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Research Article

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Synthesis and Herbicidal Activity of 2-(4-Aryloxyphenoxy)Propionamides

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ABSTRACT

Two novel 2-(4-aryloxyphenoxy) propionamides derivatives were synthesized based on the structure of metamifop. Their structures were confirmed by ^1H NMR, elemental analysis and optical rotation. The preliminary bioassay results showed that the two title compounds had some herbicidal activities at the dosage of 150 g.a.i/hm^2.

Keywords: Metamifop; Propionamide; Synthesis; Herbicidal activities

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INTRODUCTION

Metamifop was a kind of aryloxy phenoxy propionic amide (APP-A) herbicides,with low toxicity and selection of absorption, it was developed by the Korea Research Institute of chemical technology and launched in the Chinese market in 2008, Metamifop could prevent flood in annual and perennial grass weeds [1], particularly older crabgrass, such as green bristlegrass [2], The preparation has been developed by FMC company , which has been widely used in the area of the Yangtze River provinces in China,. In recent years, there have been some monocotyledonous weeds such as barnyard grass and Goosegrass on its produce resistance [3]. Therefore, the search of new aromatic phenoxy propanoides has attracted much attention to [4-6]. Herien, Fascinated by these findings and the structure-relationships of APP herbicide [7-11], the two 2-(4-aryloxyphenoxy) propionamides were synthesized and the chemical structure was confirmed by ^{1}H NMR, EI-MS, rotation and elemental analyses based on the structure of Metamifop, and the herbicidal activity were also evaluated.

EXPERIMENTAL SECTION

Chemicals and reagents, Instrumentation

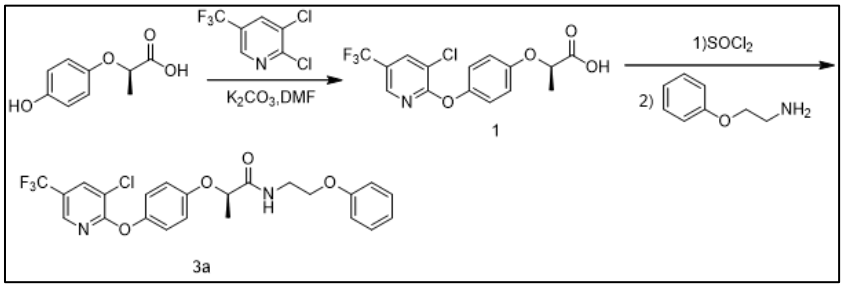
All the reagents were of analytical grade and were used without further purification. Melting points were measured on an X-4 electrothermal digital melting point apparatus and uncorrected. All reactions were monitored by thin-layer chromatography on 0.25 mm silica gel plates (60GF-254) and visualized with UV light. Flash chromatography was performed on silica gel (200-400 mesh) using commercially available petroleum ether and ethyl acetate. ^{1}HNMR spectra were recorded on a Bruker AV-400(USA) spectrometer with tetramethylsilane (TMS) as internal standard. Elemental analyses were performed on a Vario EL III (Germany) instrument.

Selection of Solvents

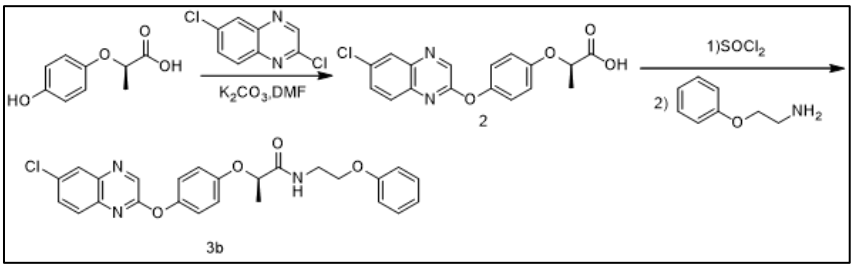
On the basis of solubility study dichloromethane was selected as the solvent for dissolving ATN and LOS.

The intermediate 1 was synthesized from (R) - (+) -2- (4- hydroxybenzoxy) propionic acid and 2,6-dichloroquixoline. The intermediate 2 wassynthesized from (R) –(+) -2- (4- hydroxybenzoxy) propionic acid and3-

chloro-5-trifluoromethylpyridine. The intermediate 1 and 2 was reacted with thionyl chloride to prepare chloride intermediate. Finally, they were reacted with 2- phenoxy ethylamine respectally to give target compounds 3. The synthetic route was seen in scheme 1,2.



Scheme 1: The synthetic route of 3a



Scheme 2: The synthetic route of 3b

The Synthesis of Intermediate 1 and 2

The synthesis of intermediate 1 and 2 were seen in literature report [7]. (*R*)-2-(4-((3-Chloro-5-trifluoromethyl pyridin-2-yl)oxy)phenoxy) propanoic acid(3d): a brown liquid, yield 95.0%, (α) 20 *D*=+25.06 (c 1 in CH_2Cl_2). MS($C_{15}H_{11}ClF_3NO_4$,calcd):361(361.0); (*R*)-2-(4-9(6-Chloroquinoxalin-2-yl)oxy)phenoxy)propanoic acid(3h): a yellow solid, yield 95.9%, m.p. 210-212℃ (lit [7]: 211-212℃), (α)20 *D*=+33.75 (c 1 in CH_2Cl_2).

(R)-2-N-(2-phenoxyethyl)-2-(4-((3-Chloro-5-trifluoromethylpyridin-2-yl)oxy]phenoxy)propionamides (3a)synthesis

A mixture of 0.137 g（1 mmol）2- phenoxy ethylamine，1.0 mmoltriethylamine，catalyst amount ofDMAP20mLdichloromethane, the(*R*)-2-(4-((3-Chloro-5-trifluoromethylpyridin-2-yl)oxy)phenoxy)propanoic acyl chloride was added dropwised and stirred for 1h at room temperature. While the reaction was completed, the miture was washed with water and brine, dryed over anhydrous sodium sulfate. And the crude product was purified with column chromatography silica gel by using petroleum ether (PE) and Ethyl acetate (EtOAc) as eluent to give white solid 3a，m.p. 138~140℃，yield80.1 %。=+20.33°(*c*=1，CH_2Cl_2)；^{1}H NMR (400 MHz, $CDCl_3$) δ：7.85 (d, *J* = 2.2 Hz, 1H), 7.50 (dd, J_1= 9.0, J_2= 2.2 Hz, 1H), 7.29 (s, 1H), 7.25 (s, 1H), 7.04 (d, *J* = 9.0 Hz, 2H, C_6H_4), 6.94 (t, *J* = 9.0 Hz, 3H), 6.84 (d, *J* = 8.7 Hz, 2H), 4.67 (q, *J* = 6.8 Hz, 1H, CHCH$_3$), 3.97~4.10 (m, 2H), 3.70 (m, 2H,), 1.58 (d, *J* =6.8 Hz, 3H, CH_3). EI-MS *m/z*: 480.1(M^+). Anal.calcd for $C_{21}H_{21}ClFN_3O_3S$: C64.78, H 4.78, N 9.06; found C 64.76, H 4.70, N 9.03.

(R)-2-N-(2-phenoxyethyl)-2-(4-((6-Chloroquinoxalin-2-yl)oxy)phenoxy)propionamides (3b) synthesis

Reaction time, 2h.White solid，m.p. 150~153℃，yleid 78.3 %，=+16.50°(*c*=1，CH_2Cl_2)；^{1}HNMR（400 MHz，$CDCl_3$）δ：8.65 (s, 1H，quinoxalin 3-H, 8.03 (d, *J*=2.2 Hz, 1H，quinoxalin 5-H), 7.64 (d, *J* =9.0 Hz, 1H quinoxalin 8-H), 7.57 (dd, J_1= 9.0, J_2= 2.3 Hz, 1H，quinoxalin 7-H), 7.19 –7.23 (m, 1H), 7.13 (d, *J* = 9.0 Hz, 2H), 6.93 (dd, *J* = 14.5, 8.2 Hz, 4H), 6.82 (d, *J* = 7.9 Hz, 2H), 4.68 (q, *J* = 6.8 Hz, 1H), 4.10 – 3.96 (m, 2H), 3.70 (t, *J* = 7.9 Hz, 2H), 1.59 (d, *J*=6.8 Hz, 3H). EI-MS *m/z*: 463.1(M^+). Anal.calcd for $C_{21}H_{21}ClFN_3O_3S$: C 56.06, H 4.70, N 9.34; found C 55.93, H 4.60, N 9.25.

The Procdeure of Herbicidal Activity

According to the national standard test program for pesticide creation center of South China [8], a certain quality of

the original medicine was used with the analytical balance (0.0001 g) ,and made the mother liquor of 1.0%~5.0% with the DMF of 1% Twain -80 emulsifier, then diluted it with distilled water. Referring to the "National South China Center for pesticide creation, bioassay program", six weeds were selected for potting activity test (screening compounds), and the results were investigated after 25 days. The results of screening were listed at the dosage was 150 g a.i/hm2, Metamifop ,a commercially available herbicide, was selected as the positive control at the dosage of 150g/hm^2.

RESULTS AND DISSCUSSION

To analysize of compound 3A spectrurm, the chemical shifts in 1.58 and 4.67, the coupling constant, which was shown the environment of hydrogen, respectively. Aryloxy phenoxy acid CH_3 and methyl hydrogen, 3.70 and 3.90 position. The results of pot experiment (Table 1) showed that the effective components in 150 g a.i/hm2 dose postemergence foliar spray treatment, compound 3a and 3b exhibited excellent herbicidal activities against monocotyledonous weeds, 3a and 3b showed 100% inhibition against *Digitaria sanguinalis*, *Echinochloa crusgalli* and *Setaria viridis*,which were better than Metamifop (150 g a.i./hm2) .Two compounds showed no herbicidalactivity on dicotyledonous weeds. The compounds these compounds would be used as lead compound for further development.

Table 1: The herbicidal activity of compound 3a and 3b

Compund	Abutilon theophrasti Medicus	*Amaranthus retroflexus*	Eclipta prostrata	*Digitaria sanguinalis*	*Echinochloa crusgalli*	Setaria viridis
3a	0	0	0	100	100	100
3b	0	0	0	100	100	100
Metamifop	0	0	0	70	80	75

Note：Metamifop：150 g a.i./hm^2

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