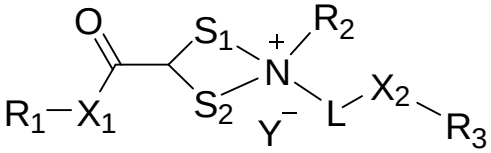
CLAIMS

1. A cyclic quaternary ammonium salt compound represented by formula (I), or a stereoisomer or solvate thereof:



(I)

wherein:

R_1 is selected from the group consisting of aryl and heteroaryl, alternatively, R_1, together with X_1, form non-condensed or condensed azacycloalkyl;

R_2 is selected from the group consisting of C_{1-8} alkyl and C_{3-12} cycloalkyl;

R_3 is selected from the group consisting of aryl, heteroaryl, and heterocycloalkyl, alternatively, R_3, together with X_2, form condensed azacycloalkyl;

X_1 is selected from the group consisting of O, S, and NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, alternatively, R_4^A and the N it is attached to, together with R_1, form non-condensed or condensed azacycloalkyl;

X_2 is selected from the group consisting of O, S, and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, alternatively, R_4^B and the N it is attached to, together with R_3, form condensed azacycloalkyl;

L is selected from C_{1-8} alkylene;

S_1 and S_2 are each independently selected from the group consisting of a bond and C_{1-6} alkylene, with the provision that S_1 and S_2 are not both bonds; and

Y^- represents a pharmaceutically acceptable anion.

2. The compound according to claim 1, wherein:

R_1 is selected from the group consisting of aryl and heteroaryl, alternatively, R_1, together with X_1, form non-condensed or condensed azacycloalkyl; wherein the aryl, the heteroaryl, the non-condensed azacycloalkyl or the condensed azacycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, cyano, halogen, hydroxyl, amino, nitro, ester, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, and a combination thereof; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

R_2 is selected from the group consisting of C_{1-8} alkyl and C_{3-12} cycloalkyl, wherein the C_{1-8} alkyl or C_{3-12} cycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, and a combination thereof; and/or

R_3 is selected from the group consisting of aryl, heteroaryl, and heterocycloalkyl, alternatively, R_3, together with X_2, form condensed azacycloalkyl; wherein the aryl, the heteroaryl, the heterocycloalkyl, or the condensed azacycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy C_{1-4} alkyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, ester, nitro, sulfonyl, thiol, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, optionally substituted aryl, optionally substituted heteroaryl, optionally substituted heterocycloalkyl, and a combination thereof; wherein the optionally substituted aryl, the optionally substituted heteroaryl, and the optionally substituted heterocycloalkyl refer to unsubstituted aryl, unsubstituted heteroaryl, and unsubstituted heterocycloalkyl, or are substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, ester, nitro, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

X_1 is selected from the group consisting of O, S, and NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl,

and C_{1-4} alkoxy C_{1-4} alkyl, alternatively, R_4^A and the N it is attached to, together with R_1, form non-condensed or condensed azacycloalkyl; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

X_2 is selected from the group consisting of O, S, and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, alternatively, R_4^B and the N it is attached to, together with R_3, form condensed azacycloalkyl; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

L is selected from C_{1-8} alkylene; wherein the C_{1-8} alkylene is optionally substituted by a group selected from the group consisting of C_{1-4} alkyl, C_{1-4} alkoxy, C_{1-4} haloalkyl, C_{1-4} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxy, cyano, amino, ester, nitro, mono-C_{1-4} alkylamino, di-C_{1-4} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; and/or

S_1 and S_2 are each independently selected from the group consisting of a bond and C_{1-6} alkylene, with the provision that S_1 and S_2 are not both bonds, wherein the C_{1-6} alkylene optionally contains, on the main chain, one heteroatom selected from the group consisting of O, S, and NR_5, wherein R_5 is hydrogen or deuterium.

3. The compound according to claim 1, wherein R_1 is phenyl or naphthyl; wherein the phenyl or naphthyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, cyano, halogen, hydroxyl, amino, nitro, ester, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, and a combination thereof; or

R_1 is phenyl, and the phenyl is optionally substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, and a combination thereof; or

R_1 is selected from the group consisting of phenyl, 2-methylphenyl, 2-methoxyphenyl, 4-methylphenyl, 4-methoxyphenyl, 4-fluorophenyl,

4-trifluoromethylphenyl, 2-chlorophenyl, 4-chlorophenyl, 2-bromophenyl, 3-bromophenyl, 4-bromophenyl, 3-hydroxyphenyl, 2,6-dimethylphenyl, 2,6-dimethoxyphenyl, 3-nitrophenyl, 2,6-difluorophenyl, 3-chloro-2-methylphenyl, 2,3-dichlorophenyl, 4-hydroxyphenyl, 2,4,6-trimethylphenyl, 2,4,6-trimethoxyphenyl, and 2,4,6-trifluorophenyl, preferably 2,6-dimethylphenyl;

alternatively,

R_1 is phenyl or naphthyl; the phenyl or naphthyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, cyano, halogen, hydroxyl, amino, nitro, ester, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, and a combination thereof; or

R_1 is phenyl, and the phenyl is optionally substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, and a combination thereof; or

R_1 is selected from the group consisting of phenyl, 2-methylphenyl, 2-methoxyphenyl, 4-methylphenyl, 4-methoxyphenyl, 4-fluorophenyl, 4-trifluoromethylphenyl, 2-chlorophenyl, 4-chlorophenyl, 2-bromophenyl, 3-bromophenyl, 4-bromophenyl, 3-hydroxyphenyl, 2,6-dimethylphenyl, 2,6-diethylphenyl, 2,6-dimethoxyphenyl, 3-nitrophenyl, 2,6-difluorophenyl, 2,6-dibromophenyl, 3-chloro-2-methylphenyl, 2,3-dichlorophenyl, 4-hydroxyphenyl, 2,4,6-trimethylphenyl, 2,4,6-trimethoxyphenyl, and 2,4,6-trifluorophenyl, preferably the group consisting of 2-methylphenyl, 4-fluorophenyl, 2,6-dibromophenyl, 2,6-diethylphenyl, and 2,6-dimethylphenyl, more preferably 2,6-dimethylphenyl.

4. The compound according to claim 1, wherein R_2 is selected from the group consisting of C_{1-8} alkyl and C_{3-8} cycloalkyl; wherein the C_{1-8} alkyl or C_{3-8} cycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, and a combination thereof; or

R_2 is selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, n-pentyl, isopentyl, n-hexyl, cyclopropyl, cyclobutyl, cyclopropylmethyl, cyclobutylmethyl, cyclopentylmethyl, n-octyl, and n-heptyl, preferably the group consisting of ethyl, n-propyl, n-butyl, n-pentyl, n-hexyl, n-octyl, and n-heptyl, more preferably n-butyl;

alternatively,

R_2 is selected from the group consisting of C_{1-8} alkyl and C_{3-8} cycloalkyl; wherein the C_{1-8} alkyl or C_{3-8} cycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, and a combination thereof; or

R_2 is selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, isobutyl, tert-butyl, n-pentyl, isopentyl, 4-methylpentyl, n-hexyl, cyclopropyl, cyclobutyl, cyclopropylmethyl, cyclobutylmethyl, cyclopentylmethyl, n-octyl, and n-heptyl, preferably the group consisting of ethyl, n-propyl, n-butyl, isobutyl, n-pentyl, 4-methylpentyl, n-hexyl, n-octyl, and n-heptyl, more preferably the group consisting of n-butyl, isobutyl, and 4-methylpentyl, and particularly preferably n-butyl.

5. The compound according to claim 1, wherein R_3 is selected from the group consisting of aryl, heteroaryl, and three-membered to eight-membered heterocycloalkyl, alternatively, R_3, together with X_2, form condensed azacycloalkyl; wherein the aryl, the heteroaryl, the three-membered to eight-membered heterocycloalkyl, or the condensed azacycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy C_{1-4} alkyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, ester, nitro, sulfonyl, thiol, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, optionally substituted phenyl, and a combination thereof; wherein the optionally substituted phenyl refers to unsubstituted phenyl, or is substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6}

haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxy, cyano, amino, ester, nitro, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; the condensed azacycloalkyl is condensed with phenyl or heteroaryl; or

R_3 is selected from the group consisting of phenyl, 4-fluorobenzyl, 2-methylphenyl, 2-methoxyphenyl, 2-fluorophenyl, 2-chlorophenyl, 2-bromophenyl, 2-hydroxyphenyl, 3-methylphenyl, 3-methoxyphenyl, 3-fluorophenyl, 3-chlorophenyl, 3-bromophenyl, 3-hydroxyphenyl, 4-methylphenyl, 4-methoxyphenyl, 4-fluorophenyl, 4-chlorophenyl, 4-bromophenyl, 4-hydroxyphenyl, 4-trifluoromethylphenyl, 2,4-dimethylphenyl, 2,4-dimethoxyphenyl, 2,4-difluorophenyl, 2,4-dichlorophenyl, 2,4-dihydroxyphenyl, 2,6-dimethylphenyl, 2,6-dimethoxyphenyl, 2,6-difluorophenyl, 2,6-dichlorophenyl, 2,6-dihydroxyphenyl, 2,4,6-trimethylphenyl, 2,4,6-trimethoxyphenyl, 2,4,6-trifluorophenyl, 2-amino-5-fluorophenyl, 2-isopropyl-5-methylphenyl, 4-cyanophenyl, 4-ethoxycarbonylphenyl, 2,6-di-tert-butyl-4-methylphenyl, 4-nitrophenyl, and 4-sulfonylphenyl; alternatively, R_3, together with X_2, form condensed piperidinyl, condensed piperazinyl, or condensed pyrrolidinyl, wherein the condensed piperidinyl, the condensed piperazinyl, or the condensed pyrrolidinyl is condensed with a group selected from the group consisting of phenyl, thienyl, furanyl, pyrrolyl, thiazolyl, isothiazolyl, imidazolyl, triazolyl, pyridinyl, and pyrimidinyl; and the condensed piperidinyl, the condensed piperazinyl or the condensed pyrrolidinyl is optionally substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, phenyl, substituted phenyl, and a combination thereof; or

R_3 is selected from the group consisting of phenyl, 2-methylphenyl, 3-methylphenyl, 4-methylphenyl, 4-fluorophenyl, 2-amino-5-fluorophenyl, 2-isopropyl-5-methylphenyl, 4-cyanophenyl, 4-ethoxycarbonylphenyl, 2,6-di-tert-butyl-4-methylphenyl, 4-nitrophenyl, 4-sulfonylphenyl, and 4-hydroxyphenyl; alternatively, R_3, together with X_2, form imidazopiperazinyl, thienopiperazinyl, or pyrrolopiperazinyl; optionally, the imidazopiperazinyl,

thienopiperazinyl, or pyrrolopiperazinyl is substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, phenyl, and a combination thereof;

alternatively,

R_3 is selected from the group consisting of aryl, heteroaryl, and three-membered to eight-membered heterocycloalkyl, alternatively, R_3, together with X_2, form condensed azacycloalkyl; wherein the aryl, the heteroaryl, the three-membered to eight-membered heterocycloalkyl, or the condensed azacycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy C_{1-4} alkyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, C_{1-6} alkanoyl, ester, nitro, sulfonyl, thiol, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, optionally substituted phenyl, and a combination thereof; optionally, adjacent substituents, together with the atoms they are attached to, form a ring; wherein the optionally substituted phenyl refers to unsubstituted phenyl, or is substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxy, cyano, amino, ester, nitro, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; the condensed azacycloalkyl is condensed with phenyl or heteroaryl; or

R_3 is selected from the group consisting of phenyl, 4-fluorobenzyl, 2-methylphenyl, 2-methoxyphenyl, 2-fluorophenyl, 2-chlorophenyl, 2-bromophenyl, 2-hydroxyphenyl, 3-methylphenyl, 3-methoxyphenyl, 3-fluorophenyl, 3-chlorophenyl, 3-bromophenyl, 3-hydroxyphenyl, 3-cyanophenyl, 3-trifluoromethylphenyl, 4-methylphenyl, 4-methoxyphenyl, 4-fluorophenyl, 4-chlorophenyl, 4-bromophenyl, 4-hydroxyphenyl, 4-trifluoromethylphenyl, 2,4-dimethylphenyl, 2,4-dimethoxyphenyl, 2,4-difluorophenyl, 2,4-dichlorophenyl, 2,4-dihydroxyphenyl, 3,4-difluorophenyl, 3,4-dichlorophenyl, 3,5-difluorophenyl, 2,6-dimethylphenyl, 2,6-dimethoxyphenyl, 2,6-difluorophenyl, 2,6-dichlorophenyl, 2,6-dihydroxyphenyl, 2,4,6-trimethylphenyl,

2,4,6-trimethoxyphenyl, 2,4,6-trifluorophenyl, 2-amino-5-fluorophenyl, 2-isopropyl-5-methylphenyl, 4-cyanophenyl, 4-ethoxycarbonylphenyl, 2,6-di-tert-butyl-4-methylphenyl, 4-nitrophenyl, 4-sulfonylphenyl, 2,2-dimethyl-2,3-dihydrobenzofuran-7-yl, naphthyl, and 6-acetylnaphth-2-yl; alternatively, R_3, together with X_2, form condensed piperidinyl, condensed piperazinyl, or condensed pyrrolidinyl, wherein the condensed piperidinyl, the condensed piperazinyl, or the condensed pyrrolidinyl is condensed with a group selected from the group consisting of phenyl, thienyl, furanyl, pyrrolyl, thiazolyl, isothiazolyl, imidazolyl, triazolyl, pyridinyl, and pyrimidinyl; and the condensed piperidinyl, the condensed piperazinyl or the condensed pyrrolidinyl is optionally substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, phenyl, substituted phenyl, and a combination thereof; or

R_3 is selected from the group consisting of phenyl, 2-methylphenyl, 3-methylphenyl, 4-methylphenyl, 4-fluorophenyl, 3-cyanophenyl, 3-trifluoromethylphenyl, 3,4-difluorophenyl, 3,4-dichlorophenyl, 3,5-difluorophenyl, 2-amino-5-fluorophenyl, 2-isopropyl-5-methylphenyl, 4-cyanophenyl, 4-ethoxycarbonylphenyl, 2,6-di-tert-butyl-4-methylphenyl, 4-nitrophenyl, 4-sulfonylphenyl, 4-hydroxyphenyl, 2,2-dimethyl-2,3-dihydrobenzofuran-7-yl, and 6-acetylnaphth-2-yl; alternatively, R_3, together with X_2, form imidazopiperazinyl, thienopiperazinyl, or pyrrolopiperazinyl; optionally, the imidazopiperazinyl, thienopiperazinyl, or pyrrolopiperazinyl is substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, phenyl, and a combination thereof.

6. The compound according to claim 1, wherein L is selected from the group consisting of C_{3-6} alkylene; wherein the C_{3-6} alkylene is optionally substituted by a group selected from the group consisting of C_{1-4} alkyl, C_{1-4} alkoxy, C_{1-4} haloalkyl, C_{1-4} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, ester, nitro, mono-C_{1-4}

alkylamino, di-C_{1-4} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; or

L is selected from the group consisting of $-(CH_2)_3-$, $-(CH_2)_4-$, $-(CH_2)_5-$, $-(CH_2)_6-$, and $-(CH_2)_2CHCH_3(CH_2)_2-$, preferably $-(CH_2)_4-$ or $-(CH_2)_5-$;

alternatively,

L is selected from C_{3-6} alkylene, with the provision that L is not C_3 alkylene; wherein the C_{3-6} alkylene is optionally substituted by a group selected from the group consisting of C_{1-4} alkyl, C_{1-4} alkoxy, C_{1-4} haloalkyl, C_{1-4} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, ester, nitro, mono-C_{1-4} alkylamino, di-C_{1-4} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; or

L is selected from the group consisting of $-(CH_2)_4-$, $-(CH_2)_5-$, $-(CH_2)_6-$, and $-(CH_2)_2CHCH_3(CH_2)_2-$, preferably $-(CH_2)_4-$ or $-(CH_2)_5-$.

7. The compound according to claim 1, wherein L is not C_3 alkylene.

8. The compound according to claim 1, wherein:

R_1 is selected from the group consisting of aryl and heteroaryl, alternatively, R_1, together with X_1, form non-condensed or condensed azacycloalkyl; wherein the aryl, the heteroaryl, the non-condensed azacycloalkyl or the condensed azacycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, cyano, halogen, hydroxyl, amino, nitro, ester, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, and a combination thereof; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

R_2 is selected from the group consisting of C_{1-8} alkyl and C_{3-12} cycloalkyl, wherein the C_{1-8} alkyl or C_{3-12} cycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, and a combination thereof; and/or

R_3 is selected from the group consisting of aryl, heteroaryl, and heterocycloalkyl,

alternatively, R_3, together with X_2, form condensed azacycloalkyl; wherein the aryl, the heteroaryl, the heterocycloalkyl, or the condensed azacycloalkyl is optionally substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy C_{1-4} alkyl, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, C_{1-6} alkanoyl, ester, nitro, sulfonyl, thiol, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, optionally substituted aryl, optionally substituted heteroaryl, optionally substituted heterocycloalkyl, and a combination thereof; optionally, adjacent substituents, together with the atoms they are attached to, form a ring; wherein the optionally substituted aryl, the optionally substituted heteroaryl, and the optionally substituted heterocycloalkyl refer to unsubstituted aryl, unsubstituted heteroaryl, and unsubstituted heterocycloalkyl, or are substituted by a group selected from the group consisting of C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, halogen, hydroxyl, cyano, amino, C_{1-6} alkanoyl, ester, nitro, mono-C_{1-6} alkylamino, di-C_{1-6} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

X_1 is selected from the group consisting of O, S, and NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, alternatively, R_4^A and the N it is attached to, together with R_1, form non-condensed or condensed azacycloalkyl; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

X_2 is selected from the group consisting of O, S, and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, alternatively, R_4^B and the N it is attached to, together with R_3, form condensed azacycloalkyl; the condensed azacycloalkyl is condensed by aryl or heteroaryl; and/or

L is selected from C_{1-8} alkylene, with the provision that L is not C_3 alkylene; wherein the C_{1-8} alkylene is optionally substituted by a group selected from the group consisting of C_{1-4} alkyl, C_{1-4} alkoxy, C_{1-4} haloalkyl, C_{1-4} haloalkoxy, C_{3-6} cycloalkyl,

halogen, hydroxy, cyano, amino, ester, nitro, mono-C_{1-4} alkylamino, di-C_{1-4} alkylamino, C_{2-4} alkenyl, C_{2-4} alkynyl, and a combination thereof; and/or

S_1 and S_2 are each independently selected from the group consisting of a bond and C_{1-6} alkylene, with the provision that S_1 and S_2 are not both bonds, wherein the C_{1-6} alkylene optionally contains, on the main chain, one heteroatom selected from the group consisting of O, S, and NR_5, wherein R_5 is hydrogen or deuterium.

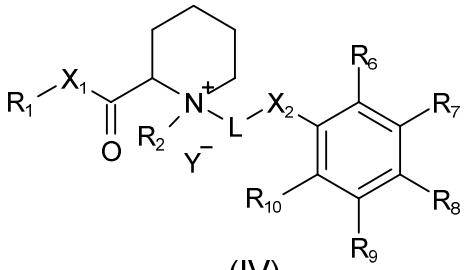
9. The compound according to claim 1, wherein X_1 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, preferably, X_1 is NH; or

X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, alternatively, X_2, together with R_3, form condensed piperidinyl, condensed piperazinyl or condensed pyrrolidinyl, wherein the condensed piperidinyl, the condensed piperazinyl or the condensed pyrrolidinyl is condensed with a group selected from the group consisting of phenyl, thienyl, furanyl, pyrrolyl, thiazolyl, isothiazolyl, imidazolyl, triazolyl, pyridinyl, and pyrimidinyl; and the condensed piperidinyl, the condensed piperazinyl or the condensed pyrrolidinyl is optionally substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, phenyl, substituted phenyl, and a combination thereof; preferably, X_2 is O or NH, alternatively, X_2, together with R_3, form imidazopiperazinyl, thienopiperazinyl, or pyrrolopiperazinyl; optionally, the imidazopiperazinyl, thienopiperazinyl, or pyrrolopiperazinyl is substituted by a group selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, fluorine, chlorine, bromine, iodine, hydroxyl, amino, nitro, carbomethoxy, carboethoxy, phenyl, and a combination thereof; or

when one of S_1 and S_2 is a bond, the other is selected from the group consisting of $-(CH_2)_2-$, $-(CH_2)_3-$, $-(CH_2)_4-$, $-(CH_2)_5-$, and $-(CH_2)_6-$; or

Y^- is selected from the group consisting of a halogen anion, sulfate, acetate, tartrate, p-toluenesulfonate, methanesulfonate, and citrate, preferably the group consisting of Cl^-, Br^-, and CH_3COO^-; more preferably Br^-.

10. The compound according to any one of claims 1, 2 and 9, wherein the compound represented by formula (I) is a compound represented by formula (IV):



(IV)

wherein X_1 is NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_1 is NH;

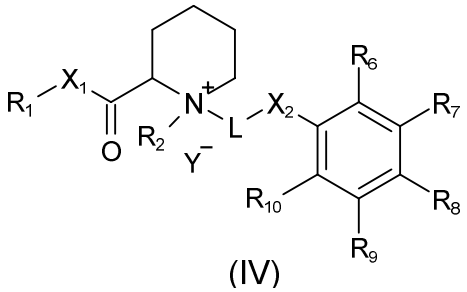
X_2 is selected from the group consisting of O, S and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl; preferably X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, more preferably X_2 is O or NH;

R_6, R_7, R_8, R_9, and R_{10} are each independently selected from the group consisting of hydrogen, fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester, C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxyC_{1-4} alkyl;

R_1, R_2, L and Y^- are as defined in formula (I) according to any one of claims 1, 2

and 9.

11. The compound according to claim 7 or 8, wherein the compound represented by formula (I) is a compound represented by formula (IV):



(IV)

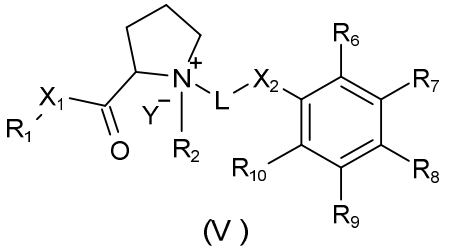
wherein X_1 is NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_1 is NH;

X_2 is selected from the group consisting of O, S and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl; preferably X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, more preferably X_2 is O or NH;

R_6, R_7, R_8, R_9, and R_{10} are each independently selected from the group consisting of hydrogen, fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester, C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxy C_{1-4} alkyl, and optionally, adjacent substituents, together with the atoms they are attached to, form a ring;

R_1, R_2, L and Y^- are as defined in formula (I) according to claim 7 or 8.

12. The compound according to any one of claims 1, 2 and 9, wherein the compound represented by formula (I) is a compound represented by formula (V):



(V)

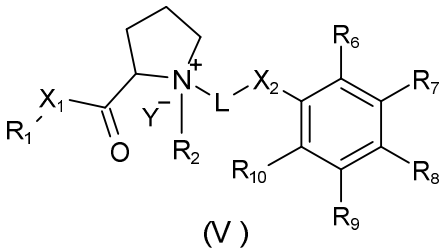
wherein X_1 is NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_1 is NH;

X_2 is selected from the group consisting of O, S and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, more preferably X_2 is O or NH;

R_6, R_7, R_8, R_9, and R_{10} are each independently selected from the group consisting of hydrogen, fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester, C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxy C_{1-4} alkyl;

R_1, R_2, L and Y^- are as defined in formula (I) according to any one of claims 1, 2 and 9.

13. The compound according to claim 7 or 8, wherein the compound represented by formula (I) is a compound represented by formula (V):



(V)

wherein X_1 is NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_1 is NH;

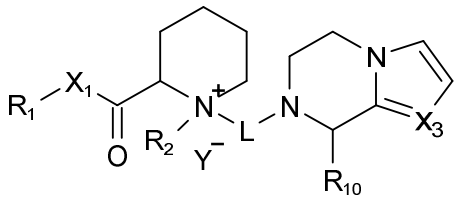
X_2 is selected from the group consisting of O, S and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, more preferably X_2 is O or NH;

R_6, R_7, R_8, R_9, and R_{10} are each independently selected from the group consisting of hydrogen, fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester,

C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxy C_{1-4} alkyl, and optionally, adjacent substituents, together with the atoms they are attached to, form a ring;

R_1, R_2, L and Y^- are as defined in formula (I) according to claim 7 or 8.

14. The compound according to any one of claims 1 to 9, wherein the compound represented by formula (I) is a compound represented by formula (VI):



(VI)

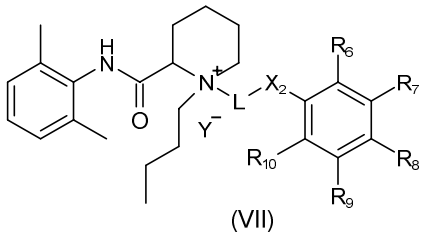
wherein X_1 is NR_4^A, wherein R_4^A is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_1 is NH;

X_3 is C or N;

R_{10} is selected from the group consisting of hydrogen, C_{1-4} alkyl, C_{1-4} alkoxy, C_{1-4} alkoxy C_{1-4} alkyl, and aryl, wherein the aryl is optionally substituted by a group selected from the group consisting of fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester, C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxy C_{1-4} alkyl;

R_1, R_2, L and Y^- are as defined in formula (I) according to any one of claims 1 to 9.

15. The compound according to any one of claims 1, 2 and 9, wherein the compound represented by formula (I) is a compound represented by formula (VII):



(VII)

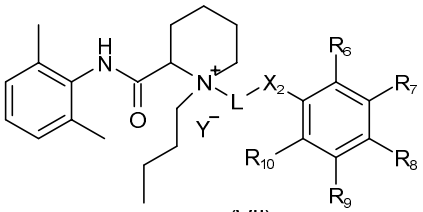
wherein X_2 is selected from the group consisting of O, S and NR_4^B, wherein R_4^B

is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, more preferably X_2 is O or NH;

R_6, R_7, R_8, R_9, and R_{10} are each independently selected from the group consisting of hydrogen, fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester, C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxy C_{1-4} alkyl;

L and Y^- are as defined in formula (I) according to any one of claims 1, 2 and 9.

16. The compound according to claim 7 or 8, wherein the compound represented by formula (I) is a compound represented by formula (VII):



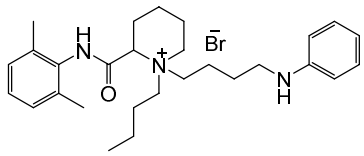
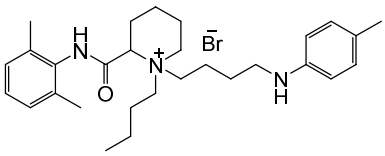
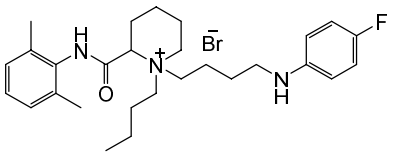
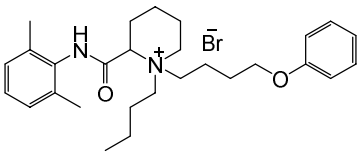
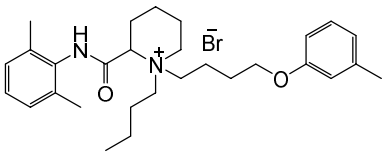
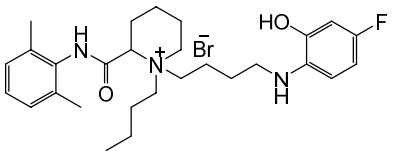
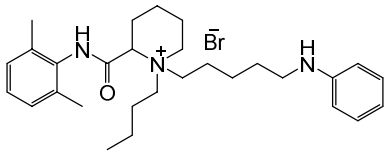
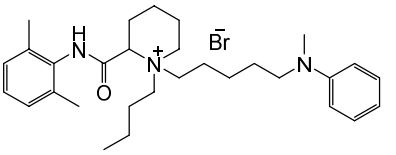
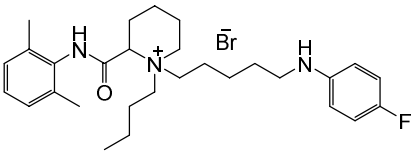
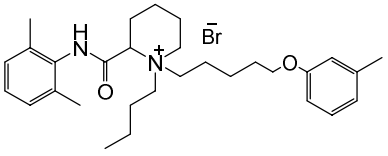
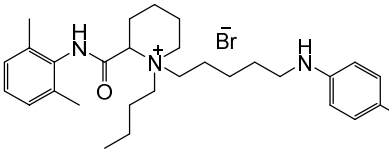
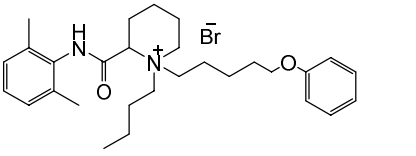
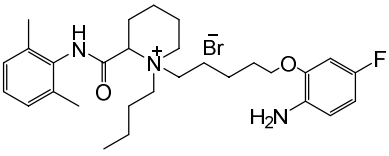
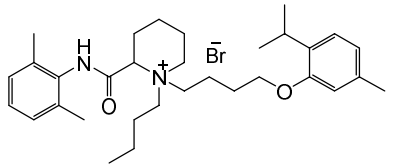
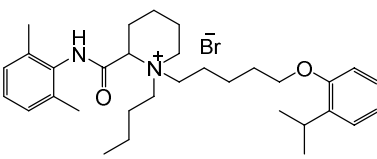
(VII)

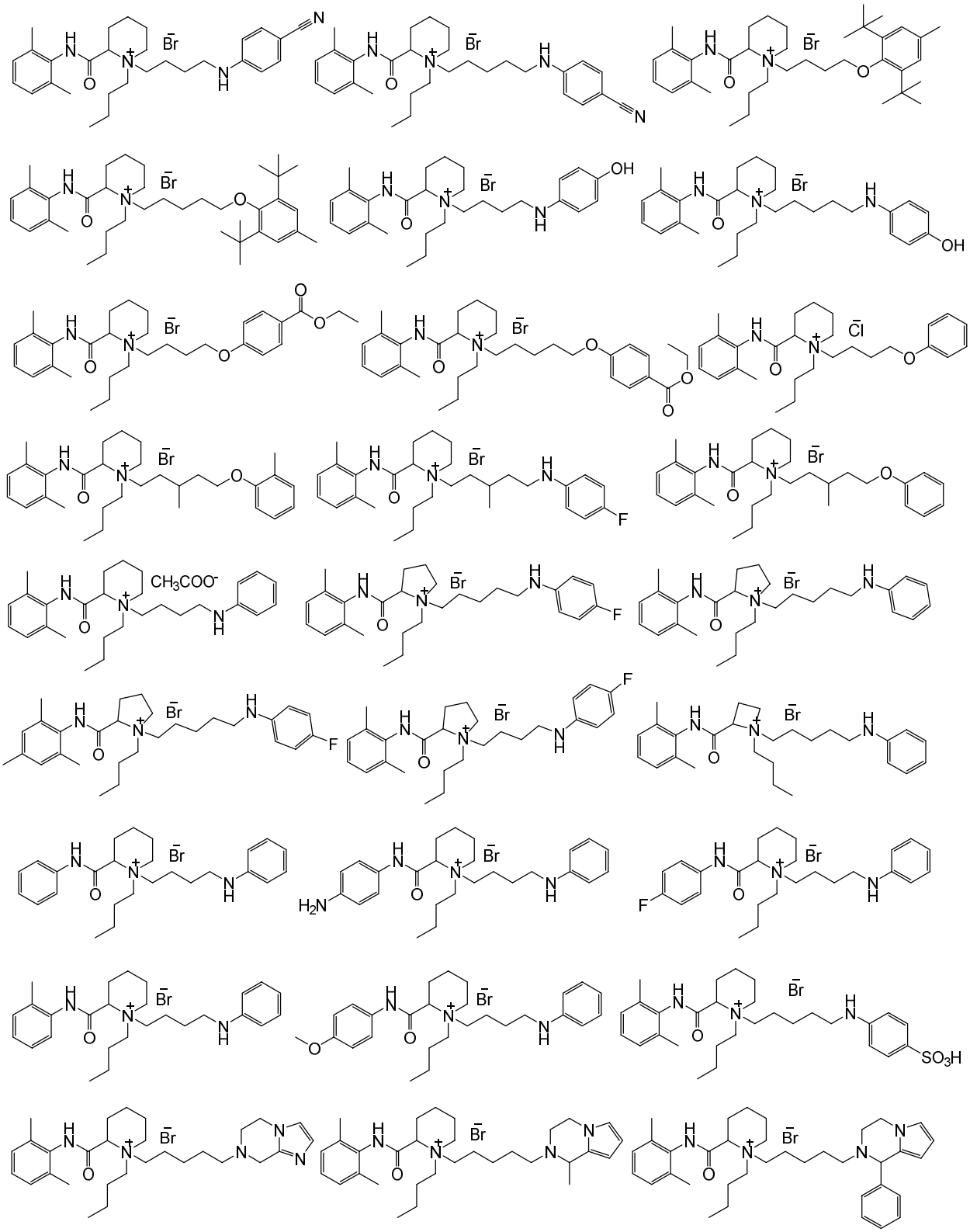
wherein X_2 is selected from the group consisting of O, S and NR_4^B, wherein R_4^B is selected from the group consisting of hydrogen, deuterium, C_{1-8} alkyl, C_{3-8} cycloalkyl, and C_{1-4} alkoxy C_{1-4} alkyl, preferably X_2 is selected from the group consisting of O, NH, NCH_3, NCH_2CH_3, and $N(CH_2)_2CH_3$, more preferably X_2 is O or NH;

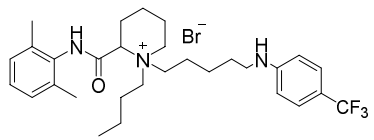
R_6, R_7, R_8, R_9, and R_{10} are each independently selected from the group consisting of hydrogen, fluorine, chlorine, bromine, iodine, hydroxyl, cyano, nitro, amino, ester, C_{1-4} alkyl, C_{1-4} alkoxy, and C_{1-4} alkoxy C_{1-4} alkyl, and optionally, adjacent substituents, together with the atoms they are attached to, form a ring;

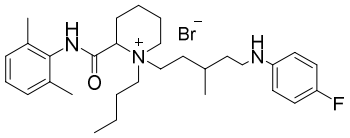
L and Y^- are as defined in formula (I) according to claim 7 or 8.

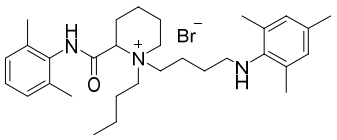
17. The compound according to claim 1, which is selected from the group consisting of:

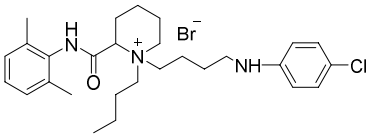
















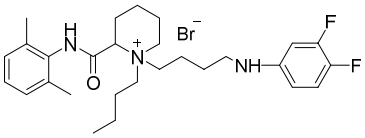


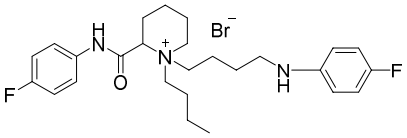


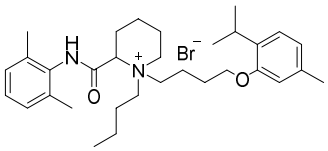


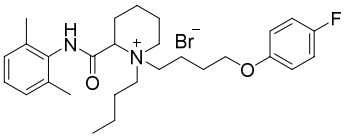


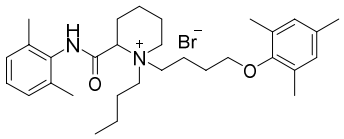


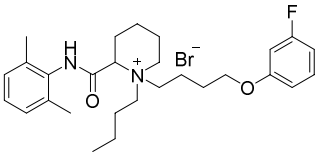


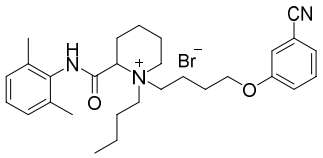


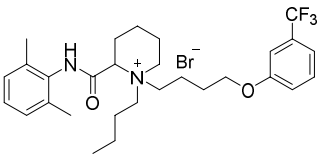


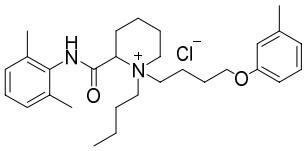


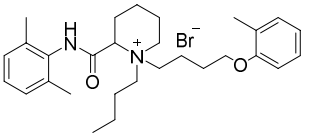


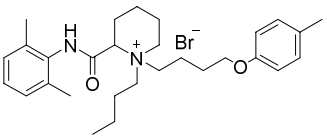


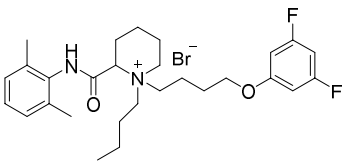


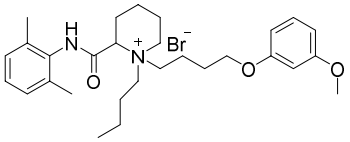


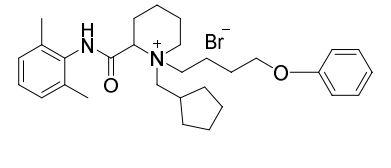


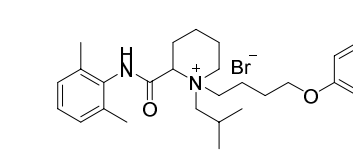


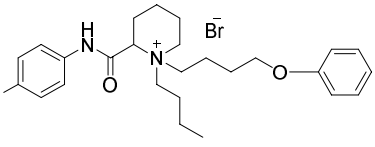


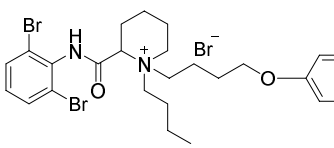


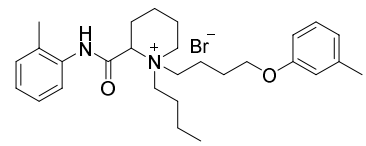


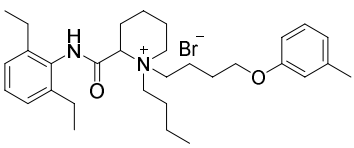


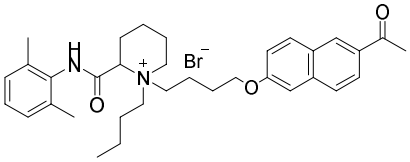


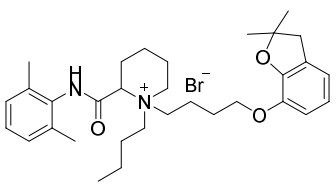




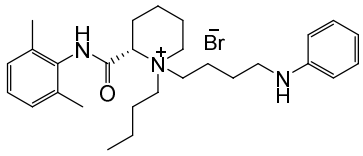
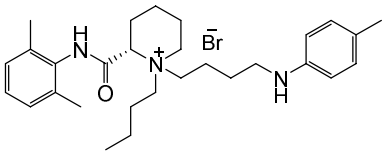
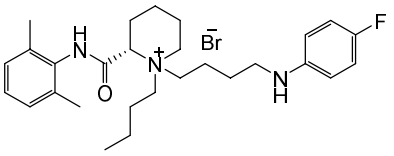
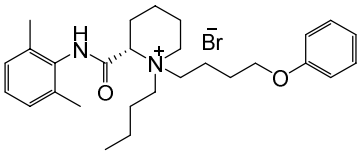
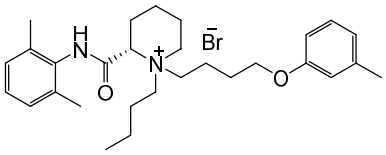
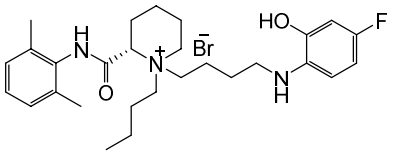
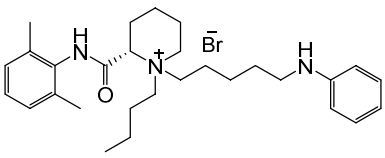
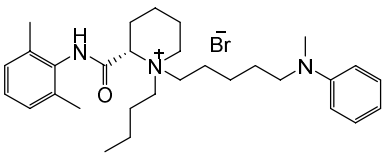
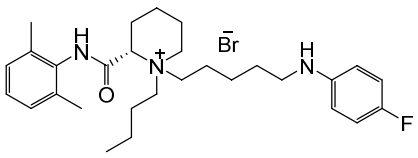
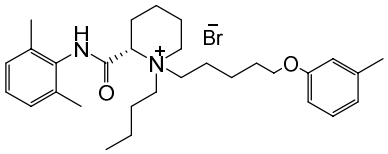
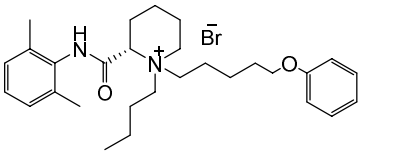
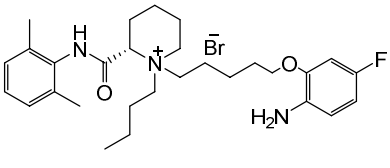
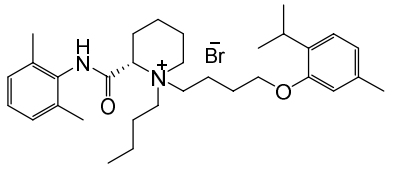
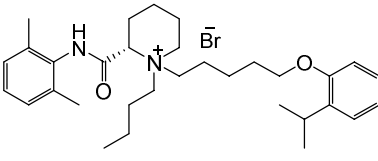


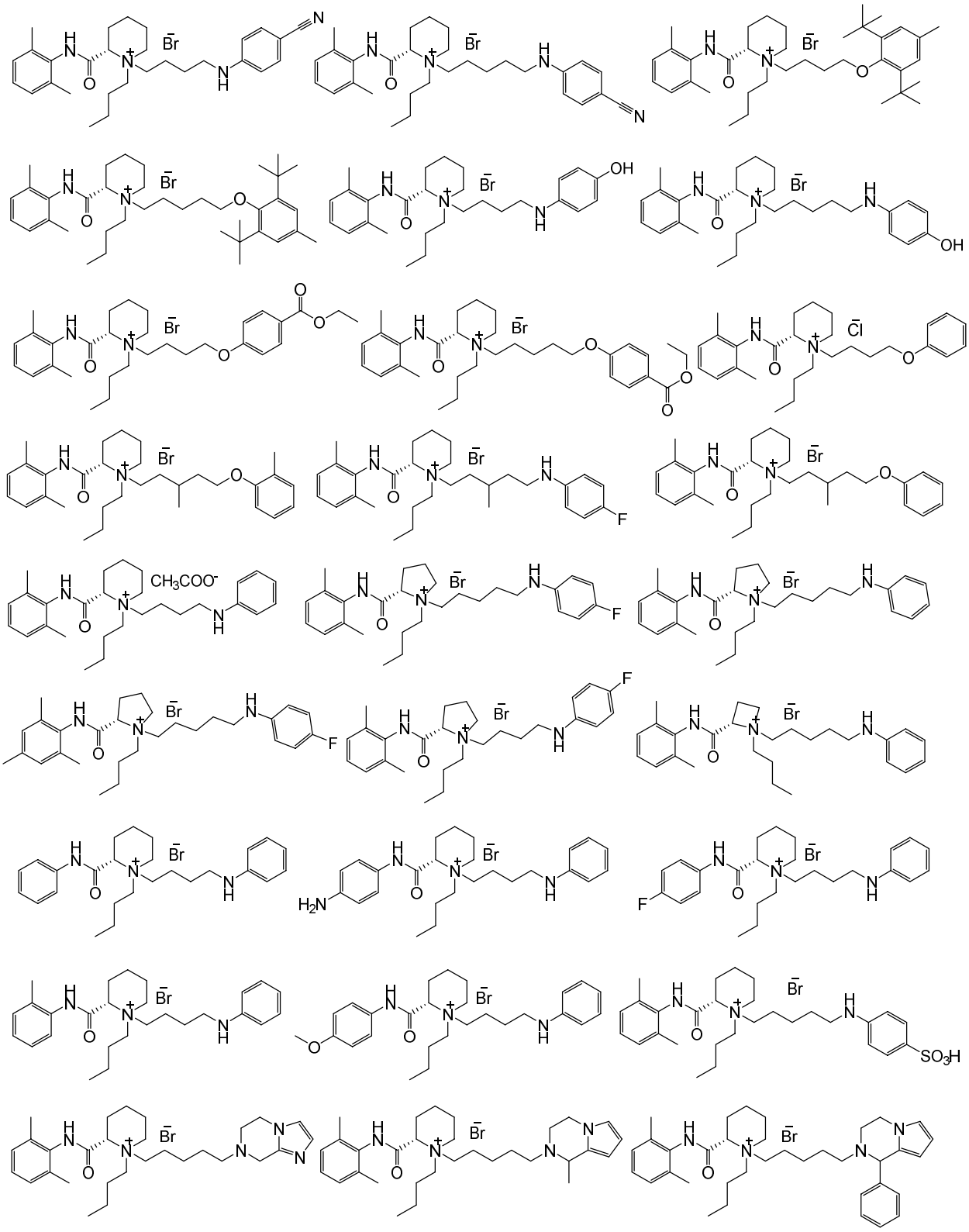


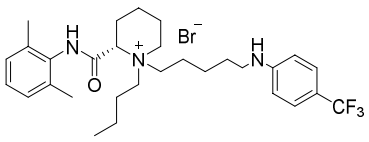




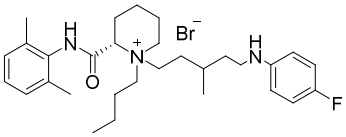
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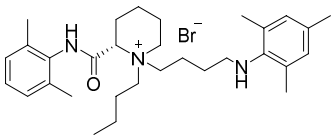




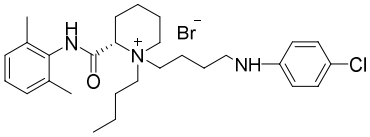
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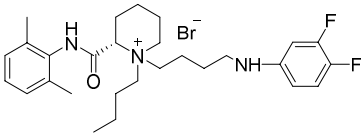
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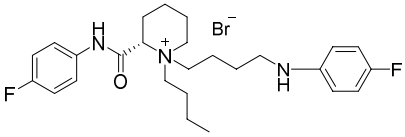
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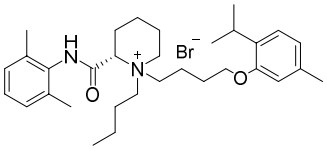
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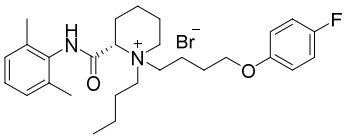
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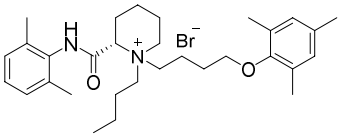
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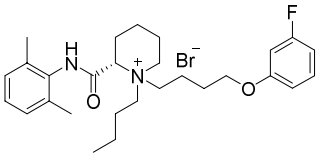
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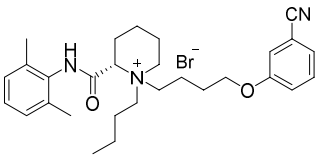
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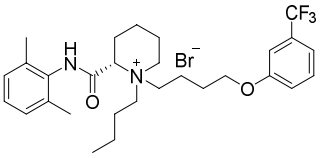
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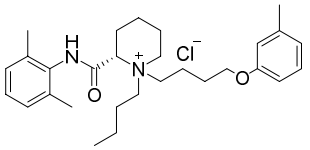
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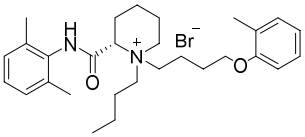
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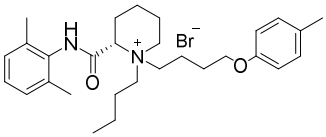
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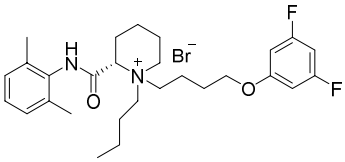
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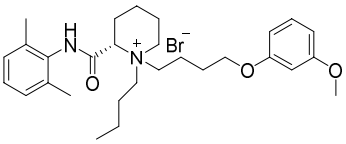
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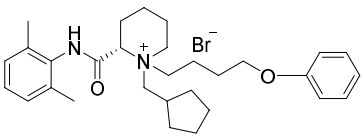
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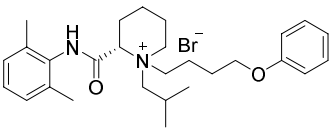
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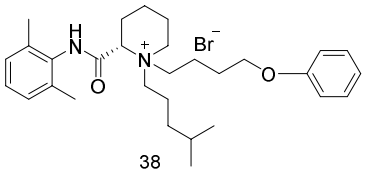
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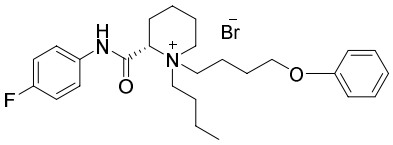
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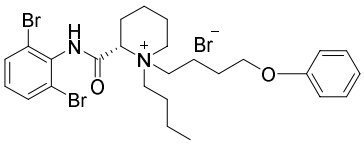
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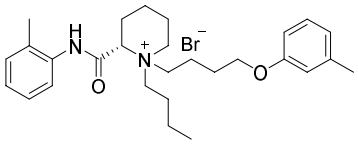
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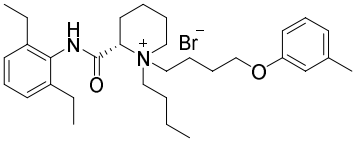
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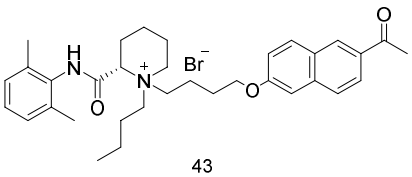
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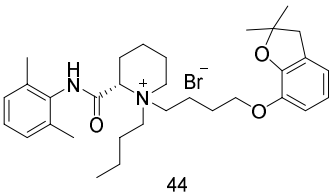
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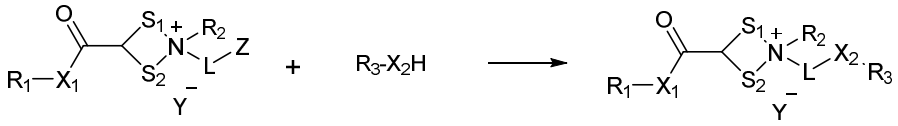
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18. A method for producing the compound according to claim 1 or the stereoisomer or solvate thereof, comprising:



(II) (III) (I)

reacting the compound represented by formula (II) with the compound represented by formula (III) to obtain the compound represented by formula (I);

wherein, Z in formula (II) is an electron-withdrawing leaving group, and the groups in formula (II) and formula (III) are defined as in formula (I).

19. A pharmaceutical composition comprising the compound according to any one of claims 1 to 17 or the stereoisomer or solvate thereof and a pharmaceutically acceptable carrier, excipient or diluent.

20. Use of the compound according to any one of claims 1 to 17 or the stereoisomer or solvate thereof or the pharmaceutical composition according to claim 19 in the manufacture of a medicament for local anesthesia or analgesia; preferably, wherein the local anesthesia is selected from the group consisting of conduction

anesthesia, surface anesthesia, and infiltration anesthesia; and the analgesia is suitable for pain selected from the group consisting of chronic pain, acute pain, inflammatory pain, cancer pain, neuropathic pain, musculoskeletal pain, primary pain, intestinal pain, and idiopathic pain;

preferably, wherein the medicament is to be administered topically via transdermal, subcutaneous, intradermal, intramuscular, near nerves, intrapulpal, intraspinal, epidural, intravenous, or mucosal routes such as eye drops.