-6}alkenyloxy, haloaryloxy, nitro, nitroC_{1-6}alkyl, nitroC_{2-6}alkenyl, nitroC_{2-6}alkynyl, nitroaryl, nitroheterocyclyl, amino, C_{1-6}alkylamino, C_{1-6}dialkylamino, C_{2-6}alkenylamino, C_{2-6}alkynylamino, arylamino, diarylamino, benzylamino, dibenzylamino, acyl, C_{2-6}alkenylacyl, C_{2-6}alkenylacyl, arylacyl,

acylamino, diacylamino, acyloxy, alkylsulphonyloxy, arylsulphonyloxy, heterocyclyl, heterocyclyloxy, heterocyclylamino, haloheterocyclyl, alkylsulphonyl, arylsulphonyl, mercapto, C_{1-6}alkylthio, benzylthio, or acylthio.

8. The compound according to claim 7 of formula (Ic-i) or salts thereof:



(Ic-i).

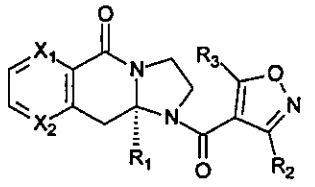
9. The compound according to claim 7, wherein R_4 is C_{1-3}alkyl, halo C_{1-3}alkyl, halogen or C_{1-3}alkoxy.

10. The compound according to claim 1, racemates, stereoisomers and/or salts thereof wherein R_1 is selected from a 3-10 membered carbocyclic ring; a 9-10 membered fused bicyclic carbocyclic ring; a 5-6 membered monocyclic heterocyclic ring; a 9-10 membered fused bicyclic heterocyclic ring; a 6-membered aromatic ring; a substituted 3-10 membered carbocyclic ring; a substituted 9-10 membered fused bicyclic carbocyclic ring; a substituted 5-6 membered monocyclic heterocyclic ring; a substituted 9-10 membered fused bicyclic heterocyclic ring; and a substituted 6-membered aromatic ring.

11. The compound according to claim 10, racemates, stereoisomers and/or salts thereof wherein R_1 is selected from a C_6cycloalkyl, phenyl, a 5-6 membered monocyclic heterocyclic ring, a 9-membered fused bicyclic heterocyclic ring, a substituted C_6cycloalkyl, a substituted phenyl, a substituted 5-6 membered monocyclic heterocyclic ring, and a substituted 9-membered fused bicyclic heterocyclic ring.

12. The compound according to claim 1 in a single stereoisomeric form.

13. The compound according to claim 12 of formula (I-i) or salts thereof:



(I-i).

14. The compound according to claim 12 or salts thereof selected from the group consisting of:

(10aS)-10a-(4-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10- ,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

(10aS)-10a-(4-fluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10- ,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one; and

(10aS)-10a-(4-fluoro-3-methylphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbony- l]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one.

15. The compound according to claim 1, racemates, stereoisomers and/or salts thereof wherein R_3 is H.

16. The compound according to claim 1, racemates, stereoisomers and/or salts thereof selected from the group consisting of:

10a-(4-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a- tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4-methoxyphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4-fluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-te- trahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4-fluoro-3-methylphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,- 10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(3,4-difluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10- a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(2-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-te- trahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-cyclohexyl-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahyd- roimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4,4-difluorocyclohexyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,1- 0,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4-chlorophenyl)-1-{[3-(trifluoromethyl)-1,2-oxazol-4-yl]carbonyl}-2,- 3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

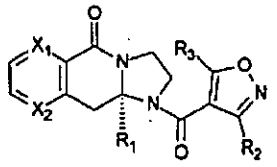
10a-(2,3-dihydro-1-benzofuran-5-yl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one.

17. The compound according to claim 1, wherein R_1 is a 5-6 membered heterocyclic ring containing nitrogen and/or oxygen.

18. A pharmaceutical composition comprising the compound, racemate, stereoisomer and/or salt thereof as defined in claim 1 and a pharmaceutically acceptable carrier.

19. The pharmaceutical composition of claim 18, wherein the compound is in a single stereoisomeric form.

20. The pharmaceutical composition of claim 19, wherein the single stereoisomeric form is represented by:



(I-i).

21. The pharmaceutical composition of claim 18, wherein the compound, racemate, stereoisomer and/or salt thereof is selected from the group consisting of:

10a-(4-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-y)carbonyl]-2,3,10,10a- tetrahydroimidazo [2,1-g] [1,7]naphthyridin-5(1H)-one;

10a-(4-methoxyphenyl)-1-[(3-methyl-1,2-oxazol-4-y)carbonyl]-2,3,10,10a- tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4-fluorophenyl)-1-[(3-methyl-1,2-oxazol-4-y)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4-fluoro-3-methylphenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo [2,1-g] [1,7]naphthyridin-5(1H)-one;

10a-(3,4-difluorophenyl)-1-[(3-methyl-1,2-oxazol-4-yl)carbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(2-chlorophenyl)-1-[(3-methyl-1,2-oxazol-4-yOcarbonyl]-2,3,10,10a- tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-cyclohexyl-1-[(3-methyl-1,2-oxazol-4-ypcarbonyl]-2,3,10,10a- tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

10a-(4,4-difluorocyclohexyl)-1-[(3-methyl-1,2-oxazol-4-ypcarbonyl]-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one;

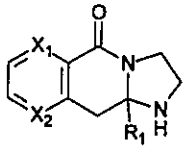
10a-(4-chlorophenyl)-1- { [3-(trifluoromethyl)-1,2-oxazol-4-yl]carbony11-2,3,10,10a-tetrahydroimidazo[2,1-g][1,7]naphthyridin-5(1H)-one; and

10a-(2,3-dihydro-l-benzofuran-5-yl)-1- [(3-methyl-1,2-oxazol-4-yl)carbonyl]- 2,3,10,10a-tetrahydroimidazo [2,1-g] [1,7]naphthyridin-5(1H)-one.

22. The pharmaceutical composition of claim 21, wherein the compound is in a single stereoisomeric form.

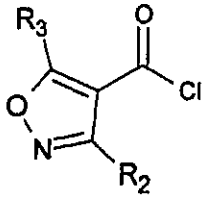
23. The pharmaceutical composition of claim 18, formulated as a liquid or powder for intranasal administration; or a tablet or capsule for oral administration; or a liquid for intravenous administration.

24. A process for preparing the compound of formula (I) according to claim 1, racemates, stereoisomers and/or salts thereof comprising the step of reacting a compound of formula (II):



(II)

with a compound of formula (III):



(III)