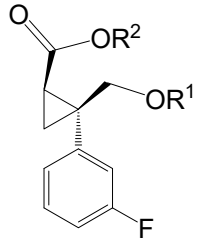
CLAIMS

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

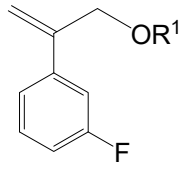


[2]

,

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]

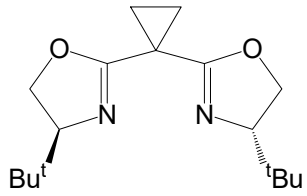


[1]

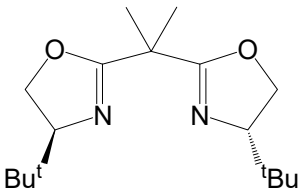
,

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]



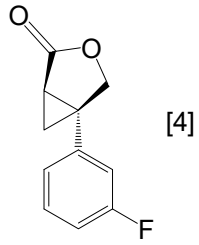
[6]

,

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

in an organic solvent.

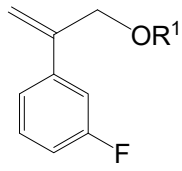
2. A method of producing an optically active compound represented by the formula [4]


[4]

,

which comprises

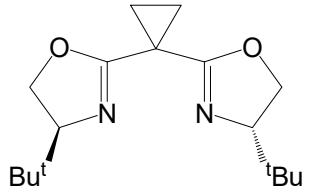
Step 1: a step of reacting a compound represented by the formula [1]

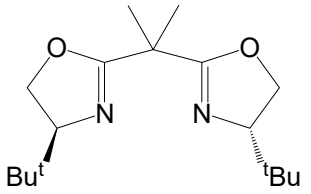

[1]

,

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]

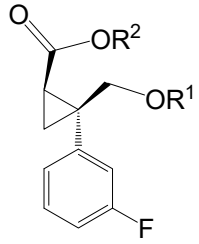

[5]


[6]

,

wherein ^tBu is a tert-butyl group,

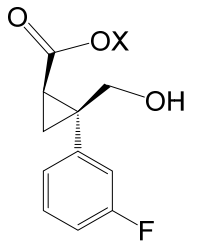
in an organic solvent to give an optically active compound represented by the formula [2]


[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]



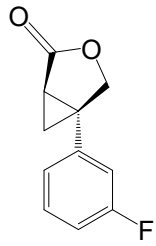
[3]

,

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]

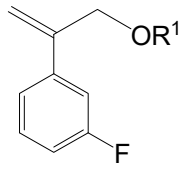


[4]

,

which comprises

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

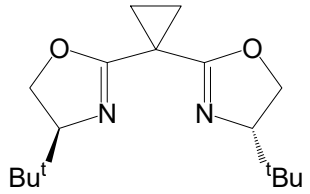


[1]

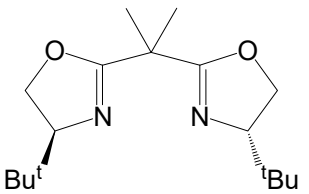
,

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]

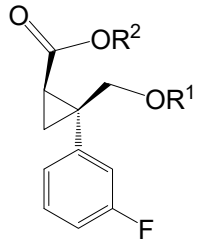


[6]

,

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]

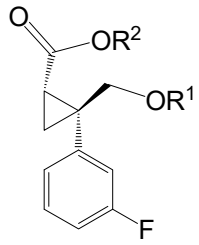


[2]

,

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

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

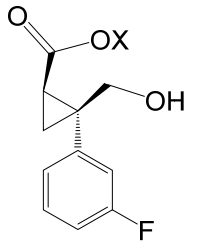


[2a]

,

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]

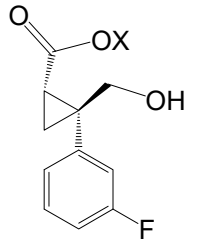


[3]

,

wherein X is an alkali metal,

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



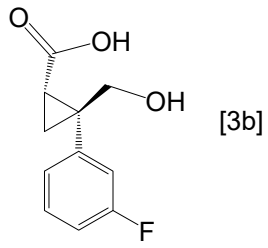
[3a]

,

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

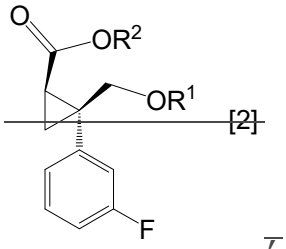
Step 3b: a step of subjecting the mixture obtained in Step 3a to an extraction operation with an aromatic hydrocarbon solvent and a liquid separation operation to remove the optically active compound represented by the formula [3b] from the mixture.

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.

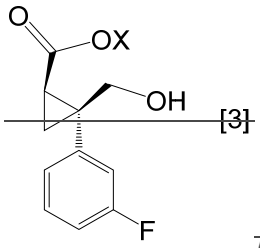
~~7. An optically active compound represented by the formula [2]~~



[2]

~~wherein R^1 is an alkylcarbonyl group, and R^2 is an alkyl group.~~

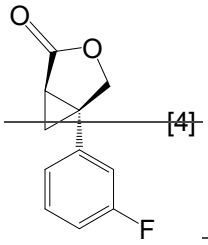
~~8. An optically active compound represented by the formula [3]~~



[3]

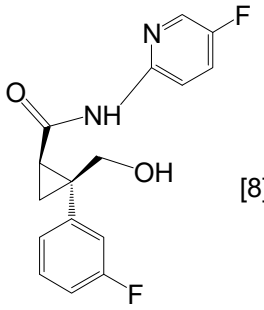
~~wherein X is an alkali metal.~~

~~9. An optically active compound represented by the formula [4]~~



[4]

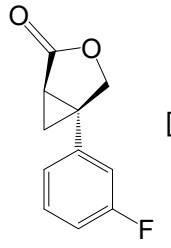
~~10~~7. A method of producing an optically active compound represented by the formula [8]



[8]

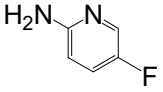
which comprises

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


[4]

,

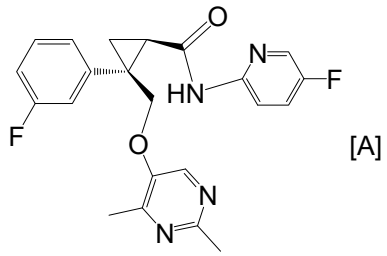
with a compound represented by the formula [7]


[7]

,

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

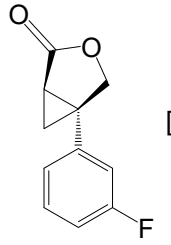
~~11~~8. A method of producing an optically active compound represented by the formula [A]


[A]

,

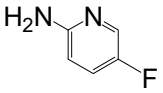
which comprises

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


[4]

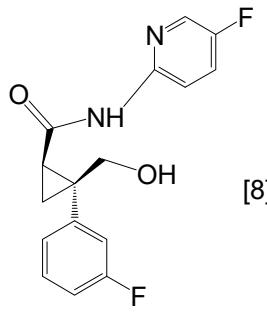
,

with a compound represented by the formula [7]


[7]

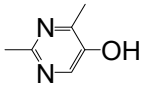
,

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

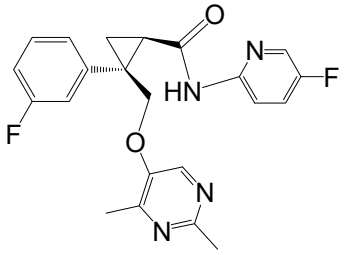
Step 5: a step of subjecting the optically active compound represented by the formula [8] obtained in Step 4 to the Mitsunobu reaction with a compound represented by the formula [9]


[9]

,

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

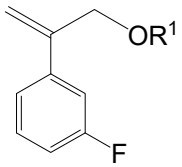
~~12~~9. A method of producing an optically active compound represented by the formula [A]


[A]

,

which comprises

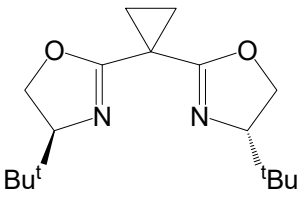
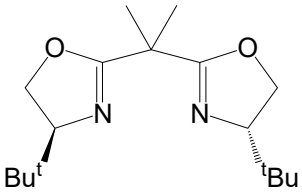
Step 1: a step of reacting a compound represented by the formula [1]


[1]

,

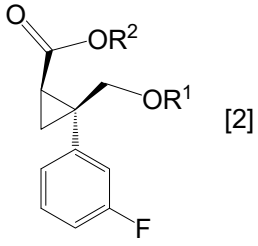
wherein R^1 is an alkylcarbonyl group,

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]
,

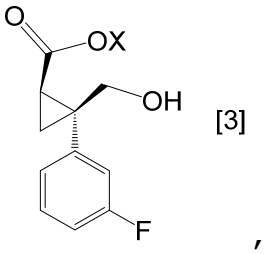
wherein ^{t}Bu is a tert-butyl group,

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


[2]
,

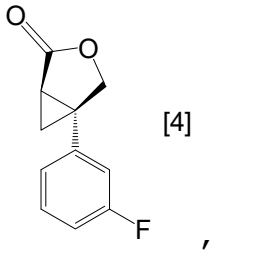
wherein R^2 is an alkyl group, and R^1 is as defined above,

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]
,

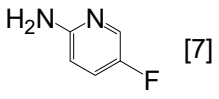
wherein X is an alkali metal,

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]
,

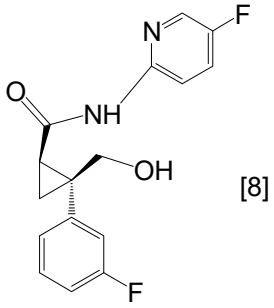
Step 4: a step of reacting the optically active compound represented by the formula [4] obtained in Step 3 with a

compound represented by the formula [7]



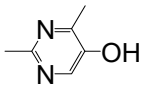
[7],

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

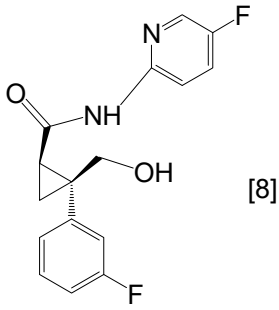
Step 5: a step of subjecting the optically active compound represented by the formula [8] obtained in Step 4 to the Mitsunobu reaction with a compound represented by the formula [9]



[9],

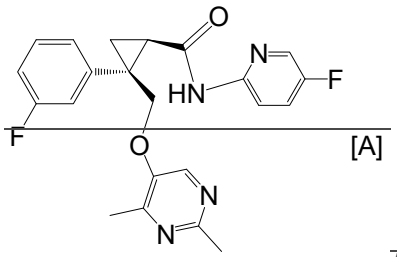
to give the optically active compound represented by the formula [A].

~~13~~10. An optically active compound represented by the formula [8]



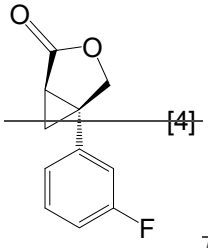
[8].

~~14. A method of producing an optically active compound represented by the formula [A]~~

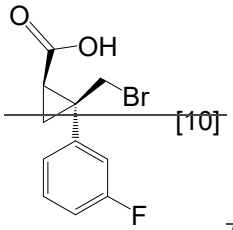


~~which comprises~~

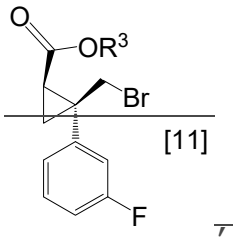
~~Step 6: a step of subjecting an optically active compound represented by the formula [4]~~



~~to bromination to give an optically active compound represented by the formula [10]~~

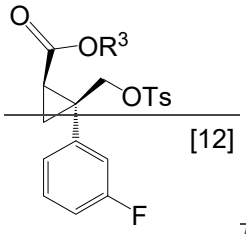


~~Step 7: a step of subjecting the optically active compound represented by the formula [10] obtained in Step 6 to alkyl esterification to give an optically active compound represented by the formula [11]~~



~~wherein R^3 is an alkyl group,~~

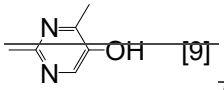
~~Step 8: a step of subjecting the optically active compound represented by the formula [11] obtained in Step 7 to tosylation to give an optically active compound represented by the formula [12]~~



[12]

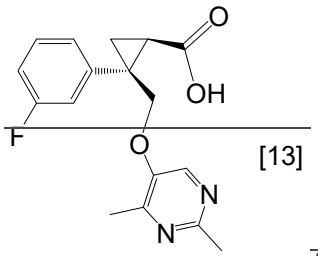
~~, wherein Ts is a tosyl group, and R^3 is as defined above,~~

~~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]~~

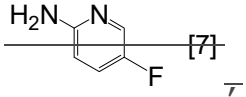
~~, in the presence of a base, in an organic solvent, and then subjecting the resulting compound to alkaline hydrolysis to give an optically active compound represented by the formula [13]~~



[13]

~~, and~~

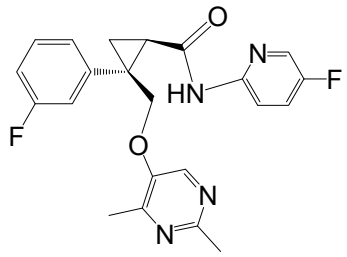
~~Step 10: a step of reacting the optically active compound represented by the formula [13] obtained in Step 9 with a compound represented by the formula [7]~~



~~[7]~~

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

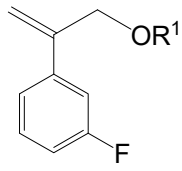
~~15~~11. A method of producing an optically active compound represented by the formula [A]


[A]

,

which comprises

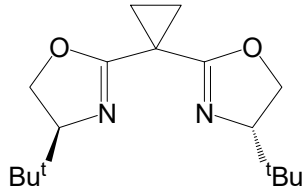
Step 1: a step of reacting a compound represented by the formula [1]

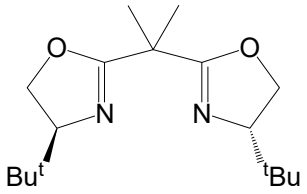

[1]

,

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]

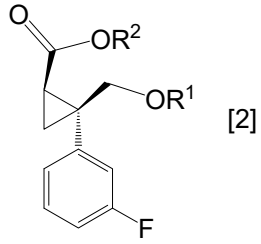

[5]


[6]

,

wherein ^tBu is a tert-butyl group,

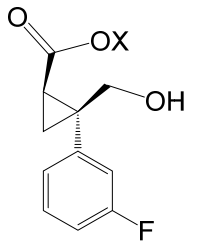
in an organic solvent to give an optically active compound represented by the formula [2]


[2]

,

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

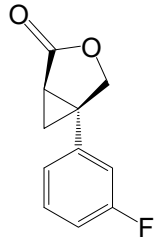
Step 2: a step of subjecting the optically active compound represented by the formula [2] obtained in Step 1 to alkaline hydrolysis to give an optically active compound represented by the formula [3]


[3]

,

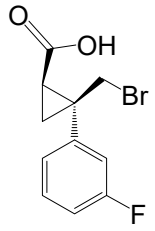
wherein X is an alkali metal,

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]

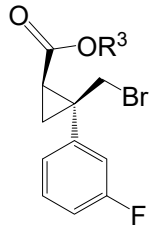
,

Step 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]

,

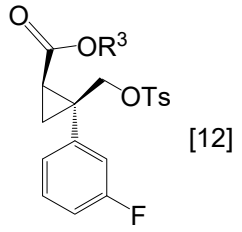
Step 7: a step of subjecting the optically active compound represented by the formula [10] obtained in Step 6 to alkyl esterification to give an optically active compound represented by the formula [11]


[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]

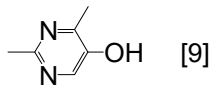


[12]

,

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

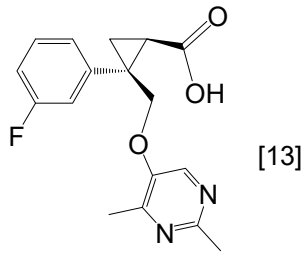
Step 9: a step of reacting the optically active compound represented by the formula [12] obtained in Step 8 with a compound represented by the formula [9]



[9]

,

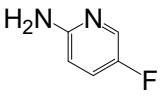
in the presence of a base, in an organic solvent, and then subjecting the resulting compound to alkaline hydrolysis to give an optically active compound represented by the formula [13]



[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]

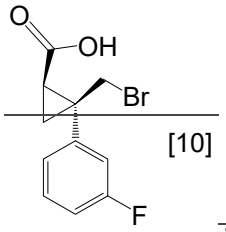


[7]

,

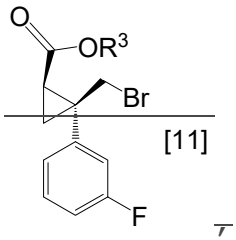
in the presence of a base, in an organic solvent to give the optically active compound represented by the formula [A].

~~16. An optically active compound represented by the formula [10]~~



[10]

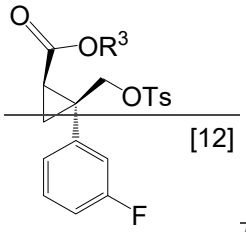
~~17. An optically active compound represented by the formula [11]~~



[11]

~~wherein R^3 is an alkyl group.~~

~~18. An optically active compound represented by the formula [12]~~



[12]

~~wherein Ts is a tosyl group, and R^3 is an alkyl group.~~