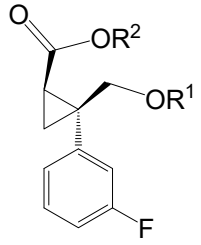
CLAIMS

1. A method of selectively producing an optically active compound represented by the formula [2]

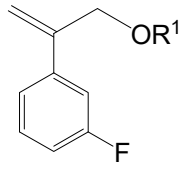


[2]

,

wherein R^1 is an alkylcarbonyl group, and R^2 is an alkyl group, which comprises

Step 1: a step of reacting a compound represented by the formula [1]

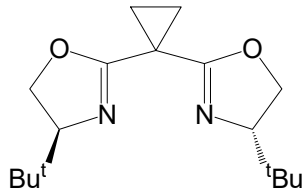


[1]

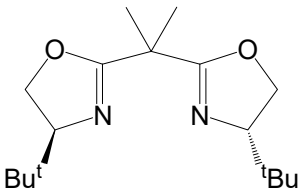
,

wherein R^1 is as defined above,

with an alkyl diazoacetate in the presence of copper trifluoromethanesulfonate and an optically active compound represented by the formula [5] or formula [6]



[5]



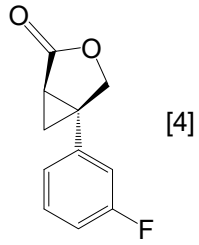
[6]

,

wherein ^{t}Bu is a tert-butyl group,

in an organic solvent.

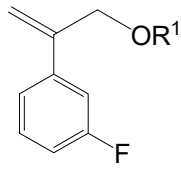
2. A method of producing an optically active compound represented by the formula [4]


[4]

,

which comprises

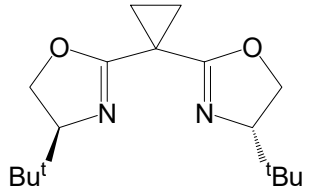
Step 1: a step of reacting a compound represented by the formula [1]

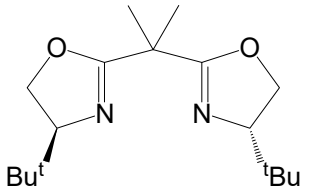

[1]

,

wherein R^1 is an alkylcarbonyl group,

with an alkyl diazoacetate in the presence of copper trifluoromethanesulfonate and an optically active compound represented by the formula [5] or formula [6]

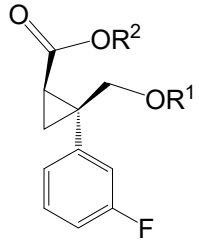

[5]


[6]

,

wherein ^tBu is a tert-butyl group,

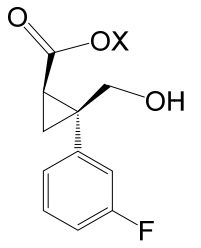
in an organic solvent to give an optically active compound represented by the formula [2]


[2]

,

wherein R^2 is an alkyl group, and R^1 is as defined above,

Step 2: a step of subjecting the optically active compound represented by the formula [2] obtained in Step 1 to alkaline hydrolysis to give an optically active compound represented by the formula [3]



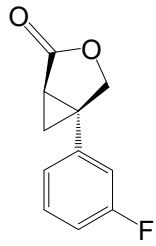
[3]

,

wherein X is an alkali metal, and

Step 3: a step of subjecting the optically active compound represented by the formula [3] obtained in Step 2 to a cyclization reaction to give the optically active compound represented by the formula [4].

3. A method of producing an optically active compound represented by the formula [4]

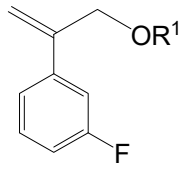


[4]

,

which comprises

Step 1: a step of reacting a compound represented by the formula [1]

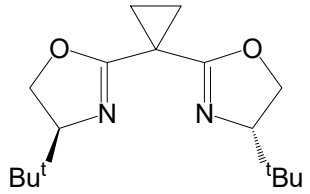


[1]

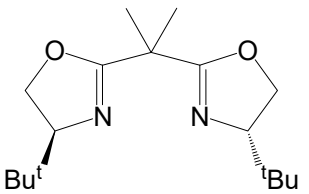
,

wherein R^1 is an alkylcarbonyl group,

with an alkyl diazoacetate in the presence of copper trifluoromethanesulfonate and an optically active compound represented by the formula [5] or formula [6]



[5]

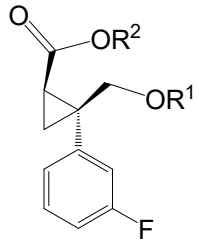


[6]

,

wherein ^{t}Bu is a tert-butyl group,

in an organic solvent to give a mixture comprising an optically active compound represented by the formula [2]

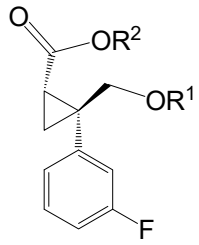


[2]

,

wherein R^2 is an alkyl group, and R^1 is as defined above,

and an optically active compound represented by the formula [2a]

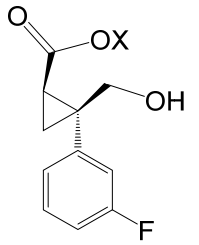


[2a]

,

wherein R^1 and R^2 are as defined above,

Step 2: a step of subjecting the mixture obtained in Step 1 to alkaline hydrolysis to give a mixture comprising an optically active compound represented by the formula [3]

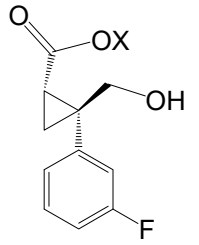


[3]

,

wherein X is an alkali metal,

and an optically active compound represented by the formula [3a]



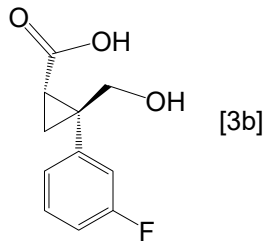
[3a]

,

wherein X is as defined above,

Step 3a: a step of subjecting the optically active compound

represented by the formula [3] to cyclization by adjusting the mixture obtained in Step 2 to pH 7.0 or below with an acid to give a mixture comprising the optically active compound represented by the formula [4] and an optically active compound represented by the formula [3b]



[3b]

, and

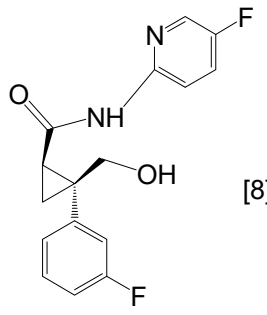
Step 3b: a step of subjecting the mixture obtained in Step 3a to an extraction operation with an aromatic hydrocarbon solvent and a liquid separation operation to remove the optically active compound represented by the formula [3b] from the mixture.

4. The method according to any of claim 1 to claim 3, wherein Step 1 is carried out in the presence of copper trifluoromethanesulfonate and an optically active compound represented by the formula [5].

5. The method according to claim 3, which further comprises a step of washing the mixture obtained in Step 2 with an aromatic hydrocarbon solvent, and then removing the organic layer.

6. The method according to any of claim 3 to claim 5, wherein the mixture obtained in Step 3a is adjusted to pH 6.0 to 8.0, before the extraction operation with an aromatic hydrocarbon solvent and the liquid separation operation.

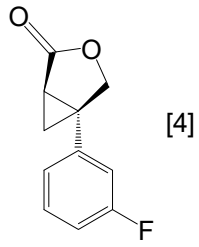
7. A method of producing an optically active compound represented by the formula [8]


[8]

,

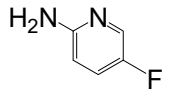
which comprises

Step 4: a step of reacting an optically active compound represented by the formula [4]


[4]

,

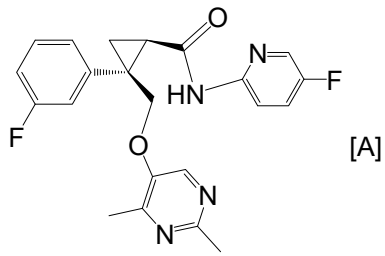
with a compound represented by the formula [7]


[7]

,

in the presence of an organic aluminium compound or a base, in an organic solvent.

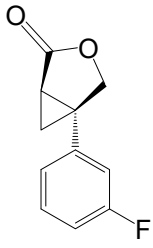
8. A method of producing an optically active compound represented by the formula [A]


[A]

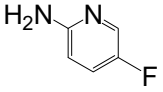
,

which comprises

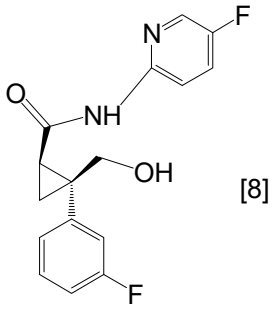
Step 4: a step of reacting an optically active compound represented by the formula [4]


[4]
,

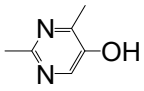
with a compound represented by the formula [7]


[7]
,

in the presence of an organic aluminium compound or a base, in an organic solvent to give an optically active compound represented by the formula [8]

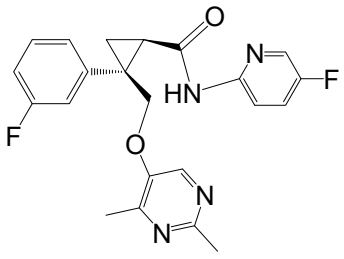

[8]
, and

Step 5: a step of subjecting the optically active compound represented by the formula [8] obtained in Step 4 to the Mitsunobu reaction with a compound represented by the formula [9]


[9]
,

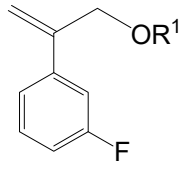
to give the optically active compound represented by the formula [A].

9. A method of producing an optically active compound represented by the formula [A]


[A]
,

which comprises

Step 1: a step of reacting a compound represented by the formula [1]

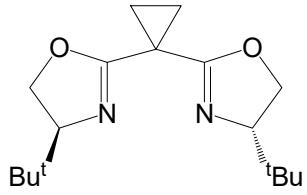


[1]

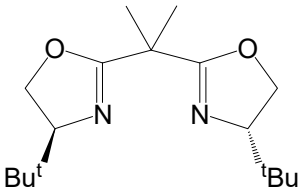
,

wherein R^1 is an alkylcarbonyl group,

with an alkyl diazoacetate in the presence of copper trifluoromethanesulfonate and an optically active compound represented by the formula [5] or formula [6]



[5]

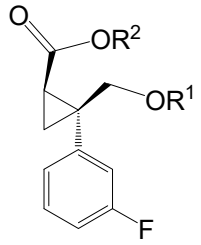


[6]

,

wherein ^tBu is a tert-butyl group,

in an organic solvent to give an optically active compound represented by the formula [2]

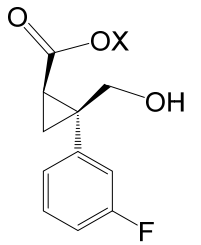


[2]

,

wherein R^2 is an alkyl group, and R^1 is as defined above,

Step 2: a step of subjecting the optically active compound represented by the formula [2] obtained in Step 1 to alkaline hydrolysis to give an optically active compound represented by the formula [3]



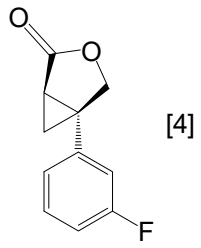
[3]

,

wherein X is an alkali metal,

Step 3: a step of subjecting the optically active compound

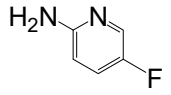
represented by the formula [3] obtained in Step 2 to a cyclization reaction to give an optically active compound represented by the formula [4]



[4]

,

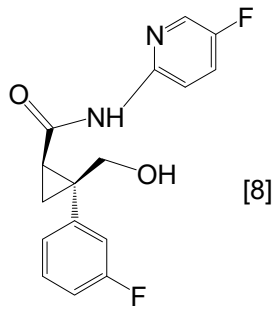
Step 4: a step of reacting the optically active compound represented by the formula [4] obtained in Step 3 with a compound represented by the formula [7]



[7]

,

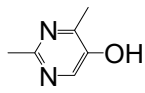
in the presence of an organic aluminium compound or a base, in an organic solvent to give an optically active compound represented by the formula [8]



[8]

, and

Step 5: a step of subjecting the optically active compound represented by the formula [8] obtained in Step 4 to the Mitsunobu reaction with a compound represented by the formula [9]

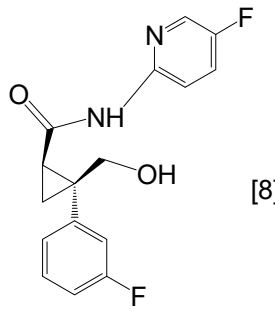


[9]

,

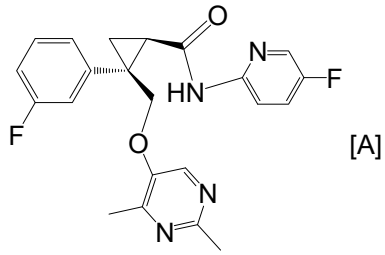
to give the optically active compound represented by the formula [A].

10. An optically active compound represented by the formula [8]


[8]

.

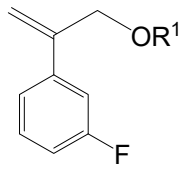
11. A method of producing an optically active compound represented by the formula [A]


[A]

,

which comprises

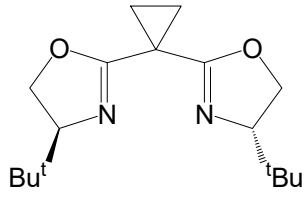
Step 1: a step of reacting a compound represented by the formula [1]

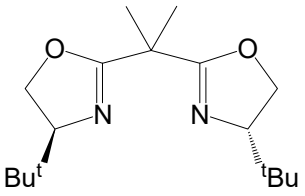

[1]

,

wherein R^1 is an alkylcarbonyl group,

with an alkyl diazoacetate in the presence of copper trifluoromethanesulfonate and an optically active compound represented by the formula [5] or formula [6]

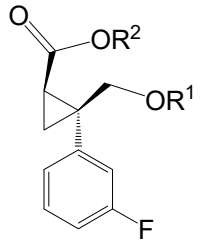

[5]


[6]

,

wherein ^{t}Bu is a tert-butyl group,

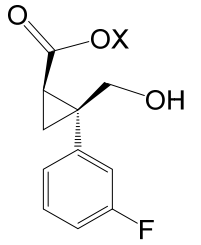
in an organic solvent to give an optically active compound represented by the formula [2]


[2]

,

wherein R^2 is an alkyl group, and R^1 is as defined above,

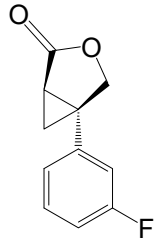
Step 2: a step of subjecting the optically active compound represented by the formula [2] obtained in Step 1 to alkaline hydrolysis to give an optically active compound represented by the formula [3]


[3]

,

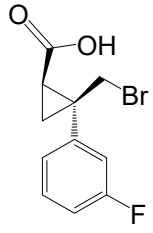
wherein X is an alkali metal,

Step 3: a step of subjecting the optically active compound represented by the formula [3] obtained in Step 2 to a cyclization reaction to give an optically active compound represented by the formula [4]


[4]

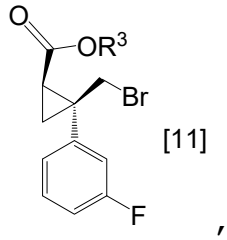
,

Step 6: a step of subjecting the optically active compound represented by the formula [4] obtained in Step 3 to bromination to give an optically active compound represented by the formula [10]


[10]

,

Step 7: a step of subjecting the optically active compound represented by the formula [10] obtained in Step 6 to alkyl esterification to give an optically active compound represented by the formula [11]

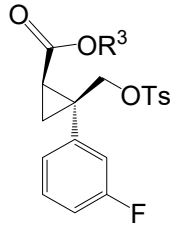


[11]

,

wherein R^3 is an alkyl group,

Step 8: a step of subjecting the optically active compound represented by the formula [11] obtained in Step 7 to tosylation to give an optically active compound represented by the formula [12]

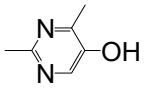


[12]

,

wherein Ts is a tosyl group, and R^3 is as defined above,

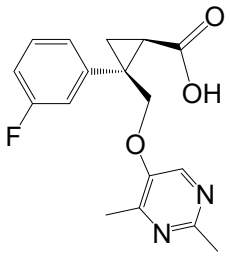
Step 9: a step of reacting the optically active compound represented by the formula [12] obtained in Step 8 with a compound represented by the formula [9]



[9]

,

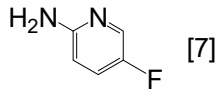
in the presence of a base, in an organic solvent, and then subjecting the resulting compound to alkaline hydrolysis to give an optically active compound represented by the formula [13]



[13]

, and

Step 10: a step of reacting the optically active compound represented by the formula [13] obtained in Step 9 with a compound represented by the formula [7]


[7]

,

in the presence of a base, in an organic solvent to give the optically active compound represented by the formula [A].