

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIRECCIÓN DE NUEVAS CREACIONES

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

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Patente de Invención ☒ Patente de Modelo de Utilidad ☐
Vía Nacional ☐
Vía PCT (fase nacional) ☒ Cap. I ☐ Cap. II ☒

No. Sol. Internacional: PCT/US2008/069415
Fecha de Presentación Internacional: 2008-07-08.

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

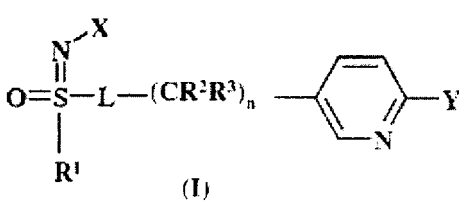
1. Documentos estudiados

Descripción:	Folios 102-186 y 190	2010-01-13
Reivindicaciones:	Folios 187-189	2010-01-13
Prioridad: US 60/691319	Folio 1	2007-07-20

2. Objeto de la invención

Título de la solicitud: Aumento de vigor de la planta. Folio 1.

Objeto de la invención: El objeto de la presente solicitud de patente de invención se refiere a un proceso para el aumento del vigor de una planta que comprende poner en contacto una composición que comprende un compuesto de formula (I) con semillas antes de sembrar dichas semillas.



El problema técnico planteado en la presente solicitud de patente radica en la necesidad de diseñar nuevos pesticidas que tengan nuevos modos de acción, especialmente que puedan aumentar el vigor de una planta. Para solucionar ese

problema técnico la presente solicitud plantea un proceso para el aumento del vigor de una planta que comprende poner en contacto una composición que comprende un compuesto de fórmula (I) con semillas antes de sembrar dichas semillas.

El objeto de la presente Solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): C07D 491/10, 493/10, A01N 43/12.

3. Análisis de la Prioridad

Se acepta la reivindicación de Prioridad porque esta solicitud fue presentada dentro del plazo establecido (Art. 9 D 486), y su contenido técnico corresponde con el de la prioridad reivindicada.

4. Excepción a la Patentabilidad (Art 20 D 486 literal (c))

El objeto de las reivindicaciones 3 y 4 no es patentable de acuerdo con el literal c del Art 20 de la Decisión 486. Puesto que incluye materia no patentable.

Se llama la atención del solicitante en cuanto a que las semillas que han sido tratadas con el compuesto de fórmula (I), son formas de vida que se encuentran en la naturaleza y a las cuales no se les ha alterado de ninguna manera su genoma, por lo tanto no pueden ser protegidas vía patente de invención. Sírvese retirar dichas reivindicaciones.

5. De la solicitud de Patente

Descripción (artículo 28)

La descripción no divulga la invención de manera suficientemente clara y completa para su comprensión y para que una persona medianamente versada en la materia puede ejecutarla debido a que no hace referencia a la tecnología anterior conocida que fuere útil para la comprensión de la invención, así como tampoco hace referencia a una clara definición del problema técnico y la forma como esta invención lo soluciona, citando, por ejemplo, diferencias y eventuales ventajas con respecto a la tecnología anterior. Asimismo tampoco incluye información acerca de la mejor manera de llevar a cabo la invención.

En consecuencia la descripción no cumplió con el requisito de claridad y/o **divulgación completa** de acuerdo al art. 28 de la Decisión 486 y el art. 22 del Tratado PCT.

Reivindicaciones (artículo 30 D 486)

El capítulo reivindicatorio es demasiado amplio y no cumple con el requisito de concisión; asimismo se considera una generalización que no se encuentra enteramente sustentada en la descripción.

Se llama la atención del solicitante en cuanto a que el proceso de interés es presentado de forma completamente amplia, sin definirse específicamente las características técnicas esenciales del mismo, es decir las etapas de proceso que lo caracterizan y las condiciones de ejecución de las mismas. Sírvese definir específicamente el objeto y alcance de la invención.

En consecuencia, el capítulo reivindicatorio no cumple con el requisito de concisión, claridad y sustento en la descripción de acuerdo al art. 30 de la Decisión 486.

6. Determinación del Estado de la Técnica

Considerando que la fecha de la prioridad de la solicitud internacional PCT es 2007-07-20, se realizó la búsqueda en el estado de la técnica y se encontraron los documentos relacionados a continuación, que pueden afectar la patentabilidad del objeto de la presente solicitud:

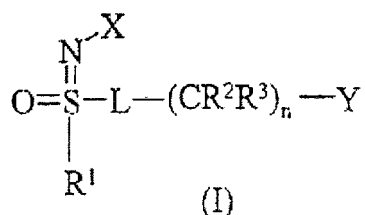
Nº	Documento	Título	Fecha de publicación
D1	WO2006060029	Insecticidal N-substituted sulfoximines	2006-06-08
D2	CO08-80047 equivalente WO2007095229	Insecticidal N-substituted (6-haloalkylpyridin-3-yl)alkyl sulfoximines	Fecha de prioridad 2006-02-10 fecha de radicación vía nacional 2008-08-06
D3	XP002509292	Synthesis and insecticidal activity of new 2-(5-(trifluoromethyl)pyridyloxymethyl)-1,3,4-oxadiazoles <i>journal of fluorine chemistry</i> , 20020101 <i>elsevier</i> , NL Vol:117, Page(s):63 - 66	2002

El solicitante podrá consultar el documento citado en la siguiente URL:

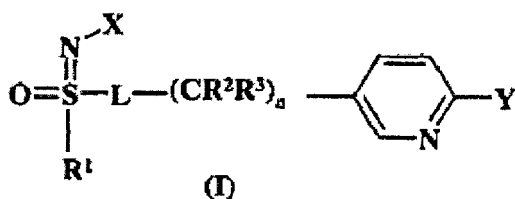
El solicitante podrá consultar el documento citado en la siguiente URL:
http://worldwide.espacenet.com/publicationDetails/citedDocuments?CC=WO&NR=2009014891A2&KC=A2&FT=D&ND=3&date=20090129&DB=EPODOC&locale=en_EP

Documento D3 anexado.

El documento D1 hace referencia a derivados pesticidas de fórmula (I), composiciones que los contienen y métodos de uso de los mismos.



El documento D2 hace referencia a 6-(haloalquilpiridin-3-il)alquil-sulfoximinas N sustituidas de fórmula (I) y métodos de uso para controlar insectos.



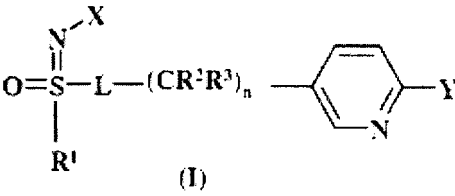
El documento D3 hace referencia a la síntesis de nuevos 2-(5-(triflorometil)piridiloximetil)-1,3,4-oxadiazoles con actividad insecticida.

7. Examen de patentabilidad (artículo 14 D486)

Novedad (artículo 16 D486)

La solicitud de patente en estudio presenta en la reivindicación 1 un proceso para el

aumento del vigor de una planta, dichos proceso comprende poner en contacto una composición que comprende un compuesto que tiene la siguiente formula general (I) con semillas, antes de sembrar dichas semillas.



En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta (60) días contados a partir de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante para los sesenta (60) días y presentarla por escrito.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.



JOSÉ LUIS SALAZAR LÓPEZ

Director de Nuevas Creaciones (C)

El anterior requerimiento fue notificado por fijación en lista, de fecha

13 NOV. 2012

Elaboró: Sandra Isabel Calderón
Revisó: Jacqueline Alfonso

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Syntheses and insecticidal activity of new 2-(5-(trifluoromethyl)pyridyloxymethyl)-1,3,4-oxadiazoles

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Abstract

Eight 2-(5-(trifluoromethyl)pyridyloxymethyl)-1,3,4-oxadiazoles have been designed and synthesized by four-step synthetic route. The structures of all new compounds were confirmed by ¹H NMR, mass and HR mass spectroscopy. The preliminary bioassay tests show that some compounds, especially those having fluorine on the benzene ring (**II**₄ and **II**₅), exhibited a significant insecticidal activity on armyworm, *Leucania separata* Walker, at 500 mg l⁻¹.

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Keywords: Trifluoromethylpyridyl; 1,3,4-Oxadiazoles; Syntheses; Insecticidal activity

1. Introduction

Much attention has been paid to 1,3,4-oxadiazole derivatives in recent years because of their showing antiinflammatory [1,2], antimicrobial [3], insecticidal [4], acaricidal activities [5]. 2,5-Disubstituted-1,3,4-oxadiazoles were disclosed as a broad-spectrum insecticide and acaricide having potential agricultural use [6,7]. In contrast to traditional pesticides, they mainly control the growth and development process of insects by interfering with chitin biosynthesis [8]. But 2,5-disubstituted-1,3,4-oxadiazoles, due to their low solvent solubility, tend to have a non-optimal use rate and formulation difficulties. With this in mind, our attention was drawn to changing the physical properties associated with oxadiazoles while attempting to retain or increase their biological efficacy through modification of substituent oxadiazoles [9–11].

The chemistry of fluorine-containing compounds has been tremendously developed. Owing to their unique properties, such as high thermal stability and lipophilicity, fluoro organic compounds have been frequently applied to bio-related materials, medicines and agrochemicals [12]. In addition, the trifluoromethyl (CF₃) group considered a

'pseudo-halogen', has often been found to impart unique biological activity [13]. In pesticides chemistry, the significance of 3-trifluoromethylpyridine has been well recognized. More than three commercial pesticides (herbicides: Fusilade 5[®], SL 160; insecticide: Jupiter[®]) containing trifluoromethylpyridine analogs whose superior properties might be considered to be arisen from 3-trifluoromethylpyridine moiety, have been manufactured and used widely [12].

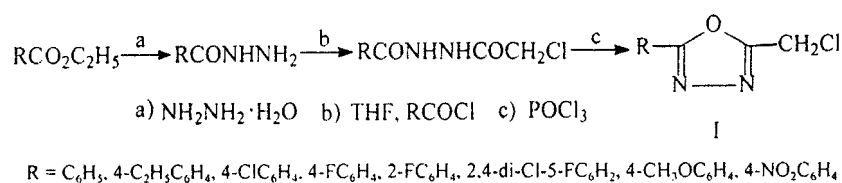
In the last few years, we were pursuing investigations on the synthesis and reactivity of pyridine containing fluorine or trifluoromethyl [14–16]. In an attempt to discover novel leading compounds with high insecticidal and low toxicity, and also in continuation of our earlier research, this paper describes synthesis and biological activities of new 2-(5-(trifluoromethyl)pyridyloxymethyl)-1,3,4-oxadiazoles. The preliminary bioassay tests show that some compounds (**II**₄, **II**₅) exhibit a significant insecticidal activity on armyworm, *Leucania separata* Walker.

2. Results and discussion

2.1. Synthesis

Starting from different esters, mono-acylhydrazines, *N,N'*-diacylhydrazines and asymmetrical 2,5-disubstituted-1,3,4-oxadiazoles were prepared (Scheme 1). All the key

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Scheme 1. Conventional synthetic route for 5-aryl-2-chloromethyl-1,3,4-oxadiazoles (I).

intermediate 5-aryl-2-chloromethyl-1,3,4-oxadiazoles (**I**) were prepared by the cyclodehydration of *N*-chloroacetyl-*N'*-aroylhydrazines in boiling POCl₃ (Scheme 1). The final compounds (**II**₁₋₈) have been obtained by *O*-alkylation of 3-chloro-5-(trifluoromethyl)-2-pyridone and 3-(trifluoromethyl)phenol with 5-aryl-2-chloromethyl-1,3,4-oxadiazoles (**I**) at 80 °C in the presence of phase transfer catalyst and powdery K₂CO₃ in DMF (Scheme 2). It is a convenient and useful method for the preparation of the title compounds.

The lowest-field protons in the ^1H NMR spectrum appear at $\delta = 7.95\text{--}8.06$ which are assigned to protons of Π_{1-8} of aromatic ring. The other protons of aromatic ring appear at $\delta = 7.49\text{--}7.60$. These chemical shift values are downfield due to stronger electron-withdrawing oxadiazole ring. The H-4, H-6 of pyridine ring appear at $\delta = 7.70$ and 7.90 , respectively, as a doublet with a coupling constant of 2.24 Hz , indicating *meta* coupling.

2.2. Insecticidal activities

We examined the biological activity of the 2-(5-(trifluoromethyl)pyridyloxymethyl)-5-aryl-1,3,4-oxadiazoles (**II**) having a variety of substituents on the benzene ring. The insecticidal activity of **II** against armyworm (*Leucania separata* Walker) was measured according to the modified method described previously [9,11], and is shown in Table 1. Results are presented as percent mortality determined at 500 mg l⁻¹. In general, the effect of electron-withdrawing substituents, such as halogens were more favorable to activity than those of electron-donating alkyl and alkoxy groups. The introduction of F on the benzene ring increased activity, for example, compounds **II**₄, **II**₅ (*o*-F and *p*-F) were the most active compounds. But a strong electron-with-

Table 1
Percent mortality (%) of Π_{1-9} against armyworms at 500 mg l⁻¹

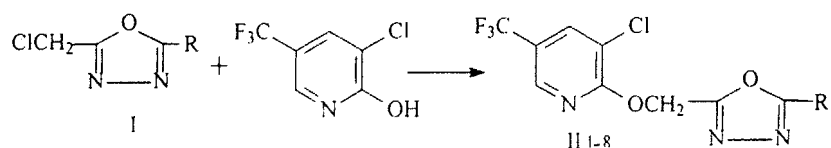
Compound	R	Mortality (%)
II ₁	C ₆ H ₅	30
II ₂	4-C ₂ H ₅ C ₆ H ₄	28
II ₃	4-ClC ₆ H ₄	84
II ₄	4-FC ₆ H ₄	90
II ₅	2-FC ₆ H ₄	96
II ₆	2,4-di-Cl-5-FC ₆ H ₂	60
II ₇	4-CH ₃ OC ₆ H ₄	18
II ₈	4-NO ₂ C ₆ H ₄	25
II ₉		0

drawing group, NO₂, decreased activity. Compound **II**₉ was designed to probe the effect of replacing the pyridyl with phenyl (Scheme 3). It is clear that such modification led to loss of biological activity, suggesting that pyridyl is critical to activity.

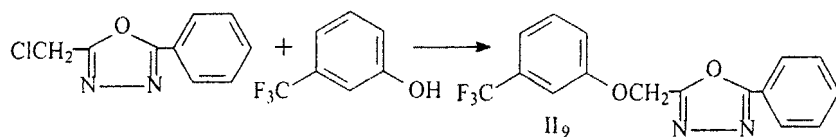
Though these compounds possess only modest biological activity, they may be useful as lead products for further structure-activity relationship studies.

3. Experimental

All melting points (mp) were obtained with an electrothermal digital apparatus made in Shanghai and are uncorrected. ^1H NMR spectra were recorded on a Bruker WP-500SY (500 MHz) spectrometer with CDCl_3 as the solvent and TMS as the internal standard. Chemical shifts are reported in δ (parts per million) values. Mass spectra were obtained by Micromass GCT CA055. Analytical thin layer chromatography (TLC) was carried out on precoated



Scheme 2. Synthesis of 2-(5-(trifluoromethyl)pyridyloxymethyl)-5-aryl-1,3,4-oxadiazoles (**II**₁₋₈).



Scheme 3. Synthesis of 2-(3-(trifluoromethyl)phenoxy)methyl)-5-phenyl-1,3,4-oxadiazole (**II**₉).

plates (silica gel 60 F₂₅₄), and spots were visualized with ultraviolet (UV) light.

3.1. Preparation of 3-chloro-5-trifluoromethyl-2-pyridone

Preparation of 3-chloro-5-trifluoromethyl-2-pyridone was performed according to the known method [17].

3.2. Preparation of *N*-chloroacetyl-*N'*-aroylhydrazines

Preparation of *N*-chloroacetyl-*N'*-aroylhydrazines were performed according to the quoted literature [18]. The ¹H NMR and melting point for the typical compound *N*-chloroacetyl-*N'*-(2,4-dichloro-5-fluorophenyl)hydrazine: δ 4.39 (s, 2H, CH₂), 7.64 (d, 1H, ArH), 8.09 (d, 1H, ArH), 10.69 and 11.23 (2s, 2H, CONHNHCO), mp 194–195 °C.

3.3. General synthetic procedure for 5-aryl-2-chloromethyl-1,3,4-oxadiazoles (I)

The mixture of the *N*-chloroacetyl-*N'*-aroylhydrazine (5 mmol) and POCl₃ (10 ml) was refluxed for 3 h [18]. After cooling to room temperature, it was poured slowly into an ice and water mixture. The resulting precipitate was filtered, washed, dried and recrystallized from ethanol to produce the pure oxadiazole **I**. The ¹H NMR and melting point for the typical compounds: 5-(4-chlorophenyl)-2-chloromethyl-1,3,4-oxadiazole δ 4.78 (s, 2H, CH₂), 7.50 (d, 2H, ArH), 8.04 (d, 2H, ArH), mp 130–131 °C; 5-(2,4-chloro-5-fluorophenyl)-2-chloromethyl-1,3,4-oxadiazole δ 4.80 (s, 2H, CH₂), 7.65 (d, 1H, ArH), 7.87 (d, 1H, ArH), mp 100–101 °C; 5-(4-fluorophenyl)-2-chloromethyl-1,3,4-oxadiazole δ 4.78 (s, 2H, CH₂), 7.19 (m, 2H, ArH), 7.90 (m, 2H, ArH), mp 79–80 °C.

3.4. General procedure for the preparation of 2-(5-(trifluoromethyl)pyridyloxymethyl)-5-aryl-1,3,4-oxadiazoles (II_{1–8})

A mixture of 3-chloro-5-trifluoromethyl-2-pyridone (2.5 mmol), anhydrous potassium carbonate (8 mmol), tetrabutyl ammonium bromide (0.2 mmol) and dry DMF (5 ml), was stirred at 90 °C for 0.5 h. To the mixture was added 5-aryl-2-chloromethyl-1,3,4-oxadiazole (**I**) (2.5 mmol) and dry DMF (5 ml). The reaction mixture was stirred at 90 °C for 2–4 h. After cooling, the mixture was treated with water (30 ml), and extracted with chloroform (3 × 15 ml). The organic layer was washed with water, dried with MgSO₄ and concentrated. The residue was chromatographed over a column of silica gel and eluted with petroleum ether (60–90 °C) and ethyl acetate. The title compound was obtained.

3.4.1. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-phenyl-1,3,4-oxadiazole (II₁)

Yield 71%, mp 113–114 °C, ¹H NMR (CDCl₃) δ 8.03 (m, 2H, ArH), 7.93 (d, *J* = 2.31 Hz, 1H, PyH), 7.70 (d,

J = 2.35 Hz, 1H, PyH), 7.56 (m, 1H, ArH), 7.49 (m, 2H, ArH), 5.53 (s, 2H, CH₂). MS: *m/z* 355 (M⁺, 100), 159 (8), 105 (19). HRMS Calc. for C₁₅H₉ClF₃N₃O₂: 355.7033; Found: 355.7062.

3.4.2. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(4-ethylphenyl)-1,3,4-oxadiazole (II₂)

Yield 74%, mp 143–146 °C, ¹H NMR (CDCl₃) δ 7.95 (d, 2H, ArH), 7.91 (d, *J* = 2.15 Hz, 1H, PyH), 7.70 (d, *J* = 2.19 Hz, 1H, PyH), 7.33 (d, 2H, ArH), 5.52 (s, 2H, CH₂), 2.71 (q, 2H, CH₂), 1.25 (t, 3H, CH₃). MS: *m/z* 383 (M⁺, 83), 187 (22), 133 (100). HRMS Calc. for C₁₇H₁₃ClF₃N₃O₂: 383.0648; Found: 383.0651.

3.4.3. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(4-chlorophenyl)-1,3,4-oxadiazole (II₃)

Yield 69%, mp 118–120 °C, ¹H NMR (CDCl₃) δ 7.98 (d, 2H, ArH), 7.90 (d, *J* = 2.21 Hz, 1H, PyH), 7.71 (d, *J* = 2.24 Hz, 1H, PyH), 7.21 (d, 2H, ArH), 5.51 (s, 2H, CH₂). MS: *m/z* 389 (M⁺, 68), 193 (16), 139 (100). HRMS Calc. for C₁₅H₈Cl₂F₃N₃O₂: 388.9946; Found: 388.9944.

3.4.4. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(4-fluorophenyl)-1,3,4-oxadiazole (II₄)

Yield 77%, mp 158–159 °C, ¹H NMR (CDCl₃) δ 8.05 (m, 2H, ArH), 7.89 (d, *J* = 2.23 Hz, 1H, PyH), 7.71 (d, *J* = 2.24 Hz, 1H, PyH), 7.21 (m, 2H, ArH), 5.51 (s, 2H, CH₂). MS: *m/z* 373 (M⁺, 100), 177 (22), 123 (85). HRMS Calc. for C₁₅H₈ClF₄N₃O₂: 373.0241; Found: 373.0266.

3.4.5. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(2-fluorophenyl)-1,3,4-oxadiazole (II₅)

Yield 70%, mp 124–125 °C, ¹H NMR (CDCl₃) δ 7.96 (m, 1H, ArH), 7.84 (d, *J* = 2.05 Hz, 1H, PyH), 7.64 (d, *J* = 2.04 Hz, 1H, PyH), 7.50 (m, 1H, ArH), 7.22 (m, 2H, ArH), 5.47 (s, 2H, CH₂). MS: *m/z* 373 (M⁺, 100), 177 (8), 123 (56). HRMS Calc. for C₁₅H₈ClF₄N₃O₂: 373.0241; Found: 373.0244.

3.4.6. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(2,4-dichloro-5-fluorophenyl)-1,3,4-oxadiazole (II₆)

Yield 75%, mp 149–150 °C, ¹H NMR (CDCl₃) δ 7.88 (m, 1H, ArH), 7.84 (d, *J* = 2.35 Hz, 1H, PyH), 7.72 (d, *J* = 2.38 Hz, 1H, PyH), 7.64 (m, 1H, ArH), 5.53 (s, 2H, CH₂). MS: *m/z* 441 (M⁺, 64), 238 (19), 191 (100). HRMS Calc. for C₁₅H₆Cl₃F₄N₃O₂: 440.9462; Found: 440.9458.

3.4.7. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(4-methoxyphenyl)-1,3,4-oxadiazole (II₇)

Yield 73%, mp 168–169 °C, ¹H NMR (CDCl₃) δ 7.90 (d, 2H, ArH), 7.82 (d, *J* = 2.04 Hz, 1H, PyH), 7.63 (d, *J* = 2.05 Hz, 1H, PyH), 6.93 (d, 2H, ArH), 5.43 (s, 2H, CH₂), 3.78 (t, 3H, OCH₃). MS: *m/z* 385 (M⁺, 100), 189 (37),

135 (77). HRMS Calc. for $C_{16}H_{11}ClF_3N_3O_3$: 385.0441; Found: 385.0445.

3.4.8. 2-(5-(Trifluoromethyl)pyridyloxymethyl)-5-(4-nitrophenyl)-1,3,4-oxadiazole (II**₈)**

Yield 78%, mp 161–162 °C, ^1H NMR ($CDCl_3$) δ 8.15 (d, 2H, ArH), 7.98 (d, $J = 2.20$ Hz, 1H, PyH), 7.82 (d, $J = 2.24$ Hz, 1H, PyH), 7.34 (d, 2H, ArH), 5.55 (s, 2H, CH_2). MS: m/z 400 (M^+ , 100), 250 (28), 150 (68). HRMS Calc. for $C_{15}H_8ClF_3N_4O_4$: 400.7002; Found: 400.7021.

3.5. Procedure for preparation of 2-(3-(trifluoromethyl)phenoxyethyl)-5-phenyl-1,3,4-oxadiazole (II**₉)**

A mixture of 3-trifluoromethyl phenol (2.5 mmol), anhydrous potassium carbonate (8 mmol), tetrabutyl ammonium bromide (0.2 mmol) and dry DMF (5 ml), was stirred at 90 °C for 0.5 h. To the mixture was added 5-phenyl-2-chloromethyl-1,3,4-oxadiazoles (2.5 mmol) and dry DMF (5 ml). The reaction mixture was stirred at 90 °C for 3 h. After cooling, the mixture was poured slowly into water. The resulting precipitate was filtered, washed, dried and recrystallized from ethanol to produce white powdery crystals.

Yield 80%, mp 126–127 °C, ^1H NMR ($CDCl_3$) δ 8.09 (m, 2H, ArH), 7.57 (m, 1H, ArH), 7.54 (m, 2H, ArH), 7.45 (m, 1H, ArH), 7.33 (m, 2H, ArH), 7.26 (m, 1H, ArH), 5.38 (s, 2H, CH_2). MS: m/z 320 (M^+ , 20), 159 (95), 105 (100). HRMS Calc. for $C_{16}H_{11}F_3N_2O_2$: 320.2694; Found: 320.2682.

Acknowledgements

We express our gratitude to the National Natural Science Foundation of China and Shanghai Foundation of Science and Technology for financial support.

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