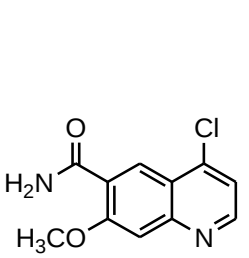
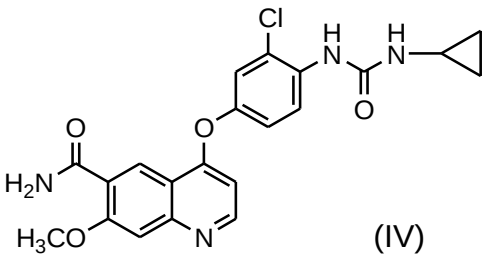
CLAIMS

1. A methanesulfonate salt of a compound represented by formula (IV), wherein the content of a compound represented by formula (A-1) is 60 ppm by mass or less



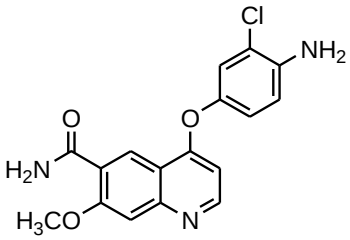
(A-1)



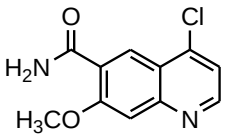
(IV)

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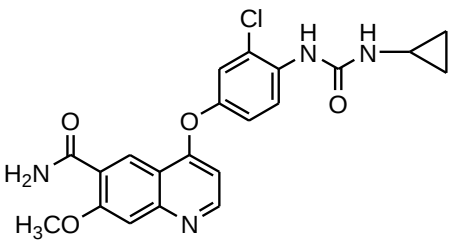
2. The methanesulfonate salt of a compound represented by formula (IV) according to claim 1, wherein the content of a compound represented by formula (I) is 183 ppm by mass or less, and the content of a compound represented by formula (A-1) is 60 ppm by mass or less



(I)



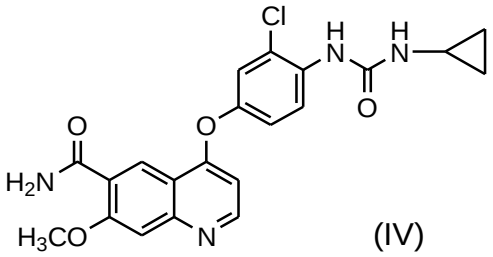
(A-1)



(IV)

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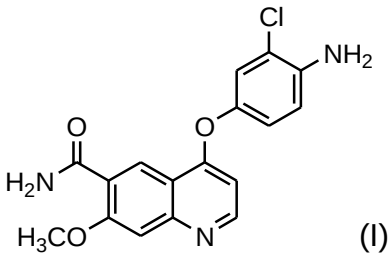
3. A method for producing a compound represented by formula (IV)



(IV)

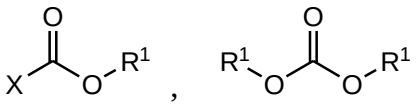
or a salt thereof, comprising:

a step B of allowing a compound represented by formula (I)



(I)

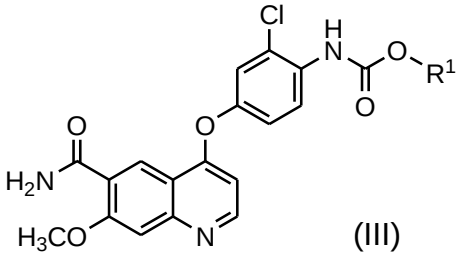
or a salt thereof to react with a compound represented by formula (II-A) or formula (II-B)



(II-A) (II-B)

wherein R^1 is a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a C_{6-10} aryl group, or a C_{7-11} aralkyl group, wherein the C_{1-6} alkyl group or the C_{2-6} alkenyl group may have one to three substituents that may be the same or different and are selected from the group consisting of a halogen atom and a methoxy group, and wherein the C_{6-10} aryl group or the C_{7-11} aralkyl group may have one to three substituents that may be the same or different and are selected from the group consisting of a halogen atom, a methyl group, a methoxy group, and a nitro group; and X is a halogen atom,

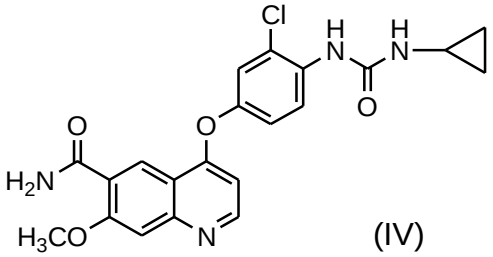
in the presence of a base to thereby obtain a compound represented by formula (III)



(III)

wherein R^1 is the same group as above, and

a step C of, after allowing the compound represented by formula (III) obtained in the step B to react without isolation with cyclopropylamine, precipitating and isolating a compound represented by formula (IV)

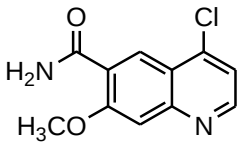


(IV)

or a salt thereof by introducing a hydrous organic solvent to a reaction solution.

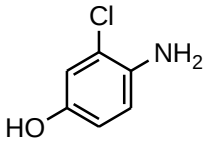
4. The method according to claim 3, comprising:

a step A of, after allowing a compound represented by formula (A-1)



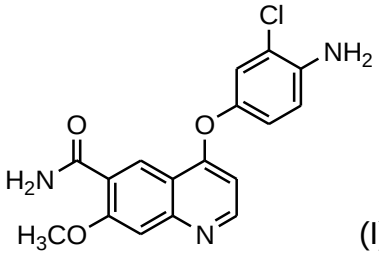
(A-1)

to react with a compound represented by formula (A-2)



(A-2)

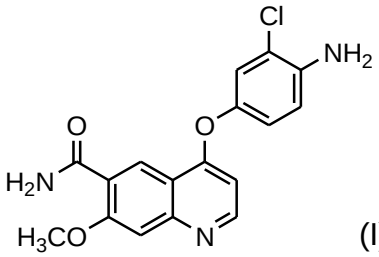
or a salt thereof in the presence of a base, precipitating and isolating a compound presented by formula (I)



(I)

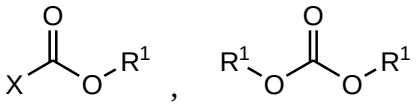
or a salt thereof from a reaction solution by introducing a hydrous organic solvent to the reaction solution,

a step B of allowing the compound represented by formula (I)



(I)

or a salt thereof obtained in the step A to react with a compound represented by formula (II-A) or formula (II-B)

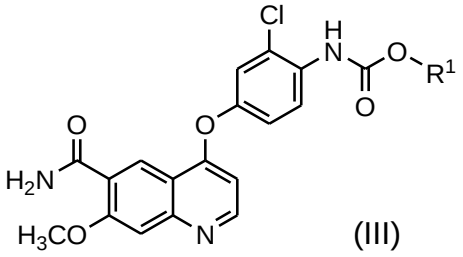


(II-A) (II-B)

wherein R^1 is a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a C_{6-10} aryl group, or a C_{7-11} aralkyl group, wherein the C_{1-6} alkyl group or the C_{2-6} alkenyl group may have one to three

substituents that may be the same or different and are selected from the group consisting of a halogen atom and a methoxy group, and wherein the C_{6-10} aryl group or the C_{7-11} aralkyl group may have one to three substituents that may be the same or different and are selected from the group consisting of a halogen atom, a methyl group, a methoxy group, and a nitro group; and X is a halogen atom,

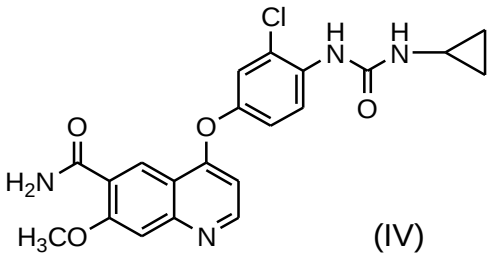
in the presence of a base to thereby obtain a compound represented by formula (III)



(III)

wherein R^1 is the same group as above, and

a step C of, after allowing the compound represented by formula (III) obtained in the step B to react without isolation with cyclopropylamine, precipitating and isolating a compound represented by formula (IV)



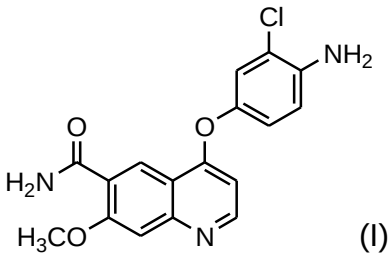
(IV)

or a salt thereof by introducing a hydrous organic solvent to a reaction solution.

5. The method according to claim 3, further comprising a step D of converting the compound represented by formula (IV) obtained in the step C into a salt of the compound represented by formula (IV).

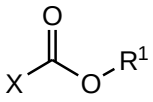
6. The method according to claim 5, wherein the salt obtained in the step D is a methanesulfonate.

7. The method according to claim 3, wherein the step B is a step of allowing the compound represented by formula (I)



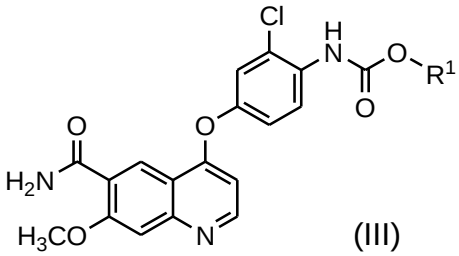
(I)

or a salt thereof to react with the compound represented by formula (II-A)



(II-A)

wherein R^1 is a C_{6-10} aryl group that may have one to three substituents that may be the same or different and are selected from the group consisting of a halogen atom, a methyl group, a methoxy group, and a nitro group; and X is a halogen atom,
in the presence of a base to thereby obtain a compound represented by formula(III)

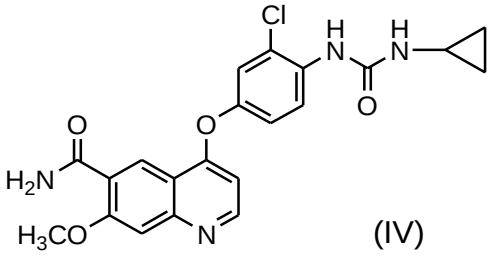


(III)

wherein R^1 is the same group as above.

8. The method according to claim 3, wherein the compound represented by formula (II-A) is phenyl chloroformate.

9. The methanesulfonate salt of a compound represented by formula (IV) according to claim 1, wherein the content of the methanesulfonate salt of a compound represented by formula (IV) is 98.0% by mass or more

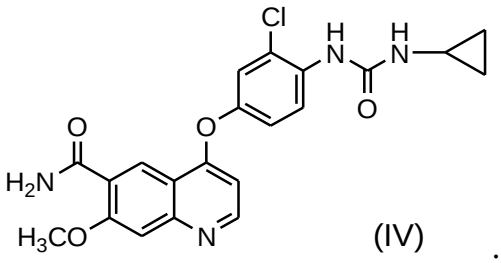


(IV)

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10. The methanesulfonate salt of a compound represented by formula (IV)

according to claim 2, wherein the content of the methanesulfonate salt of a compound represented by formula (IV) is 98.0% by mass or more



(IV)

11. The methanesulfonate salt of a compound represented by formula (IV) according to claim 1, wherein the content of the compound represented by formula (A-1) is determined by HPLC.

12. The methanesulfonate salt of a compound represented by formula (IV) according to claim 2, wherein the content of the compound represented by formula (I) and the content of the compound represented by formula (A-1) are measured by HPLC.