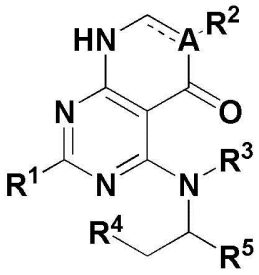
CLAIMS:

1. A compound represented by formula 1, an optical isomer thereof, or a pharmaceutically acceptable salt thereof:

[Formula 1]



In the formula 1,

---- is single bond or double bond;

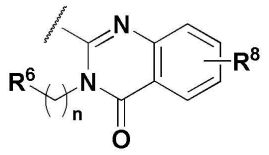
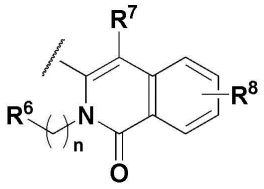
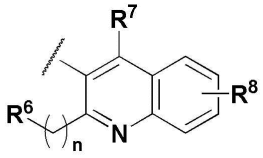
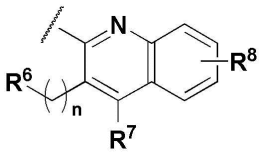
A is carbon (C) or nitrogen (N);

R^1 is hydrogen (H) or $-NH_2$;

R^2 is H, –CN, C_{1-5} straight or branched alkyl, unsubstituted C_{3-7} cycloalkyl or halogen;

R^3 and R^4 are independently H or C_{1-5} straight or branched alkyl; or

R^3 and R^4 can form 5 ~ 7 membered unsubstituted heterocycloalkyl containing one hetero atoms of N along with the atoms which are conjugated to the same; and

R^5 is , , , , or ;

wherein, n is an integer of 0 or 1,

R^6 is unsubstituted or substituted C_{6-8} aryl or unsubstituted or substituted 5 ~ 6 membered heteroaryl containing one or more hetero atoms selected from the group consisting of N, O, and S, wherein the substituted aryl and the substituted heteroaryl, can be independently substituted with one or more substituents selected from the group consisting of halogen, C_{1-5} straight or branched alkyl, and C_{1-5} straight or branched alkylsulfonyl,

R^7 and R^8 are independently H, halogen, -CN, unsubstituted or substituted C_{6-8} aryl, unsubstituted or substituted 5 ~ 6 membered heteroaryl containing one or more hetero atoms selected from the group consisting of N, O, and S, C_{1-5} straight or branched alkyl, C_{1-5} straight or branched alkoxy, or $-NR^9R^{10}$, wherein R^9 and R^{10} are independently H, C_{1-5} straight or branched alkyl, C_{1-5} straight or branched alkylamino,

unsubstituted or substituted C_{6-8} aryl, unsubstituted or substituted 5 ~ 6 membered heteroaryl containing one or more hetero atoms selected from the group consisting of N, O, and S, or unsubstituted or substituted 3 ~ 6 membered heterocycloalkyl containing one or more hetero atoms selected from the group consisting of N, O, and S, wherein the substituted C_{6-8} aryl, the substituted 5 ~ 6 membered heteroaryl, and the substituted 3 ~ 6 membered heterocycloalkyl can be independently substituted with one or more substituents selected from the group consisting of halogen and C_{1-5} straight or branched alkyl.

2. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein:

---- is single bond or double bond;

A is carbon (C) or nitrogen (N);

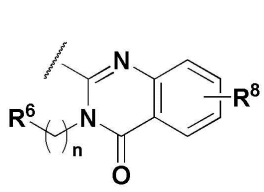
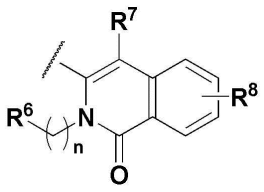
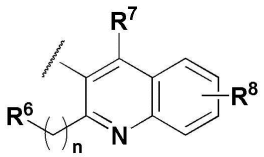
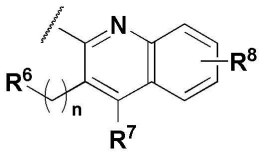
R^1 is H or $-NH_2$;

R^2 is H, $-CN$, C_{1-3} straight or branched alkyl, unsubstituted C_{3-5} cycloalkyl or halogen;

R^3 and R^4 are independently H or C_{1-5} straight or branched alkyl; or

R^3 and R^4 can form 5 ~ 7 membered unsubstituted heterocycloalkyl containing one or more hetero atoms

of N along with the atoms which are conjugated to the same; and

R^5 is , , ,  or ;

wherein, n is an integer of 0 or 1,

R^6 is unsubstituted or substituted C_{6-8} aryl or unsubstituted or substituted 5 ~ 6 membered heteroaryl containing one or more hetero atoms selected from the group consisting of N, O, and S, wherein the substituted aryl and the substituted heteroaryl can be independently substituted with one or more substituents selected from the group consisting of halogen and C_{1-5} straight or branched alkyl,

R^7 is H, halogen, unsubstituted or substituted C_{6-8} aryl, or unsubstituted or substituted 5 ~ 6 membered heteroaryl containing one or more hetero atoms selected from the group consisting of N, O, and S, wherein the substituted aryl and the substituted heteroaryl can be independently substituted with one or more substituents selected from the group

consisting of halogen and C_{1-5} straight or branched alkyl, and

R^8 is H, halogen, C_{1-3} straight or branched alkyl, or C_{1-3} straight or branched alkoxy.

3. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein:

---- is single bond or double bond;

A is carbon (C) or nitrogen (N);

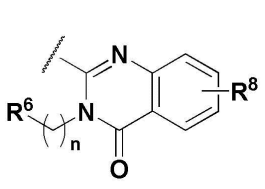
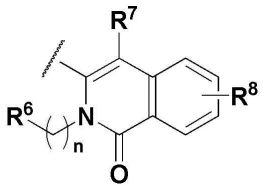
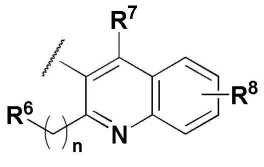
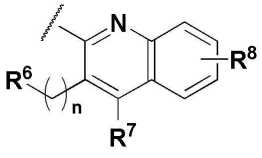
R^1 is H or $-NH_2$;

R^2 is H, –CN, C_{1-3} straight or branched alkyl, C_{3-5} cycloalkyl or halogen;

R^3 is H;

R^4 is H or C_{1-3} straight or branched alkyl; or

R^3 and R^4 can form 5 ~ 7 membered unsubstituted heterocycloalkyl containing one atom of N along with the atoms which are conjugated to the same; and

R^5 is , , ,  or ;

wherein, n is an integer of 0 or 1,

R^6 is unsubstituted or substituted phenyl or pyridinyl,

the substituted phenyl and pyridinyl can be independently substituted with one or more substituents selected from the group consisting of halogen and C_{1-3} straight or branched alkyl;

R^7 is H, halogen, or unsubstituted or substituted 5 ~ 6 membered heteroaryl containing one or more hetero atoms of N, wherein the substituted aryl and the substituted heteroaryl can be independently substituted with one or more substituents selected from the group consisting of halogen and C_{1-3} straight or branched alkyl, and

R^8 is H, halogen, or C_{1-3} straight or branched alkyl.

4. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein:

---- is single bond or double bond;

A is carbon (C) or nitrogen (N);

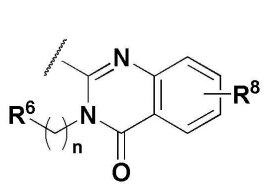
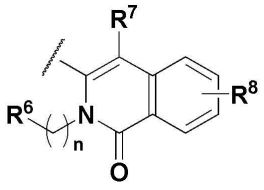
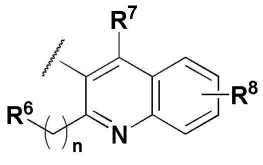
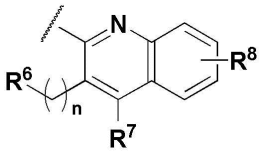
R^1 is H or $-NH_2$;

R^2 is H, -F, -Cl, -CN, methyl, ethyl, propyl, isopropyl, cyclopropyl, or cyclopentyl;

R^3 is H;

R^4 is H or methyl; or

R^3 and R^4 can form pyrrolidine along with the atoms which are conjugated to the same; and

R^5 is , , ,  or ;

wherein, n is an integer of 0 or 1,

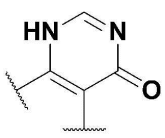
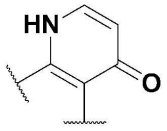
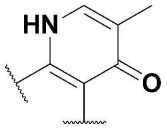
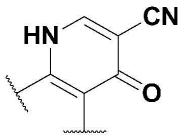
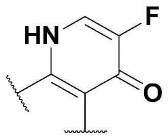
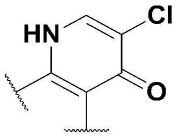
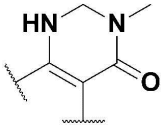
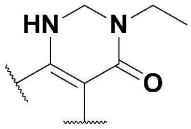
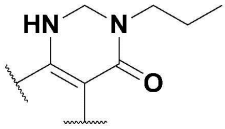
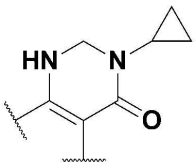
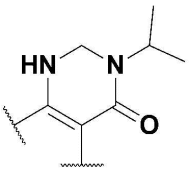
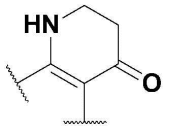
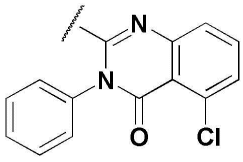
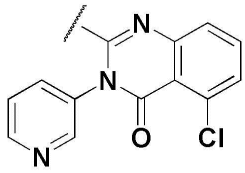
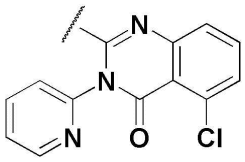
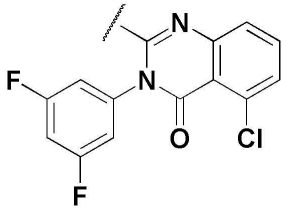
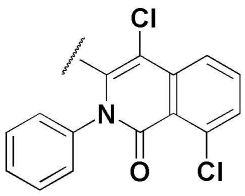
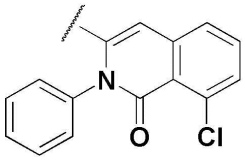
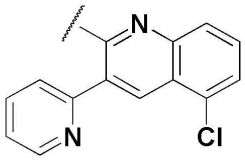
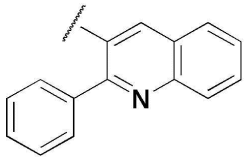
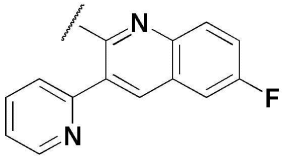
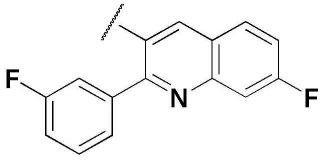
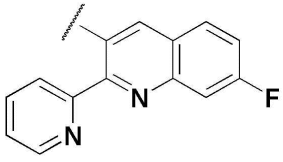
R^6 is unsubstituted or substituted phenyl or pyridinyl,

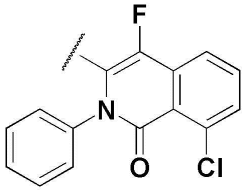
the substituted phenyl and pyridinyl can be independently substituted with one or more substituents selected from the group consisting of –F, –Cl, and methyl;

R^7 is H, –F, –Cl, or pyridinyl; and

R^8 is H, –F, or –Cl.

5. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein the ring containing A and R^2 is exemplified

by , , , , , , , , , , , ,  or , and R^5 is exemplified by , , , , , , , , , , ,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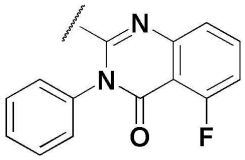
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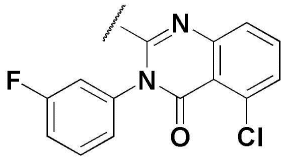
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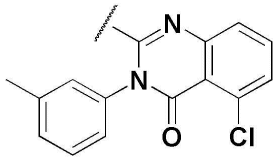
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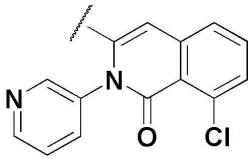
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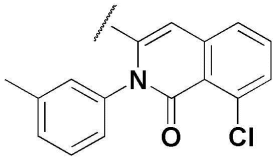
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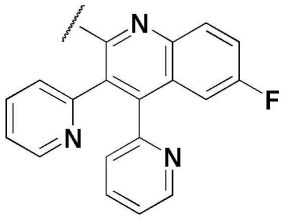
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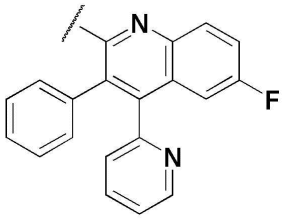
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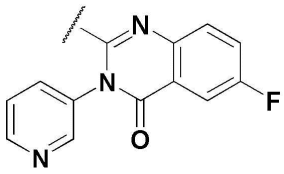
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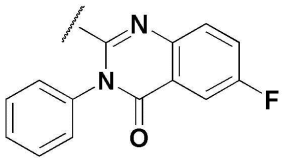
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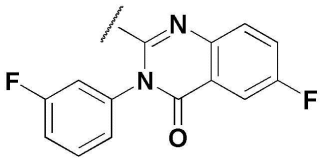
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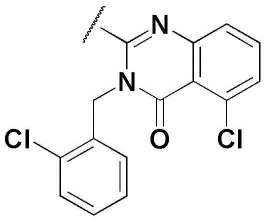
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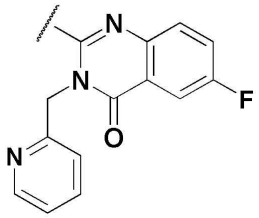
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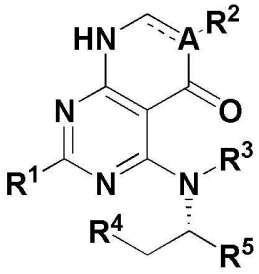
6. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein the compound represented by formula 1 is

characteristically the compound represented by formula 1A:

[Formula 1A]



In the formula 1A,

----, A, R^1, R^2, R^3, R^4, and R^5 are as defined in formula 1.

7. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein the compound represented by formula 1 is selected from the group consisting of the following compounds:

<1> 4-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<2> 4-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<3> 4-((1-(5-chloro-4-oxo-3-(pyridine-2-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<4> 4-((1-(5-chloro-3-(3,5-difluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<5> 4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<6> 4-((1-(2-phenylquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<7> 4-((1-(6-fluoro-3-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<8> 4-((1-(7-fluoro-2-(3-fluorophenyl)quinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<9> 4-(1-(7-fluoro-2-(pyridine-2-yl)quinoline-3-yl)ethylamino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<10> 4-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<11> 4-((1-(8-chloro-4-fluoro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<12> 4-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<13> 4-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrido[2,3-d]pyrimidine-5(8H)-one;

<14> 4-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrido[2,3-d]pyrimidine-5(8H)-one;

<15> 2-amino-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<16> 2-amino-4-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrido[2,3-d]pyrimidine-5(8H)-one;

<17> 4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-6-methylpyrido[2,3-d]pyrimidine-5(8H)-one;

<18> 2-amino-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-6-methylpyrido[2,3-d]pyrimidine-5(8H)-one;

<19> 4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-5-oxo-5,8-dihydropyrido[2,3-d]pyrimidine-6-carbonitrile;

<20> 4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-6-fluoropyrido[2,3-d]pyrimidine-5(8H)-one;

<21> 4-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)-6-fluoropyrido[2,3-d]pyrimidine-5(8H)-one;

<22> 6-chloro-4-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<23> 6-chloro-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<24> 6-chloro-4-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<25> 2-amino-4-((1-(6-fluoro-3-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<26> 4-((1-(6-fluoro-3,4-di(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<27> 4-((1-(6-fluoro-3-phenyl-4-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<28> 4-((1-(6-fluoro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<29> 4-((1-(6-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<30> 4-((1-(6-fluoro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<31> 4-((1-(5-chloro-3-(2-chlorobenzyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<32> 4-((1-(6-fluoro-4-oxo-3-(pyridine-2-ylmethyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<33> 4-((1-(5-chloro-3-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<34> 5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<35> 5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<36> 5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<37> 5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<38> 5-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<39> 3-methyl-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<40> 5-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<41> 5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<42> 5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<43> 5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<44> 5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<45> 5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<46> 5-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<48> 7-amino-5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<49> 7-amino-5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<50> 7-amino-5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<51> 7-amino-5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<52> 7-amino-5-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<53> 7-amino-3-methyl-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<54> 7-amino-5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<55> 7-amino-5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<56> 7-amino-5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<57> 7-amino-5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<58> 7-amino-5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<59> 7-amino-5-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<60> 5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-ethyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<61> 5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-propyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<62> 5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-cyclopropyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<63> 5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-cyclopentyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<64> 5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-isopropyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<65> 5-(1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propylamino)-3-isopropyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<66> 5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<67> 5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<68> 5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<69> 5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<70> 5-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<72> 5-((1-(2-phenylquinoline-3-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<73> 5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<74> 5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<75> 5-(2-(8-chloro-1-oxo-2-(pyridine-3-yl)-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<76> 5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<77> 5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<78> 5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<81> 7-amino-5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<82> 7-amino-5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<83> 7-amino-5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<84> 7-amino-5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<85> 7-amino-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<88> 7-amino-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<89> 7-amino-5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<90> 7-amino-5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<91> 7-amino-5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<92> 7-amino-5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<93> 7-amino-5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<94> 7-amino-5-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<97> 4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-7,8-dihydropyrido[2,3-d]pyrimidine-5(6H)-one; and

<98> 4-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-7,8-dihydropyrido[2,3-d]pyrimidine-5(6H)-one.

8. The compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof according to claim 1, wherein

the compound represented by formula 1 is selected from the group consisting of the following compounds:

<1> (S)-4-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<2> (S)-4-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<3> (S)-4-((1-(5-chloro-4-oxo-3-(pyridine-2-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<4> (S)-4-((1-(5-chloro-3-(3,5-difluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<5> (S)-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<6> (S)-4-((1-(2-phenylquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<7> (S)-4-((1-(6-fluoro-3-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<8> (S)-4-((1-(7-fluoro-2-(3-fluorophenyl)quinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<9> (S)-4-(1-(7-fluoro-2-(pyridine-2-yl)quinoline-3-yl)ethylamino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<10> (S)-4-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<11> (S)-4-((1-(8-chloro-4-fluoro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<12> (S)-4-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<13> (S)-4-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrido[2,3-d]pyrimidine-5(8H)-one;

<14> (S)-4-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrido[2,3-d]pyrimidine-5(8H)-one;

<15> (S)-2-amino-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<16> (S)-2-amino-4-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrido[2,3-d]pyrimidine-5(8H)-one;

<17> (S)-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-6-methylpyrido[2,3-d]pyrimidine-5(8H)-one;

<18> (S)-2-amino-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-6-methylpyrido[2,3-d]pyrimidine-5(8H)-one;

<19> (S)-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-5-oxo-5,8-dihydropyrido[2,3-d]pyrimidine-6-carbonitrile;

<20> (S)-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-6-fluoropyrido[2,3-d]pyrimidine-5(8H)-one;

<21> (S)-4-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)-6-fluoropyrido[2,3-d]pyrimidine-5(8H)-one;

<22> (S)-6-chloro-4-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<23> (S)-6-chloro-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<24> (S)-6-chloro-4-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<25> (S)-2-amino-4-((1-(6-fluoro-3-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<26> (S)-4-((1-(6-fluoro-3,4-di(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<27> (S)-4-((1-(6-fluoro-3-phenyl-4-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<28> (S)-4-((1-(6-fluoro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<29> (S)-4-((1-(6-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<30> (S)-4-((1-(6-fluoro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<31> (S)-4-((1-(5-chloro-3-(2-chlorobenzyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<32> (S)-4-((1-(6-fluoro-4-oxo-3-(pyridine-2-ylmethyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<33> (S)-4-((1-(5-chloro-3-(pyridine-2-yl)quinoline-2-yl)ethyl)amino)pyrido[2,3-d]pyrimidine-5(8H)-one;

<34> (S)-5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<35> (S)-5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<36> (S)-5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<37> (S)-5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<38> (S)-5-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<39> (S)-3-methyl-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<40> (S)-5-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<41> (S)-5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<42> (S)-5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<43> (S)-5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<44> (S)-5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<45> (S)-5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<46> (S)-5-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<48> (S)-7-amino-5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<49> (S)-7-amino-5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<50> (S)-7-amino-5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<51> (S)-7-amino-5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<52> (S)-7-amino-5-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<53> (S)-7-amino-3-methyl-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<54> (S)-7-amino-5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<55> (S)-7-amino-5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<56> (S)-7-amino-5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<57> (S)-7-amino-5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-

yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<58> (S)-7-amino-5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<59> (S)-7-amino-5-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)-3-methyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<60> (S)-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-ethyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<61> (S)-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-propyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<62> (S)-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-cyclopropyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<63> (S)-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-cyclopentyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<64> (S)-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)-3-isopropyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<65> (S)-5-(1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propylamino)-3-isopropyl-2,3-dihydropyrimido[4,5-d]pyrimidine-4(1H)-one;

<66> (S)-5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<67> (S)-5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<68> (S)-5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<69> (S)-5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<70> (S)-5-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<72> (S)-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<73> (S)-5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<74> (S)-5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<75> (S)-5-(2-(8-chloro-1-oxo-2-(pyridine-3-yl)-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<76> (S)-5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<77> (S)-5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<78> (S)-5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<81> (S)-7-amino-5-((1-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<82> (S)-7-amino-5-((1-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<83> (S)-7-amino-5-((1-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<84> (S)-7-amino-5-((1-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<85> (S)-7-amino-5-(1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethylamino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<88> (S)-7-amino-5-((1-(2-phenylquinoline-3-yl)ethyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<89> (S)-7-amino-5-((1-(5-fluoro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)propyl)amino)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<90> (S)-7-amino-5-(2-(5-chloro-4-oxo-3-phenyl-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<91> (S)-7-amino-5-(2-(5-chloro-4-oxo-3-(pyridine-3-yl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<92> (S)-7-amino-5-(2-(5-chloro-3-(3-fluorophenyl)-4-oxo-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<93> (S)-7-amino-5-(2-(5-chloro-4-oxo-3-(m-tolyl)-3,4-dihydroquinazoline-2-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

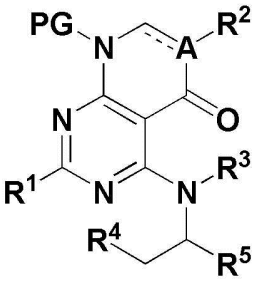
<94> (S)-7-amino-5-(2-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)pyrrolidine-1-yl)pyrimido[4,5-d]pyrimidine-4(1H)-one;

<97> (S)-4-((1-(8-chloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-7,8-dihydropyrido[2,3-d]pyrimidine-5(6H)-one; and

<98> (S)-4-((1-(4,8-dichloro-1-oxo-2-phenyl-1,2-dihydroisoquinoline-3-yl)ethyl)amino)-7,8-dihydropyrido[2,3-d]pyrimidine-5(6H)-one.

9. An intermediate compound represented by formula 1B below or an optical isomer of the same:

[Formula 1B]



In the formula 1B,

----, A, R^1, R^2, R^3, R^4, and R^5 are as defined in formula 1; and

PG is an amine protecting group selected from the group consisting of t-butyloxycarbonyl (Boc), carbobenzyloxy (Cbz), 9-fluorenylmethyloxycarbonyl (Fmoc), acetyl (Ac), benzoyl (Bz), benzyl (Bn), p-

methoxybenzyl (PMB), 3,4-dimethoxybenzyl (DMPM), p-methoxyphenyl (PMP), tosyl (Ts), 2,2,2-trichloroethoxycarbonyl (Troc), 2-trimethylsilylethoxycarbonyl (Teoc), and aryloxycarbonyl (Alloc).

10. A method for preparing the compound represented by formula 1 comprising the following steps as shown in the below reaction formula 1:

preparing the compound represented by formula 2A by reacting the compound represented by formula 2 and the compound represented by formula 3 (step 1);

preparing the compound represented by formula 5 by reacting the compound represented by formula 2A prepared in step 1 and the compound represented by formula 4 (step 2);

preparing the compound represented by formula 7 by reacting the compound represented by formula 5 prepared in step 2 and the compound represented by formula 6 (step 3);

preparing the compound represented by formula 8 by reacting the compound represented by formula 7 prepared in step 3 and the compound represented by formula 2B under basic condition (step 4);

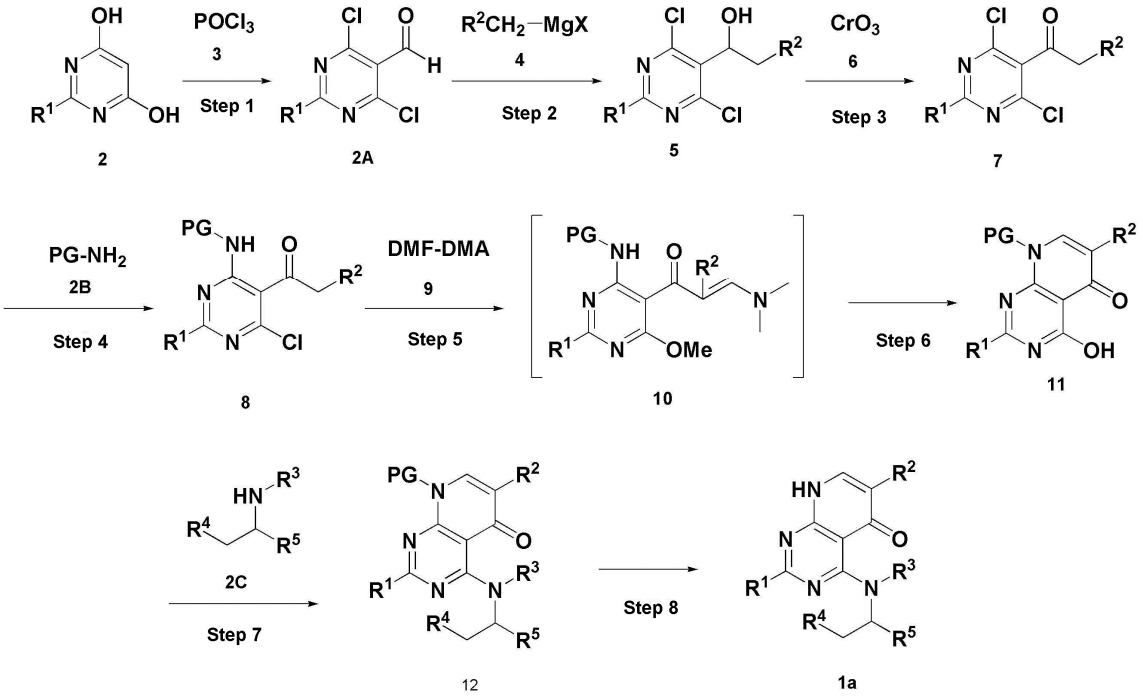
preparing the compound represented by formula 10 by reacting the compound represented by formula 8 prepared in step 4 and the compound represented by formula 9 (step 5);

preparing the compound represented by formula 11 by reacting the compound represented by formula 10 prepared in step 5 under acidic condition (step 6);

preparing the compound represented by formula 12 by reacting the compound represented by formula 11 prepared in step 6 and the compound represented by formula 2C (step 7); and

preparing the compound represented by formula 1a by eliminating the amine protecting group from the compound represented by formula 12 prepared in step 7 under acidic condition (step 8):

[Reaction Formula 1]



In the reaction formula 1,

PG is amine protecting group;

the compound represented by formula 1a is a derivative of the compound represented by formula 1, in which ---- is double bond and A is carbon, and R^1, R^2, R^3, R^4, and R^5 are as defined in formula 1.

11. A method for preparing the compound represented by formula 1 comprising the following steps as shown in the below reaction formula 2:

preparing the compound represented by formula 15 by reacting the compound represented by formula 2A and the compound represented by formula 14 (step 1);

preparing the compound represented by formula 17 by reacting the compound represented by formula 15 prepared in step 1 and the compound represented by formula 16 (step 2);

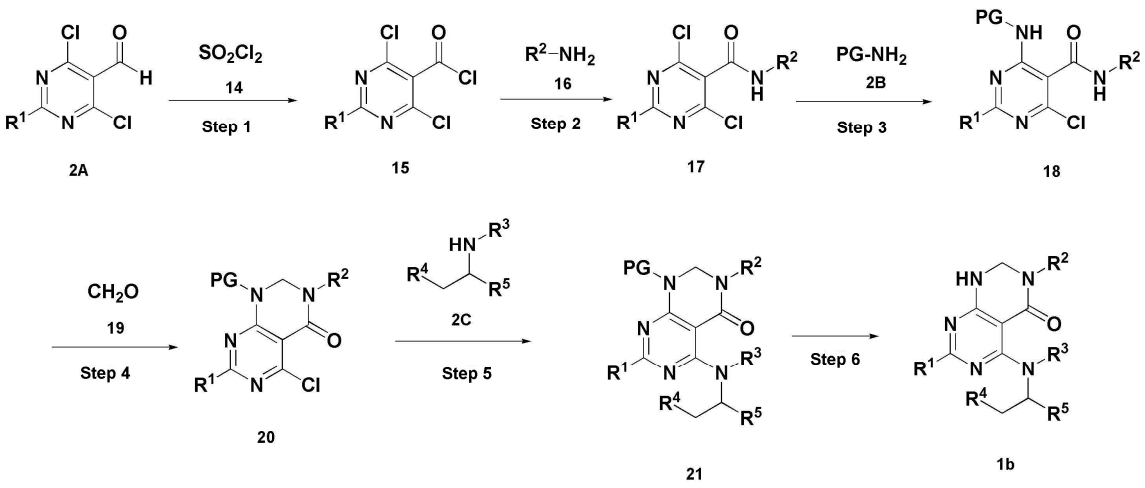
preparing the compound represented by formula 18 by reacting the compound represented by formula 17 prepared in step 2 and the compound represented by formula 2B (step 3);

preparing the compound represented by formula 20 by reacting the compound represented by formula 18 prepared in step 3 and the compound represented by formula 19 (step 4);

preparing the compound represented by formula 21 by reacting the compound represented by formula 20 prepared in step 4 and the compound represented by formula 2C under basic condition (step 5); and

preparing the compound represented by formula 1b by eliminating the amine protecting group from the compound represented by formula 21 prepared in step 5 under acidic condition (step 6):

[Reaction Formula 2]



In the reaction formula 2,

PG is amine protecting group;

the compound represented by formula 1b is a derivative of the compound represented by formula 1, in which ---- is single bond and A is nitrogen, and R^1, R^2, R^3, R^4, and R^5 are as defined in formula 1.

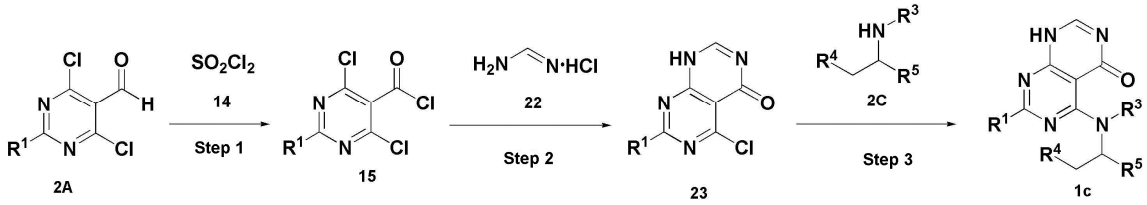
12. A method for preparing the compound represented by formula 1 comprising the following steps as shown in the below reaction formula 3:

preparing the compound represented by formula 15 by reacting the compound represented by formula 2A and the compound represented by formula 14 (step 1);

preparing the compound represented by formula 23 by reacting the compound represented by formula 15 prepared in step 1 and the compound represented by formula 22 (step 2); and

preparing the compound represented by formula 1c by reacting the compound represented by formula 23 prepared in step 2 and the compound represented by formula 2C under basic condition (step 3):

[Reaction Formula 3]



In the reaction formula 3,

the compound represented by formula 1c is a derivative of the compound represented by formula 1, in which ---- is double bond and A is nitrogen, and R^1, R^2, R^3, R^4, and R^5 are as defined in formula 1.

13. A pharmaceutical composition for the prevention or treatment of PI3 kinase related disease, which comprises the compound represented by formula 1, the optical isomer thereof, or the pharmaceutically acceptable salt thereof of claim 1 as an active ingredient, wherein the PI3 kinase related disease is selected from the group consisting of cancer; autoimmune disease; and respiratory disease selected from the group consisting of chronic obstructive

pulmonary disease(COPD), rhinitis, asthma, chronic bronchitis, chronic inflammatory lung disease, silicosis, pulmonary sarcoidosis, pleurisy, alveolitis, vasculitis, emphysema, pneumonia, and bronchiectasis.

14. The pharmaceutical composition for the prevention or treatment of PI3 kinase related disease according to claim 13, wherein the cancer is selected from the group consisting of hematological malignance, ovarian cancer, cervical cancer, breast cancer, colorectal cancer, liver cancer, stomach cancer, pancreatic cancer, colon cancer, peritoneal metastasis, skin cancer, bladder cancer, prostate cancer, thyroid cancer, lung cancer, osteosarcoma, fibrous tumor, and brain tumor.

15. The pharmaceutical composition for the prevention or treatment of PI3 kinase related disease according to claim 13, wherein the autoimmune disease is selected from the group consisting of rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, type 1 diabetes, hyperthyroidism, myasthenia, Crohn’s disease, ankylosing spondylitis,

psoriasis, autoimmune pernicious anemia, and Sjogren's syndrome.