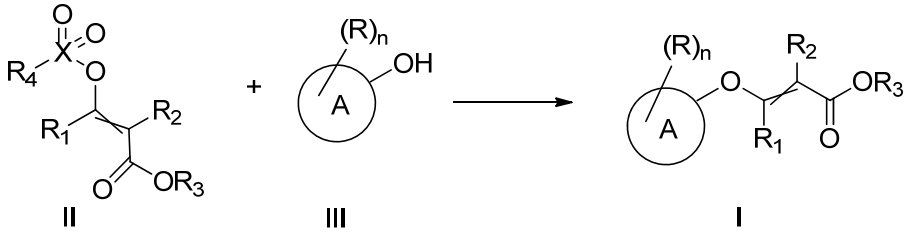
CLAIMS

1. A method of preparing a compound of general formula (I), comprising reacting a compound of general formula (II) with a compound of general formula (III), in the presence of a base:



II III I

wherein

ring A is C_{6-10} aryl or 5- to 10-membered heteroaryl;

X is S;

R_1 is selected from H, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{3-7} cycloalkyl, and 3- to 8-membered heterocyclyl;

R_2 is selected from H, C_{1-6} alkyl, and C_{1-6} haloalkyl;

R_3 is selected from H, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, -C_{0-6} alkylene-C_{3-7} cycloalkyl, -C_{0-6} alkylene-3- to 8-membered heterocyclyl, -C_{0-6} alkylene-C_{6-10} aryl, and -C_{0-6} alkylene-5- to 10-membered heteroaryl, wherein the groups are unsubstituted or independently substituted with m R' group(s);

R_4 is selected from C_{1-20} alkyl, C_{1-6} haloalkyl, -OR_a, -NR_aR_b, C_{3-7} cycloalkyl, 3- to 8-membered heterocyclyl, C_{6-10} aryl, and 5- to 10-membered heteroaryl, wherein the groups are unsubstituted or independently substituted with m' R'' group(s);

R is selected from H, halogen, -O-C_{1-6} alkyl, C_{1-6} alkyl, and C_{1-6} haloalkyl;

n is 0, 1, 2, 3, 4, or 5;

wherein R' and R'' are independently selected from halogen, -NO_2, -CN, -NR_aR_b, -$NR_aC(O)R_b$, C_{1-20} alkyl, C_{1-6} haloalkyl, -O-C_{1-6} alkyl, and phenyl;

m is 1, 2, 3, 4, or 5;

m' is 1, 2, 3, 4, or 5;

R_a and R_b are independently selected from H, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{3-7} cycloalkyl, 3- to 8-membered heterocyclyl, C_{6-10} aryl, and 5- to 10-membered heteroaryl; or R_a and R_b, together with the nitrogen atom to which they are attached, form 3- to 8-membered heterocyclyl or 5- to 10-membered heteroaryl.

2. The method of claim 1, wherein R_4 is C_{6-10} aryl or 5- to 10-membered heteroaryl, which is unsubstituted or independently substituted with m' R'' group(s).

3. The method of claim 2, wherein R_4 is selected from phenyl, 1-naphthyl, 2-naphthyl, 2-chlorophenyl, 3-chlorophenyl, 4-chlorophenyl, 2-bromophenyl, 3-bromophenyl, 4-bromophenyl, 2-fluorophenyl, 3-fluorophenyl, 4-fluorophenyl, 2,6-dichlorophenyl, 2,4-difluorophenyl, 3-cyanophenyl, 4-cyanophenyl, 2-nitrophenyl, 4-nitrophenyl, 2-methylphenyl, 4-methylphenyl, 4-propylphenyl, 4-t-butylphenyl, 2,5-dimethylphenyl, mesityl, 2,4,6-triisopropylphenyl, 2-dodecylphenyl, 3-dodecylphenyl, 4-dodecylphenyl, 2-(trifluoromethyl)phenyl, 3-(trifluoromethyl)phenyl, 3,5-bis(trifluoromethyl)phenyl, 4-methoxyphenyl, N,N-dimethylaminophenyl, 4-acetylaminophenyl, 4-biphenyl, thienyl and 5-bromothienyl; alternatively, R_4 is selected from phenyl, 1-naphthyl, 2-naphthyl, 4-chlorophenyl, 3-fluorophenyl, 4-fluorophenyl, 4-nitrophenyl, 2-methylphenyl, 4-propylphenyl, 4-t-butylphenyl, 2,5-dimethylphenyl, 2,4,6-triisopropylphenyl, 2-dodecylphenyl, 3-dodecylphenyl, 4-dodecylphenyl, 4-methoxyphenyl, 4-acetylaminophenyl, 4-methylphenyl and mesityl; yet alternatively, R_4 is selected from phenyl, 4-chlorophenyl, 4-methylphenyl and mesityl.

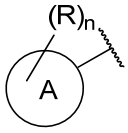
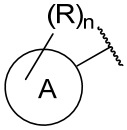
4. The method of claim 1, wherein R_4 is C_{1-12} alkyl, $-OR_a$, $-NR_aR_b$, C_{3-7} cycloalkyl, or 3- to 8-membered heterocyclyl, which is unsubstituted or independently substituted with m' R'' group(s).

5. The method of claim 4, wherein R_4 is selected from N,N-dimethylamino, methyl, ethyl, butyl, dodecyl, methoxy, ethoxy, and cyclopropyl.

6. The method of any one of claims 1-5, wherein ring A is substituted or unsubstituted phenyl, naphthyl or thienyl; alternatively substituted or unsubstituted phenyl.

7. The method of any one of claims 1-6, wherein R is H, halogen, C_{1-6} alkyl, or C_{1-6} haloalkyl;

alternatively, R is H or halogen.

8. The method of any one of claims 1-7, wherein  is selected from phenyl, naphthalene-1-yl, naphthalene-2-yl, 2-chlorophenyl, 3-chlorophenyl, 4-chlorophenyl, 2-bromophenyl, 3-bromophenyl, 4-bromophenyl, 2,3-dichlorophenyl, 2,4-dichlorophenyl, 2,5-dichlorophenyl, 3,4-dichlorophenyl, 2,3,5-trichlorophenyl, 4-isopropylphenyl and 4-t-butylphenyl; alternatively,  is 2-chlorophenyl.

9. The method of any one of claims 1-8, wherein R_1 is selected from C_{1-6} alkyl, such as methyl.

10. The method of any one of claims 1-9, wherein R_2 is H.

11. The method of any one of claims 1-10, wherein R_3 is H, $-CH_3$, $-CH_2CH_3$, $-CH(CH_3)_2$, $-C(CH_3)_3$, $-CH_2CH_2CH_2CH_3$, phenyl or $-CH_2$-phenyl; alternatively, R_3 is $-CH_3$, $-CH_2CH_3$, $-C(CH_3)_3$ or $-CH_2$-phenyl.

12. The method of any one of claims 1-11, wherein the base is selected from inorganic bases and organic bases; alternatively, the inorganic base is selected from carbonates, bicarbonates, phosphates, hydrogenphosphates, dihydrogenphosphates, hydroxides and hydrides of alkali metals and alkaline earth metals, for example, LiOH, NaOH, KOH, Li_2CO_3, Na_2CO_3, K_2CO_3, Cs_2CO_3, Na_3PO_4, K_3PO_4, K_2HPO_4, KH_2PO_4 and NaH; alternatively, the organic base is selected from alkoxides of alkali metals and alkaline earth metals and organic amines, such as NaOMe, KOMe, NaOEt, KOEt, NaOtBu, KOtBu, triethylamine, DBU, DIPEA, DABCO and DMAP.

13. The method of any one of claims 1-12, wherein the reaction is performed in the presence

of a solvent selected from water, alkanes, ethers, esters, alcohols, halogenated hydrocarbons, ketones, amides, sulfones, sulfoxides, nitriles, and mixtures thereof, such as water, n-heptane, toluene, THF, MTBE, methyltetrahydrofuran, ethyl acetate, isopropyl acetate, butyl acetate, methanol, ethanol, isopropanol, tert-butanol, tert-amyl alcohol, dichloromethane, 1,2-dichloroethane, chlorobenzene, acetone, 2-butanone, DMF, DMA, NMP, DMSO and acetonitrile.

14. The method of any one of claims 1-13, wherein the reaction temperature is from room temperature to the reflux temperature of the solvent, alternatively 40-90℃; yet alternatively 50-80℃.

15. The method of any one of claims 1-14, wherein the molar ratio of the compound of the general formula (II) to the compound of the general formula (III) is 1:(0.7-3), alternatively 1:(0.7-1.5), yet alternatively 1:(1-1.2), still alternatively 1:1, 1:1.05, 1:1.1, 1:1.15 or 1:1.2.

16. The method of any one of claims 1-15, wherein the molar ratio of the compound of the general formula (II) to the base is 1:(1-5), alternatively 1:(2-4), yet alternatively 1:1.5, 1:1.6, 1:1.7, 1:1.8, 1:1.9, 1:2, 1:2.1, 1:2.2, 1:2.3, 1:2.4, 1:2.5, 1:2.6, 1:2.7, 1:2.8, 1:2.9 or 1:3.