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(54) Benævnelse: **FORBEDRET FREMGANGSMÅDE TIL FREMSTILLING AF 4-(1-(4-(PERFLUOROETHOXY)PHENYL)-1H-1,2,4-TRIAZO-3-YL)BENZOYLAZID**

(56) Fremdragne publikationer:
US-A- 5 736 528
US-A1- 2006 014 777
US-A1- 2007 078 156
US-A1- 2009 209 476
A Arrieta ET AL: "N,N-DIMETHYLCHLOROSULPITEMETHANIMINIUM CHLORIDE (SOC12-DMP) A VERSATILE DEHYDRATING REAGENT", , vol. 25, no. 31 1 January 1984 (1984-01-01), 1984, pages 3365-3368, XP055429605, Retrieved from the Internet: URL:https://ac.els-cdn.com/S00404039018138 61/1-s2.0-S0040403901813861-main.pdf?_tid= 15a5a80c-d437-11e7-b97e-00000aab0f6c&acdna t=1511872051_9b92c24f2285efdb829e262d59991 fce
KANGANI ET AL: "Direct, facile synthesis of acyl azides and nitriles from carboxylic acids using bis(2-methoxyethyl)aminosulfur trifluoride", TETRAHEDRON LETTERS, ELSEVIER, AMSTERDAM, NL, vol. 48, no. 34, 20 August 2007 (2007-08-20), pages 5933-5937, XP022169095, ISSN: 0040-4039, DOI: 10.1016/J.TETLET.2007.06.119
GUMASTE V K ET AL: "A mild and efficient method for the preparation of acyl azides from carboxylic acids using triphosgene", TETRAHEDRON LETTERS, vol. 43, no. 7, 2002, pages 1345-1346, XP085016068, ISSN: 0040-4039, DOI: 10.1016/S0040-4039(01)02377-2
Susumu Kobayashi ET AL: "Creation of novel chiral synthons with enzymes and applications to natural

Fortsættes ...

product synthesis", Tetrahedron Letters, vol. 25, no. 24 1 January 1984 (1984-01-01), 1984, pages 2557-2560, XP055429629, Retrieved from the Internet: URL:https://ac.els-cdn.com/S00404039018123 02/1-s2.0-S0040403901812302-main.pdf?_tid= 4ce4af8a-d43b-11e7-8d4c-00000aacb362&acdna t=1511873862_c301b8499c4384e83a2d679c8e54e 1e1 [retrieved on 2017-11-28]
NAJMEH NOWROUZI ET AL: "One-pot, direct synthesis of acyl azides from carboxylic acids using PhPCl/I/NaNreagent system", CHINESE CHEMICAL LETTERS, vol. 23, no. 4, 2012, pages 442-445, XP028474804, ISSN: 1001-8417, DOI: 10.1016/J.CCLET.2012.01.031 [retrieved on 2012-01-20]

DESCRIPTION

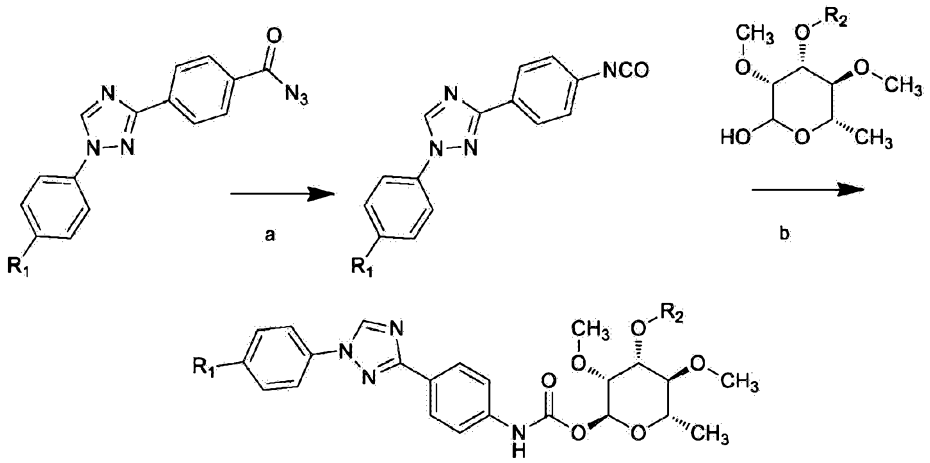
CROSS REVERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of, and priority from U.S. Provisional Patent Application Serial No. 62/023,225 filed 11 July 2014.

BACKGROUND OF THE INVENTION

[0002] The present invention concerns an improved process for preparation of 4-(1-(4-(perfluoroethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoyl azide.

[0003] U.S. Patent 8,178,658 describes, *inter alia*, certain triaryl rhamnose carbamates and their use as insecticides. One of the methods used to prepare such triaryl compounds is by way of the following 2 step process

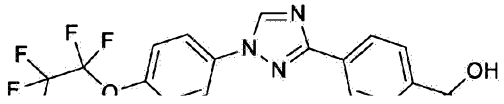


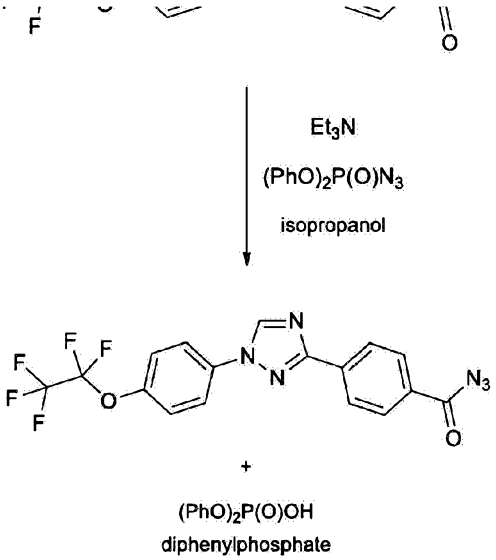
wherein

R_1 represents (C_1-C_6) haloalkyl or (C_1-C_6) haloalkoxy, and

R_2 represents (C_1-C_6) alkyl, (C_2-C_6) alkenyl, or (C_2-C_6) alkynyl, in which a triaryl acyl azide is converted to an isocyanate followed by reaction with a tetrahydropyran-2-ol and a strong base to give the triaryl rhamnose carbamate pesticide.

[0004] U.S. Patent 8,178,658 describes the preparation of 4-(1-(4-(perfluoroethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoyl azide from 4-(1-(4-(perfluoroethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoic acid and the azide transfer agent diphenylphosphorylazide.

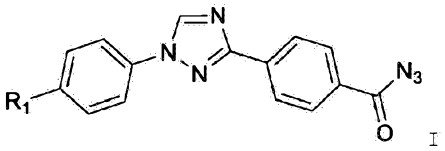




However, diphenylphosphorylazide is a very expensive reagent and is only available in research quantities. Additionally, diphenylphosphorylazide gives yields of the desired acyl azide in the range of 60-80% and the by-product diphenylphosphate is not water soluble and is difficult to remove from acyl azide. Consequently the acyl azide is usually contaminated with 5-10% of the diphenylphosphate. It would also be desirable to prepare 4-(1-(4-(perfluoro-ethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoyl azide from 4-(1-(4-(perfluoro-ethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoic acid in high yield (85-95%) using inexpensive commercially available reagents. It would also be desirable if the by-products could be easily removed from the acyl azide.

SUMMARY OF THE INVENTION

[0005] The present invention provides such conditions. Thus, the present invention concerns a process for preparing certain triaryl acyl azides of the Formula (I),



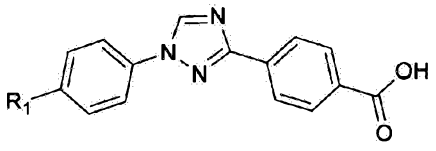
I

wherein

R_1 represents (C_1-C_6) haloalkyl or (C_1-C_6) haloalkoxy,

which comprises

1. a) contacting a triaryl acid of Formula (II)

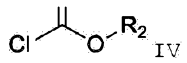


II

wherein

R_1 is as previously defined,

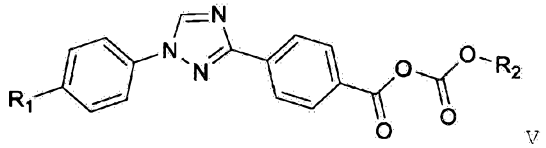
with chlorocarbonate of Formula (IV)



IV

wherein

R_2 represents (C_1-C_6) alkyl, phenyl or benzyl, in the presence of a base in an organic solvent that is tetrahydrofuran or dimethoxyethane to provide a triaryl mixed anhydride of Formula (V)



V

wherein

R_1 and R_2 are as previously defined, and

2. b) contacting the triaryl mixed anhydride of Formula (V) with an aqueous solution of sodium azide in the organic solvent tetrahydrofuran or dimethoxyethane.

[0006] In another embodiment of the invention, R_1 represents OCF_2CF_3.

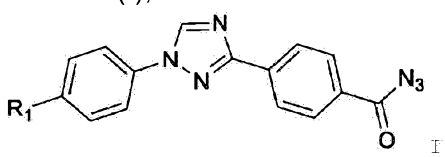
[0007] In another embodiment of the invention, R_2 represents CH_2CH_3, $C(CH_3)_3$ or $CH_2C_6H_5$.

DETAILED DESCRIPTION OF THE INVENTION

[0008] Throughout this document, all temperatures are given in degrees Celsius, and all percentages are weight percentages unless otherwise stated.

[0009] The term "alkyl", as well as derivative terms such as "haloalkyl" and "haloalkoxy", as used herein, include within their scope straight chain, branched chain and cyclic moieties. Thus, typical alkyl groups are methyl, ethyl, propyl, butyl, pentyl, hexyl, 1-methylethyl, 1,1-dimethylethyl, 1-methylpropyl, 2-methylpropyl, cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. The terms "haloalkyl" and "haloalkoxy" includes alkyl or alkoxy groups substituted with from one to the maximum possible number of halogen atoms, all combinations of halogens included. Unless specifically defined otherwise, the term "halogen" or "halo" includes fluorine, chlorine, bromine and iodine, with fluorine being preferred.

[0010] The present invention concerns a process for preparing certain triaryl acyl azides of the Formula (I),

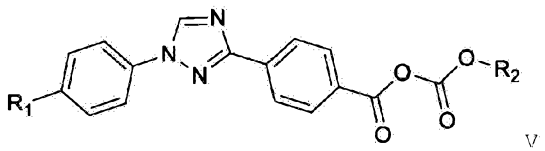


I

wherein

R_1 represents (C_1-C_6) haloalkyl or (C_1-C_6) haloalkoxy.

By forming a triaryl mixed anhydride of Formula (V)



V

wherein

R_1 represents (C_1-C_6) haloalkyl or (C_1-C_6) haloalkoxy, and

R_2 represents C_1-C_6 alkyl, phenyl or benzyl

and subsequently treating with aqueous sodium azide, triaryl acyl azides are prepared in high yield (85-95%) using inexpensive commercially available reagents in a process in which by-products are easily removed from the triaryl acyl azide.

[0011] The conversion of the triaryl acid II to the triaryl mixed anhydride V is conducted by treating the triaryl acid II with a (C_1-C_6) alkyl, phenyl or benzyl chlorocarbonate in the presence of a base in an organic solvent that is inert to the chlorocarbonate at a temperature from about 0 °C to about 60°C. Approximately a 1:1 molar ratio of the triaryl acid II and chlorocarbonate may be used, however, a slight excess of chlorocarbonate is preferred.

[0012] Similarly, approximately a 1:1 molar ratio of base to chlorocarbonate is required as an acid acceptor. Suitable bases include alkali metal carbonates and amine bases. Tertiary amine bases like triethylamine and aromatic amine bases like pyridine are preferred.

[0013] Since it is most convenient to use the triaryl mixed anhydride V in the second step without isolation, the inert organic solvent is the same for both steps. Preferably, the inert organic solvent should be miscible with water. The inert water-miscible organic solvents used in the present process are tetrahydrofuran or dimethoxyethane.

[0014] In the second step, the triaryl mixed anhydride V is reacted with an aqueous solution of sodium azide in an inert organic solvent at a temperature from about 0 °C to about ambient. Approximately a 1:1 molar ratio of the triaryl mixed anhydride V and sodium azide may be used, however, a slight excess of sodium azide is preferred.

[0015] In the second step, triaryl mixed anhydride V is reacted with an aqueous solution of sodium azide in the inert organic solvent described above.

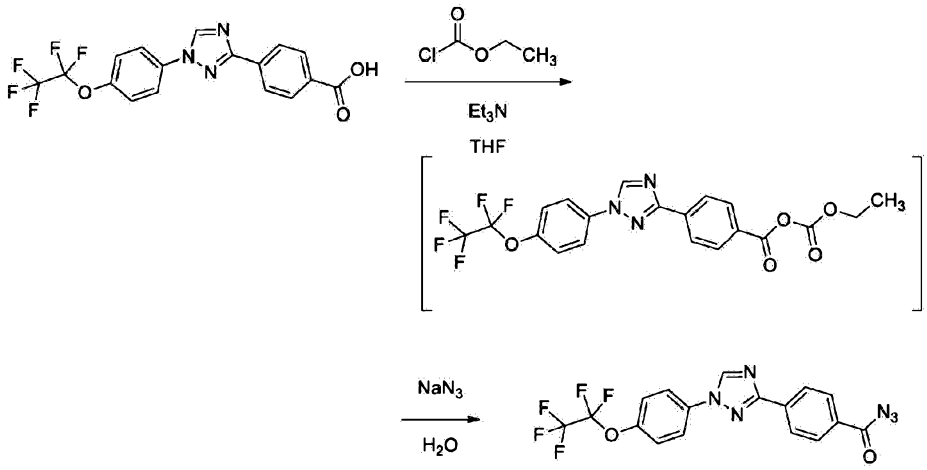
[0016] In a typical reaction, the triaryl acid II is dissolved or suspended in the inert organic solvent. The mixture is cooled to about 10 °C and the base is added. The mixture is further cooled to about 0 °C and the chlorocarbonate is added at a rate to maintain the temperature at about 5 °C. The mixture is stirred until the reaction is completed. The mixture is again cooled to about 0 °C and aqueous sodium azide is added at a rate to maintain the temperature at about 5 °C. After completion of the reaction, the mixture is diluted with water and the solid product collected by filtration.

[0017] The following example is presented to illustrate the invention.

EXAMPLE

Preparation of 4-(1-(4-(perfluoroethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoyl azide from mixed anhydride

[0018]



[0019] Into a 3-L, three-neck round bottom flask equipped with overhead stirrer, temperature probe, addition funnel, and nitrogen inlet, was added 4-(1-(4-(perfluoroethoxy)phenyl)-1*H*-1,2,4-triazol-3-yl)benzoic acid (100 g, 238 mmol) and tetrahydrofuran (550 mL). This gave a brown solution which was cooled to 9 °C and triethylamine (36.9 mL, 262 mmol) was added all at once. The temperature rose from 9 °C to 11 °C. The solution was cooled back down to 1.4 °C and ethyl chloroformate (28.7 g, 25.3 mL, 262 mmol) was added drop wise over a 12 minute period. The mixture exothermed from 1.4 °C to 5.5 °C, with the average addition temperature being 4.4 °C. The mixture was allowed to stir for 30 minutes and assayed by LCMS (reaction complete). To the reaction mixture, at 0.3 °C, was ***slowly*** added a solution of sodium azide (17.01 g, 262 mmol) in water (300 mL). The azide solution was added at such a rate as to keep the temperature below 4 °C. After addition was complete, the mixture was allowed to stir at 0 °C for 2 hours. The ice bath was removed and a sample was pulled while still cold (5 °C) and assayed by LCMS and ^{1}H NMR (reaction complete). The reaction was allowed to stir for 16 hours at 25 °C. The reaction was cooled to 5.5 °C, water was slowly added (1100 mL) over 20 minutes. The mixture exothermed from 5.5 °C to 11.5 °C and was stirred at <10 °C for 1 hour. The solids were collected by vacuum filtration, washed with water (3 x 500 mL), and vacuum dried under a stream of nitrogen to constant weight providing the title compound as a white solid (95.3 g, 90%): ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.61 (s, 1H), 8.35 - 8.23 (m, 2H), 8.19 - 8.07 (m, 2H), 7.82 (d, *J* = 9.0 Hz, 2H), 7.42 (d, *J* = 8.9 Hz, 2H); EIMS *m/z* 425 ([M^+]).

REFERENCES CITED IN THE DESCRIPTION

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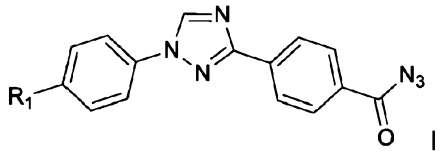
Patent documents cited in the description

- US62023225A **[0001]**
- US8178658B **[0003]** **[0004]**

Patentkrav

1. Fremgangsmåde til fremstilling af visse triarylacylazider med formlen (I),

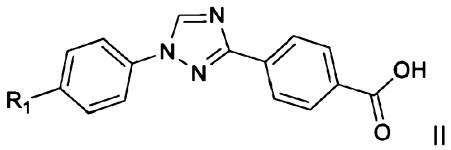


I

hvori

R_1 repræsenterer (C_1-C_6)-halogenalkyl eller (C_1-C_6)-halogenalkoxy, hvilken fremgangsmåde omfatter

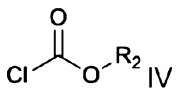
a) at kontakte en triarylsyre med formel (II)



II

hvori

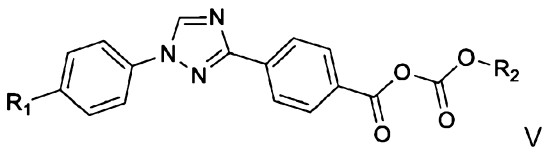
R_1 er som tidligere defineret, med chlorcarbonat med formel (IV)



IV

hvori

R_2 repræsenterer (C_1-C_6)-alkyl, phenyl eller benzyl, i nærvær af en base i et organisk opløsningsmiddel, der er tetrahydrofuran eller dimethoxyethan, for at tilvejebringe et triarylblandet anhydrid med formel (V)



V

hvori

R_1 og R_2 er som tidligere defineret, og

b) at bringe triarylblandet anhydrid med formel (V) i kontakt med en vandig opløsning af natriumazid i det organiske opløsningsmiddel tetrahydrofuran eller dimethoxyethan.

2. Fremgangsmåden ifølge krav 1, hvori R_1 er OCF_2CF_3.

3. Fremgangsmåden ifølge krav 1, hvori R_2 er CH_2CH_3.

4. Fremgangsmåden ifølge krav 1, hvor basen er et alkalimetalcarbonat, en tertiær amin eller en aromatisk amin.