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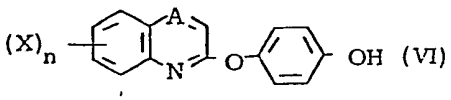
(54) **Heterocyclic oxyphenols**

(57) Heterocyclic phenols are disclosed having the general formula:



(VI)

wherein A represents –CH– or –N–; X represents a halogen atom; n is 0, 1 or 2. These compounds can be reacted with α-halofatty acids and their derivatives to produce heterocyclic phenoxy fatty acid derivaties having useful herbicidal properties.

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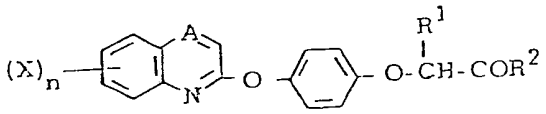
SPECIFICATION

Heterocyclic oxyphenols

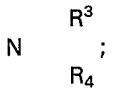
This invention relates to novel heterocyclic oxyphenols to be used as intermediates in the synthesis of heterocyclic phenoxy fatty acid derivatives having herbicidal properties.

Our co-pending application No. 8004144, published as No. 2042539, discloses and claims a novel class of heterocyclic phenoxy fatty acid derivatives having the formula:



(I)

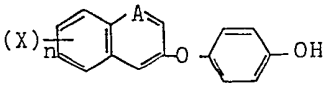
wherein A represents —CH— or —N—; X represents a halogen atom; n is 0, 1 or 2; R^1 represents a hydrogen atom or a C_1-C_4 alkyl group; R^2 represents —OH; —O—alkyl; —OM (M is an inorganic or organic salt moiety);



O- C_2-C_4 alkenyl, O- benzyl, O- C_1-C_4 alkoxyalkyl O-phenyl, O-cyclohexyl, -O- halogenoalkyl, -O- C_2-C_4 alkynyl or -O- cyanoalkyl and R^3 and R^4 respectively represent a hydrogen atom or a C_1-C_4 alkyl group.

The compounds of formula (I) defined above are unique compounds which are effective for controlling gramineous weeds, without any phytotoxicity to broad leaf crop plants, as well as controlling broad leaf crop plants, as well as controlling broad leaf weeds especially in a post-emergence treatment.

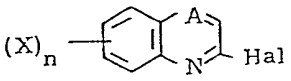
The present invention provides, as intermediates for the synthesis of the above compounds, heterocyclic oxyphenols having the general formula:



(VI)

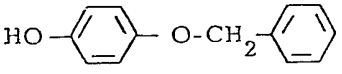
wherein A,X and n are as defined above.

The compounds of the present invention can be produced by a condensation of a compound having the formula:



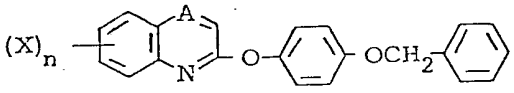
(II)

wherein A,X and n are as defined above and Ha1 designates a halogen atom, with a hydroquinone monobenzyl ether having the formula:



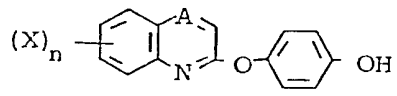
(IV)

in the presence of an inorganic or organic base to produce a compound having the formula:



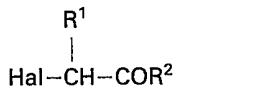
(V)

wherein A,X and n are as defined above; and then hydrogenating the product with a catalyst such as palladium-carbon to effect a debenzylation and obtain a compound having the formula:



(VI)

To obtain one of the herbicidal compounds of formula (I) described above, a compound of formula (VI) is condensed with an α-halofatty acid derivative having the formula:



(VII)

wherein R^1, R^2 and Hal are defined above; in the presence of an inorganic or organic base such potassium carbonate and preferably in a polar organic solvent such as methyl ethyl ketone, acetonitrile or dimethylformamide.

The products obtained by the above process can be converted into other compounds of formula (I) by hydrolysis, esterification, ester interchange, conversion to a salt or amidation.

The condensation to produce the compounds of formula (V) is preferably carried out at 50 to 200°C, especially at 100 to 150°C at a molar ratio of compound (II) to the hydroquinone monobenzyl ether (IV) of 1:0.2 to 1:5.0, more preferably 1:0.5 to 1:2.0 and especially 1:0.8 to 1:1.5. The inorganic or organic base can be any base which is suitable for the condensation of the compound (II) and the compound (IV). The reaction is preferably carried out in an inert solvent at a concentration of the starting material of 5 to 50 wt.%, more preferably 10 to 30 wt.%.

The hydrogenation of the resulting intermediate (V) is carried out under suitable conditions for the debenzylation to obtain the compound (VI). The hydrogen pressure is preferably in the range of 1 to 5 atm., more preferably 1 to 2 atm.

The reaction of the compound (VI) with the α-halofatty acid derivative (VII) is preferably carried out at 80 to 100°C at a molar ratio of the compound (VI): the compound (VII) of 1:0.2 to 5.0, more preferably 1:0.5 to 2.0 and especially 1:0.8 to 1.5. The inorganic or organic base can be one of those mentioned above. The concentration of the starting materials in the inert solvent can be in a range of 5 to 50 wt.% preferably 10 to 30 %.

The following examples illustrate the preparation of compounds of the invention and their subsequent reaction to form herbicidal compounds.

PREPARATION 1

Preparation of methyl 2-[4-(2-quinolyloxy)phenoxy]propionate using 2-(4-benzyloxyphenoxy)quinoline as intermediate

In 50 ml, of dimethylsulfoxide, 12 g of hydroquinone monobenzyl ether, 8.2 g of 2-chloroquinoline and 8.3 g of potassium carbonate were dissolved and the mixture was heated at 150 to 160°C for 4 hours to react them. After cooling, the reaction mixture was poured into water, the product was extracted several times with ether and the ether layer was washed with an aqueous solution of sodium hydroxide and then with water and the ether layer was dehydrated over sodium sulfate. The solvent was distilled off. The resulting crude crystals were washed with diisopropyl ether to obtain 12 g (yield 75%) of *2-(4-benzyloxyphenoxy)quinoline*. All of the intermediate was dissolved in 200 ml of a mixed solvent of tetrahydrofuran and ethanol (5:1), 1.5 g of palladium-carbon type catalyst was added and 880 ml of hydrogen gas was fed into the mixture to carry out the hydrogenation at atmosphere pressure. After the hydrogenation, the catalyst was separated by a suction filtration, the solvent was distilled off and the residue was washed with a chloroform-n-hexane type solvent to obtain 6.3 g (yield 74%) of white crystal of 2-(4-hydroxyphenoxy)quinoline (m.p. 177°C).

In 50 ml of methyl ethyl ketone, 2.37 g of the product, 2.1 g of methyl α-bromopropionate and 2.0 g of potassium carbonate were added and the mixture was refluxed for 5 hours to react them. After cooling to room termperature, the precipitated product was separated by a filtration and the solvent was distilled off to obtain 2.2 g (yield 68%) of the object compound.

PREPARATION 2

Preparation of 2-[4-(2-quinolyloxy)phenoxy]propionic acid N,N-dimethylamide from 2-(4-hydroxyphenoxy)quinoline

In 100 ml of methyl ethyl ketone, 2.3 g of the intermediate of Preparation 1 of 2-(4-hydroxyphenoxy) quinoline, 1.8 g of N,N-dimethyl- -bromopropionic acid amide and 1.4 g of potassium carbonate were added and the mixture was refluxed for 5 hours. After the reaction, the precipitated crystals were separated by filtration, the solvent was distilled off and the product was dried under a reduced pressure. The resulting

crude crystals were recrystallized from a solvent of methanol-water to obtain 3.6 g (yield 88%) of white crystal of the object compound.

PREPARATION 3

Preparation of methyl D(+)-2-{4-(6-chloro-2-quinoxalyloxy)phenoxy} propionate from 6-chloro-2-(4'-hydroxy)phenoxyquinoxaline

In 30 ml of acetonitrile, 1.36 g (5 mmole) of 6-chloro-2-(4'-hydroxy)phenoxyquinoxaline, 1.55 g (6 mmole) of methyl L-(−)-lactate tosylate and 0.83 g (6 mmole) of potassium carbonate were added. The mixture was refluxed for 12 hours. After the reaction, the reaction mixture was cooled. The resulting potassium tosylate and potassium bicarbonate were separated by a suction filtration. The filtrate was concentrated and dried. The residue was dissolved in methylene chloride and a methylene chloride solution was washed twice with water and dried. Methylene chloride was distilled off under a reduced pressure. The resulting crude methyl D(+)-2-{4-(6-chloro-2-quinoxalyloxy)phenoxy}propionate was collected in methylene chloride and was purified by a column chromatography with silica gel to obtain 1.35 (yield 75%) of the purified object compound having $[\alpha]_D^{31} = +32.8°C$ (chloroform: c=1.20%) and a melting point of 112-114°C.

PREPARATION 4

Preparation of ethyl 2-{4-(6-fluoro-2-quinoxalyloxy)phenoxy}propionate using 6-fluoro-2-(4-hydroxyphenoxy)quinoxaline

A mixture of 18.3 g (0.1 mole) of 2-chloro-6-fluoroquinoxaline, 33 g. (0.3 mole) of hydroquinone and 42 g. (0.3 g.) of potassium carbonate was admixed with 500 ml. of acetonitrile and the mixture was refluxed with stirring for 10 hours.

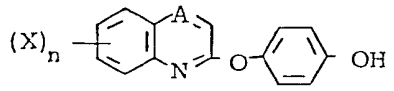
After the reaction, acetonitrile was distilled off under a reduced pressure and the residue was poured on 500 ml. of ice water and acidifed with hydrochloric acid. The precipitated crystals were separated by a filtration. The crystal was washed with hot water several times to remove the unreacted hydroquinone to obtain 19.2 g. of 6-fluoro-2-(4-hydroxyphenoxy) quinoxaline (yield: 75%).

In 100 ml. of methyl ethyl ketone, 2.6 g. (0.01 mole) of the resulting product, 1.8 g. (0.01 mole) of ethyl α-bromopropionate and 1.4 g. (0.01 mole) of potassium carbonate were added. The mixture was refluxed for 10 hours. After the reaction, the precipitated salt was separated by a filtration and the filtrate was distilled off to obtain a viscous oily product.

The oily product was purified by column chromatography with silica gel (chloroform) to obtain 3.2 g. (yield 89%) of the purified object compound having a melting point of 78 to 79°C.

CLAIMS

1. A heterocyclic oxyphenol having the general formula:



(VI)

wherein A represents −CH− or −N−; X represents a halogen atom; n is 0, 1 or 2.

2. 2-(4-hydroxyphenoxy) 6-chloroquinoxaline.

3. A heterocyclic oxyphenol according to Claim 1, substantially as herein described with reference to any one of Preparations 1 to 4.

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