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(13) **T2**

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(54) **Eljárások HIV-kötésinhibitor prodrugvegyület és köztes termékek előállítására**

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(54) **METHODS OF MAKING HIV ATTACHMENT INHIBITOR PRODRUG COMPOUND AND INTERMEDIATES**

VERFAHREN ZUR HERSTELLUNG EINER HIV-BINDUNGSINHIBITOR-PRODRUGVERBINDUNG UND ZWISCHENPRODUKTE

PROCÉDÉS DE FABRICATION DE COMPOSÉ PROMÉDICAMENT INHIBITEUR DE LA FIXATION DU VIH ET DE SES INTERMÉDIAIRES

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(56) References cited:
US-A1- 2005 209 246 **US-A1- 2006 293 304**

EP 2 670 751 B1

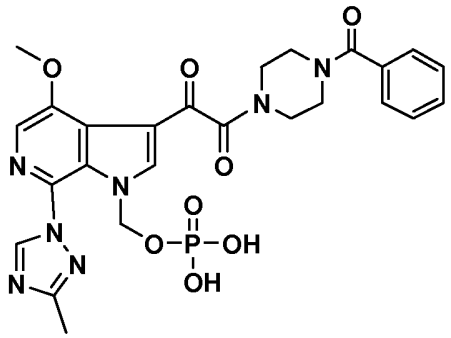
Description

FIELD OF THE INVENTION

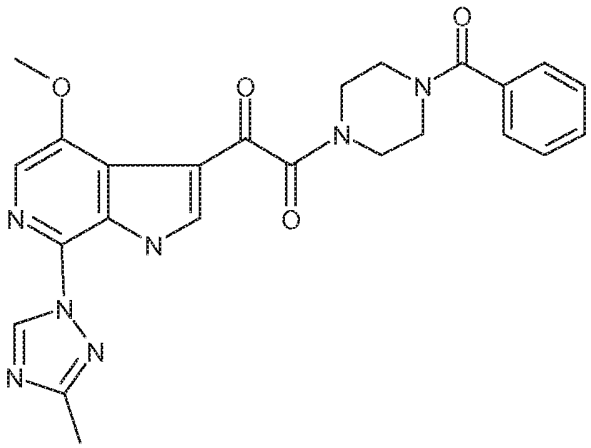
[0001] The invention relates to methods of making prodrug compounds useful against HIV, and in particular, to methods of making the prodrug 1-benzoyl-4-[2-[4-methoxy-7-(3-methyl-1*H*-1,2,4-triazol-1-yl)-1-[(phosphonooxy)methyl]-1*H*-pyrrolo[2,3-c]pyridin-3-yl]-1,2-dioxoethyl]-piperazine, as well certain intermediates thereof, using novel alkylation, amidation, chlorination, and phosphate installation strategies. The invention also relates to the compounds obtained by the processes herein set forth.

BACKGROUND OF THE INVENTION

[0002] The HIV attachment inhibitor prodrug compound identified as 1-benzoyl-4-[2-[4-methoxy-7-(3-methyl-1*H*-1,2,4-triazol-1-yl)-1-[(phosphonooxy)methyl]-1*H*-pyrrolo[2,3-c]pyridin-3-yl]-1,2-dioxoethyl]-piperazine, and having the structural formula:



has been set forth and described in U.S. Patent No. 7,745,625, which is incorporated herein in its entirety. This compound is the phosphate prodrug of the basic compound having the structural formula:



which is set forth and described in U.S. Patent No. 7,354,924, also incorporated herein in its entirety. Both this compound and the prodrug identified above have so far demonstrated excellent prowess against HIV.

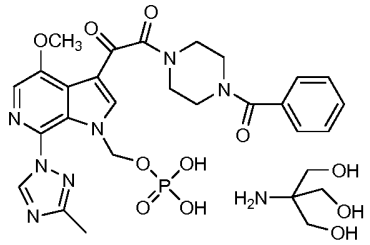
[0003] During scale-up procedures for the production of the phosphate prodrug compound, two compounds were utilized in an alkylation process between phosphonic acid, P-(chloromethyl)-, bis(1,1-dimethylethyl) ester and 1-(4-benzoylpiperazin-1-yl)-2-(4-methoxy-7-(3-methyl-1*H*-1,2,4-triazol-1-yl)-1*H*-pyrrolo-[2,3-c]pyridin-3-yl)ethane-1,2-dione. However, these compounds have proved to be difficult to process, or unstable and difficult to procure on scale. Furthermore, the yields of the alkylation reaction using these compounds has diminished as the reaction was scaled up.

[0004] What is now needed in the art are new processes for making the HIV prodrug compound 1-benzoyl-4-[2-[4-methoxy-7-(3-methyl-1*H*-1,2,4-triazol-1-yl)-1-[(phosphonooxy)methyl]-1*H*-pyrrolo[2,3-c]pyridin-3-yl]-1,2-dioxoethyl]-piperazine, as well as intermediate compounds. These new processes should utilize distinct alkylation, amidation,

chlorination and phosphate installation procedures. Also needed are new compounds and intermediates which are generated as a result of the novel processes.

SUMMARY OF THE INVENTION

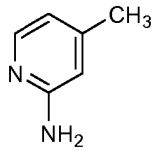
[0005] In a first embodiment, the invention provides a method for making the compound of Formula I:



(I)

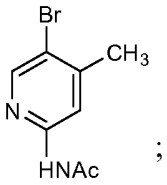
with the chemical name 2-amino-2-(hydroxymethyl)propane-1,3-diol-(3-(2-(4-benzoylpiperazin-1-yl)-2-oxoacetyl)-4-methoxy-7-(3-methyl-1*H*-1,2,4-triazol-1-yl)-1*H*-pyrrolo[2,3-c]pyridin-1-yl)methyl phosphate which comprises:

(a) brominating the compound



(1)

to yield the compound

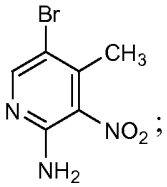


;

(2)

and

(b) nitrating compound 2 to yield the compound

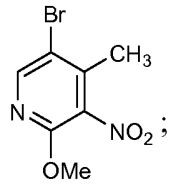


;

(3)

and

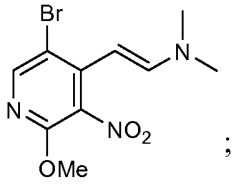
(c) converting the amine group on compound 3 to a methoxy group to yield compound



(4)

and

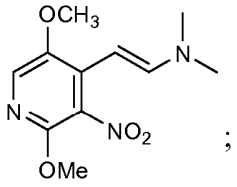
(d) then converting compound 4 to the compound



(5)

and

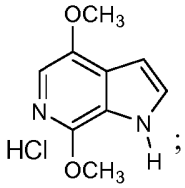
(e) converting compound 5 to the compound



(6)

and

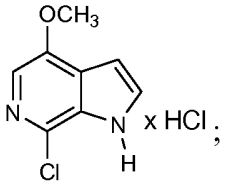
(f) forming a bicyclic structure from compound 6 to yield



(7)

and

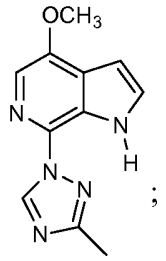
(g) then chlorinating compound 7 to produce



(8)

and

(h) thereafter adding a triazolyl moiety to the compound 8 to yield

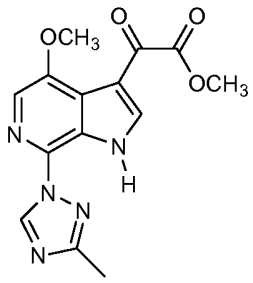


;

(9)

and

(i) converting compound 9 to the structure

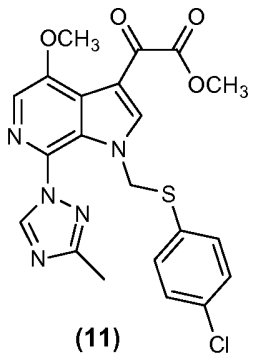


;

(10)

and

(j) modifying compound 10 to yield the compound

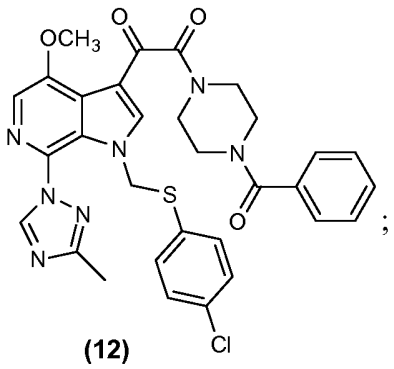


;

(11)

and

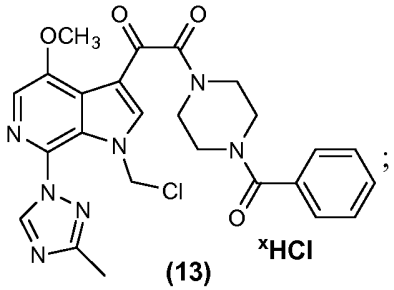
(k) reacting compound 11 to produce the compound



(12)

and

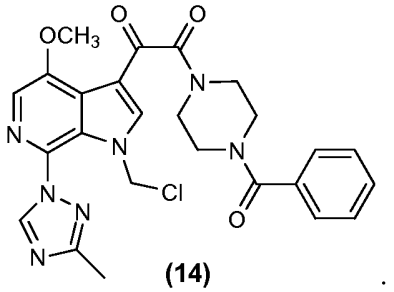
(l) then converting the compound 12 to the compound



(13)

and

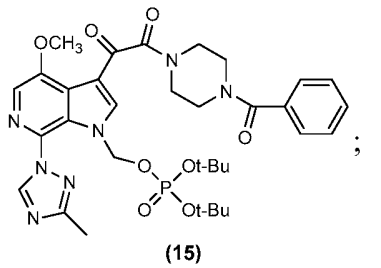
(m) then reacting the compound 13 to produce the compound



(14)

and

(n) then reacting the compound 14 to produce the compound

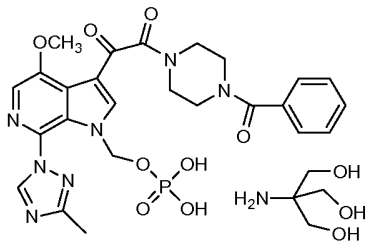


(15)

and

(o) then converting the compound 15 to the compound of Formula I.

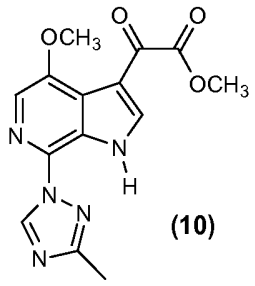
[0006] In a further embodiment of the invention, there is provided a method of making the compound of Formula I:



(I)

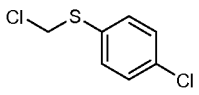
which comprises:

(i) reacting the compound

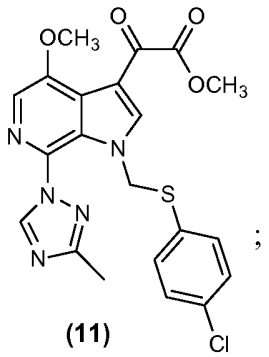


(10)

with



in the presence of TMG, NMP and NaI or K_2CO_3, MeCN and TBAI to yield the compound.

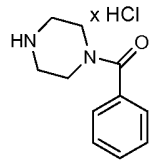


(11)

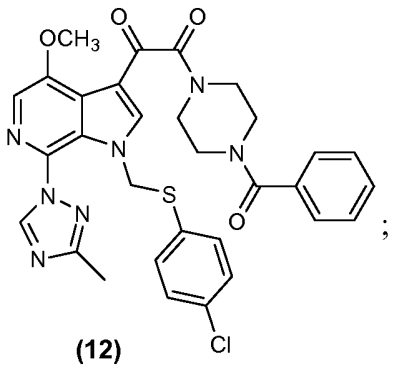
;

and

(ii) reacting compound 11 with



to produce the compound

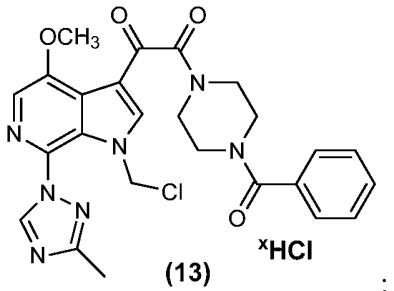


(12)

;

and

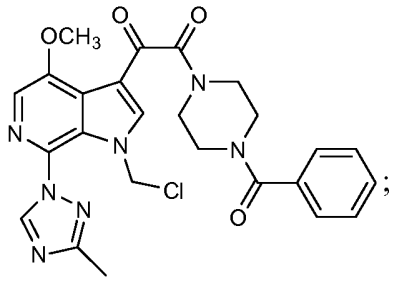
(iii) then converting the compound 12 to the compound



(13)

;

(iv) and then reacting compound 13 to produce

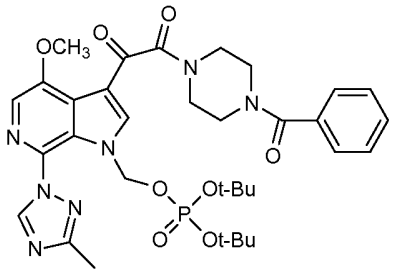


(14)

;

and

(v) then reacting the compound 14 to produce the compound

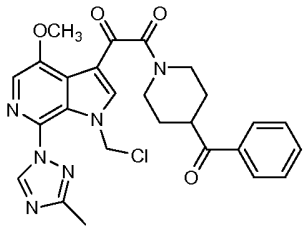


;

(15)

and
then converting the compound 15 to the compound of Formula I.

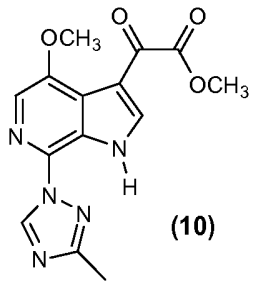
[0007] Also provided herein is a method for making the compound of formula (14):



(14)

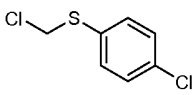
which comprises:

(i) reacting the compound

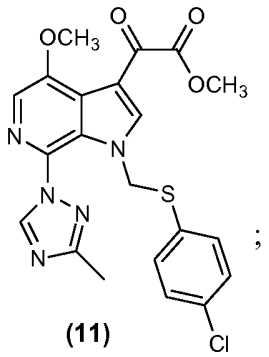


(10)

with



to yield the compound

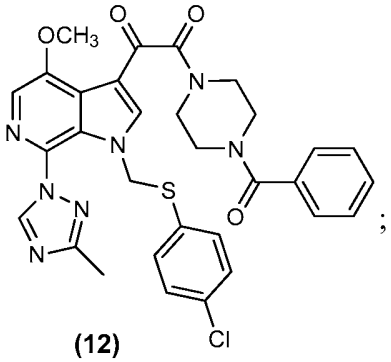


(11)

;

and

(ii) reacting compound 11 to produce the compound

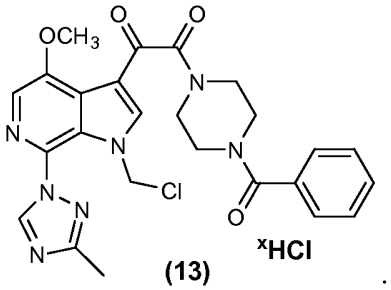


(12)

;

and

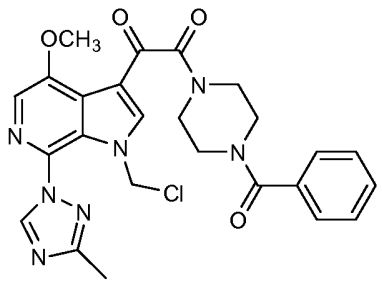
(iii) then converting the compound 12 to the compound



(13)

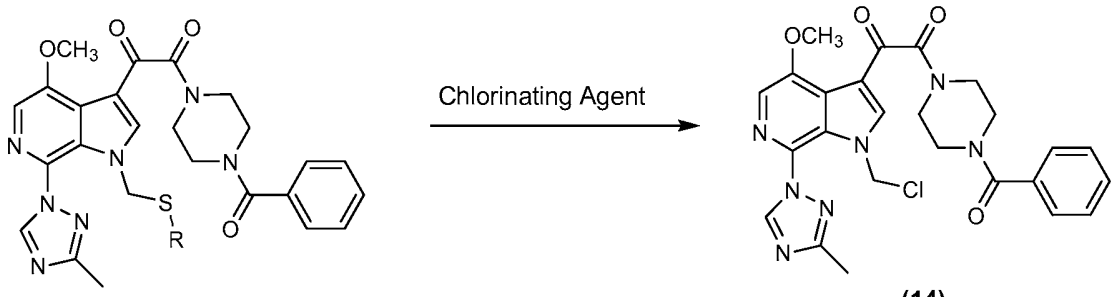
;

(iv)
and then converting compound (13) to the compound



(14)

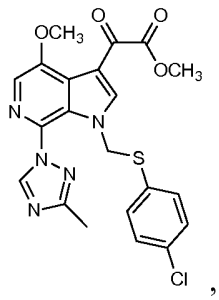
[0008] The invention is also directed to the more general chemical transformation of converting a thio ether to the corresponding chloride using a chlorinating agent.



(14)

wherein R can be, but is not limited to alkyl, cycloalkyl, phenyl, substituted and polysubstituted phenyl rings, heteroaromatic rings, substituted and polysubstituted heteroaromatic rings. The chlorinating agent employed in this transformation can be, but is not limited to, chlorine gas, sulfuryl chloride , hexachlorethane, dichlorotriphenylphosphorane, N,N-dichloro-4-methylbenzenesulfonamide, trichloroisocyanuric acid, N-Chlorosuccinimide, 2-chloroisoindoline-1,3-dione or N-chlorosaccharin.

[0009] The invention is also directed to the novel compounds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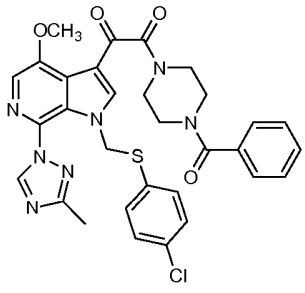
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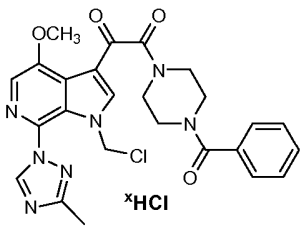
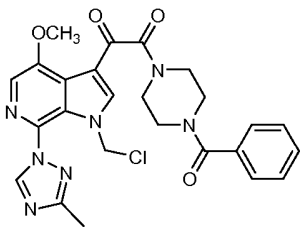


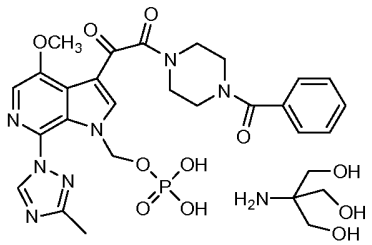
, and


.

[0010] The invention is directed to these and other important ends, hereinafter described.

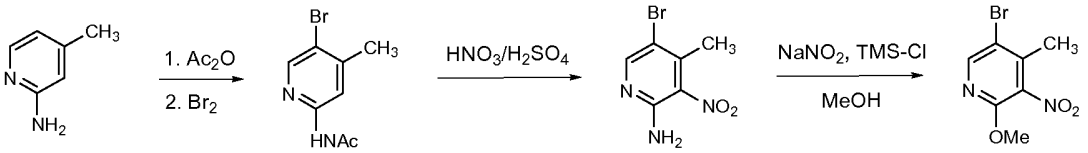
DETAILED DESCRIPTION OF THE EMBODIMENTS

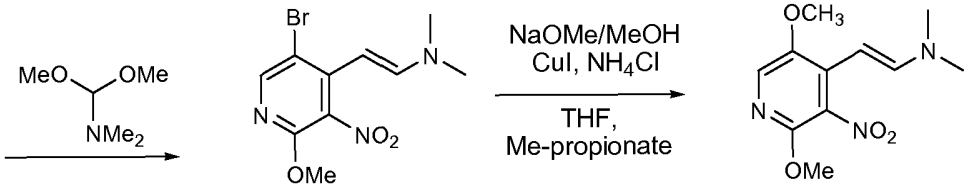
[0011] The invention provides methods for the production of the compound of Formula I:

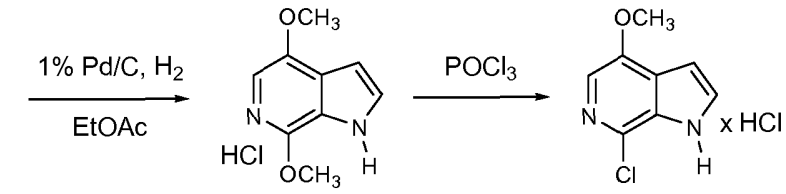


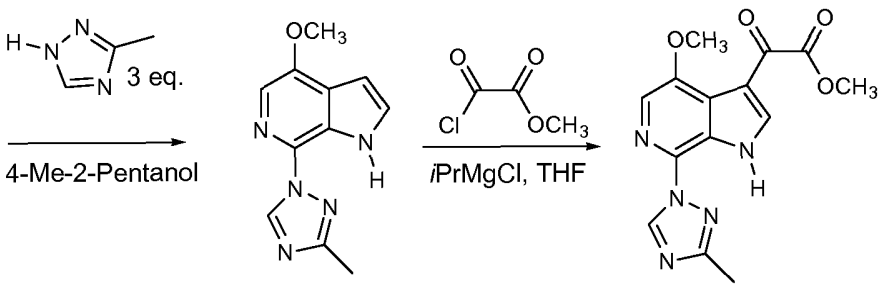
(I)

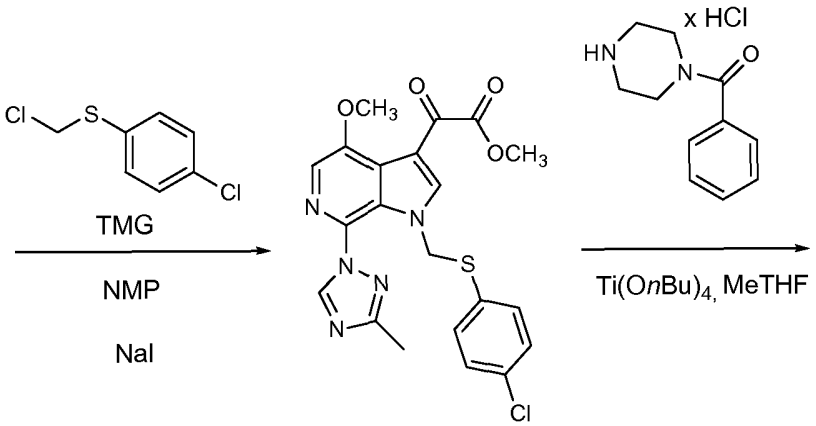
as well as certain intermediates. The overall reaction scheme may be summarized and set forth as follows:

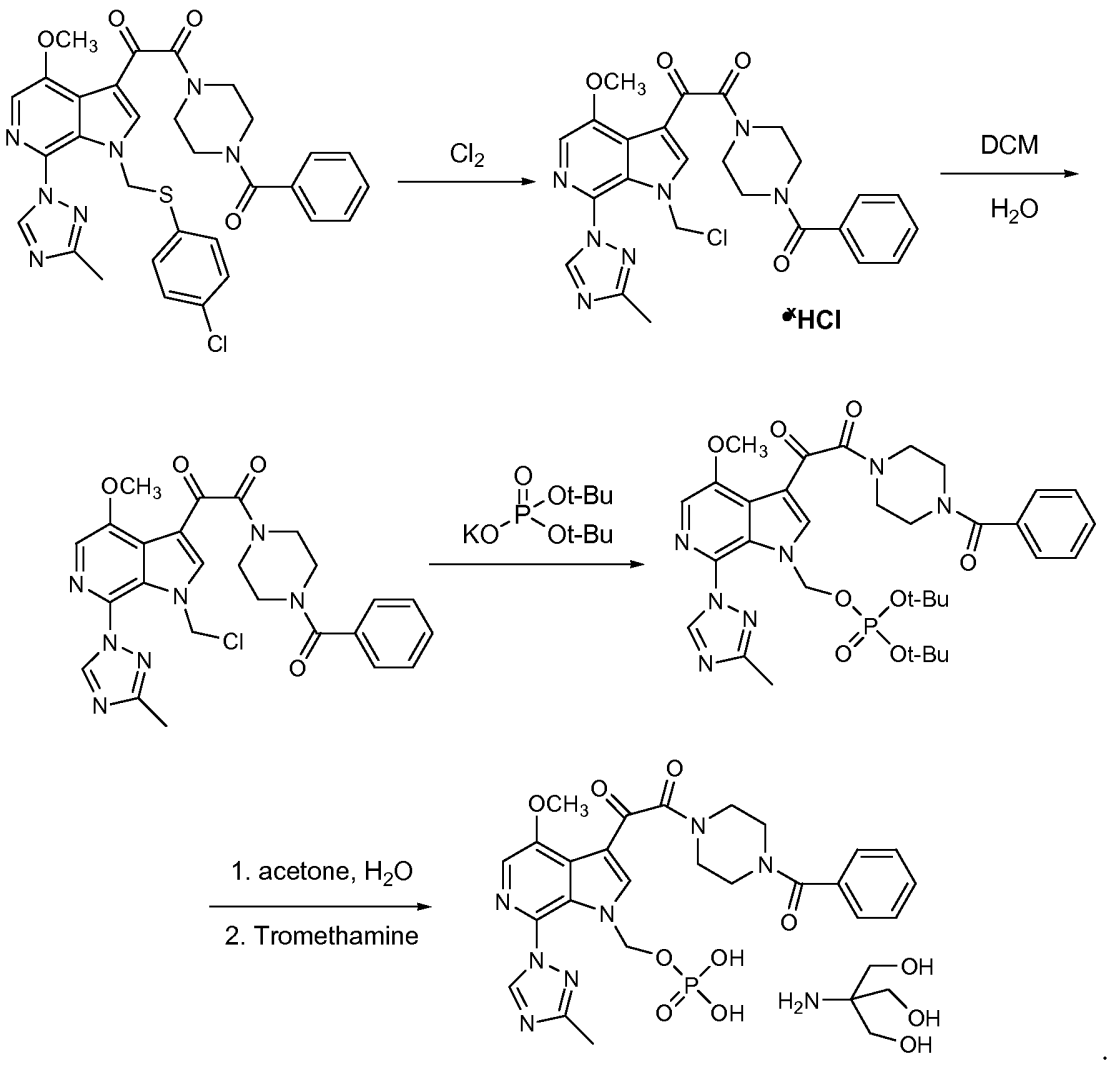

1. Ac2O
2. Br2
HNO3/H2SO4
NaNO2, TMS-Cl
MeOH


NaOMe/MeOH
CuI, NH4Cl
THF,
Me-propionate

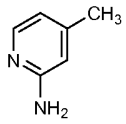

1% Pd/C, H2
EtOAc
POCl3
x HCl


3 eq.
4-Me-2-Pentanol
iPrMgCl, THF

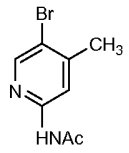

TMG
NMP
NaI
x HCl
Ti(OnBu)4, MeTHF



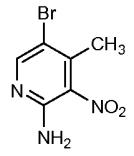
[0012] Thus, in a first embodiment the compound



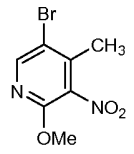
is utilized as starting material. This compound is reacted with acetic anhydride (Ac_2O) and then bromine to produce



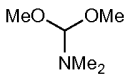
Next, this compound is reacted with nitric acid and sulfuric acid to produce



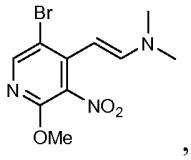
Thereafter, this compound is then reacted with sodium nitrite ($NaNO_2$) and trimethylsilyl chloride (TMS-Cl) in methanol (MeOH) to yield



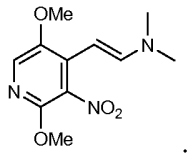
Then this compound is reacted with



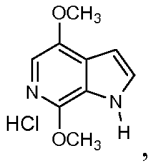
to produce



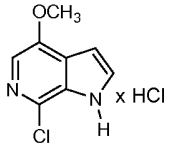
which is then reacted with a mixture of NaOMe/MeOH, CuI and NH_4Cl in tetrahydrofuran (THF) and methyl propionate to produce



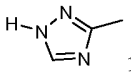
This compound is then reacted with 1% Pd/C under a hydrogen gas (H_2) atmosphere in ethyl acetate (EtOAc) to yield



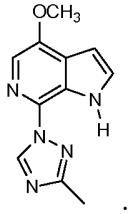
which is further reacted with $POCl_3$ to produce



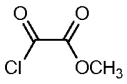
This resultant compound is in turn reacted with three (3) equivalents of



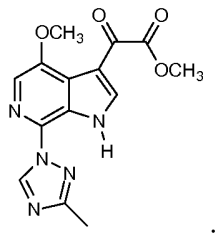
in 4-Me-2-pentanol to produce



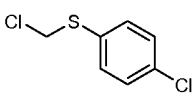
This compound is then reacted with



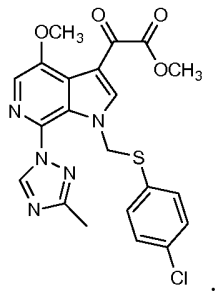
in *i*PrMgCl and THF to get



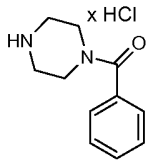
Next, this compound is reacted with



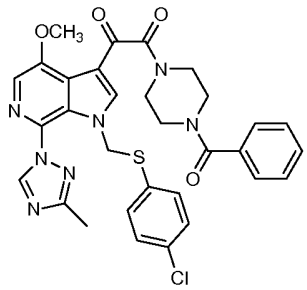
and tetramethylguanidine (TMG) in *N*-methylpyrrolidone (NMP) or K_2CO_3 in MeCN to obtain



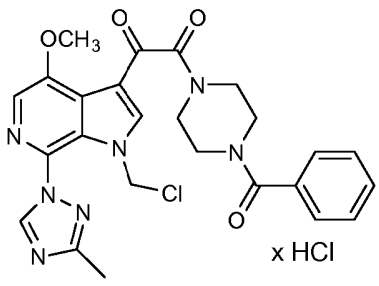
This compound is then reacted with



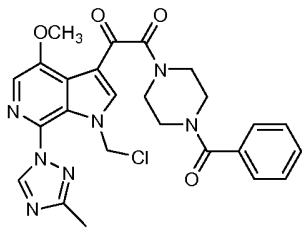
in Ti(O*n*Bu)$_4$ and MeTHF to yield



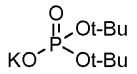
Next, this compound is chlorinated using chlorine gas (Cl_2) to yield



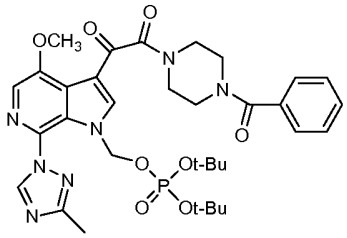
Next, this compound is reacted with dichloromethane (DCM) in water to produce



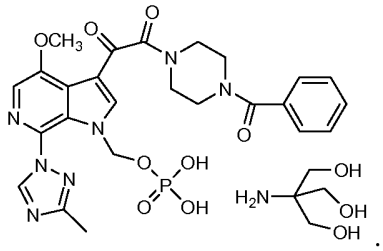
This compound is then further reacted with



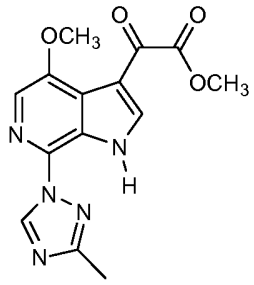
to obtain



[0013] Finally, there is a further reaction with acetone in water, and then tromethamine to produce the prodrug

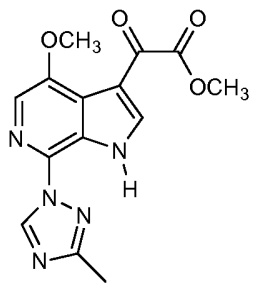


[0014] In a further embodiment of the invention, the compound of Formula I above is produced utilizing

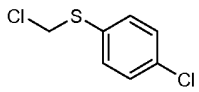


as a starting material. This compound may be synthesized according to the procedures detailed above, or may be obtained according to the processes set forth and described in U.S. 20060293304, 28 Dec 2006, which is incorporated herein by reference in its entirety.

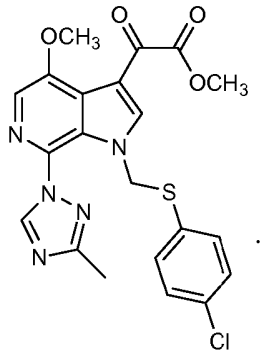
[0015] In this embodiment,



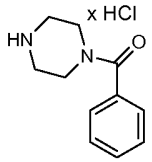
is first reacted with



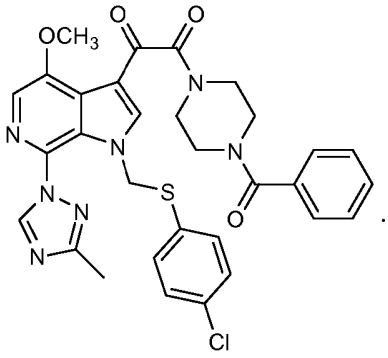
in the presence of TMG, NMP and NaI or K_2CO_3, MeCN and TBAI to yield the compound



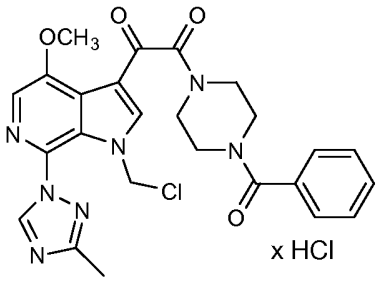
Next, this compound is reacted with



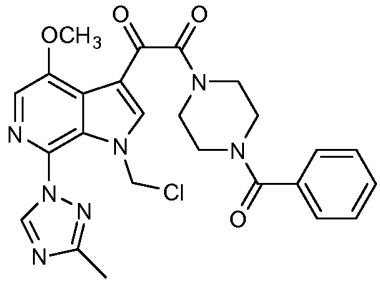
to produce the compound



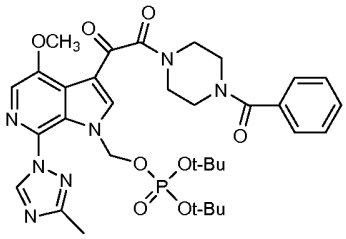
This compound is then converted to the compound



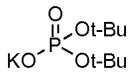
using chlorine (Cl_2) gas. Thereafter, this compound is converted to



using dichloromethane in water. This compound is then reacted to produce the compound

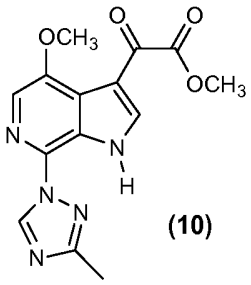


using



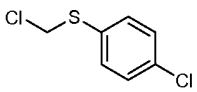
and finally, this compound is then converted to the compound of Formula I with acetone in water, and then tromethamine.

[0016] In a further embodiment of the invention, the compound of formula (14) is made using the compound of formula (10) as starting material. This process involves reacting the compound

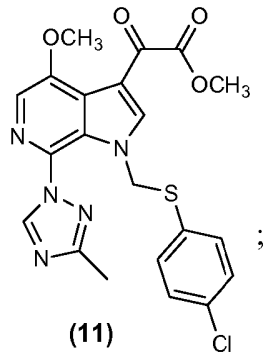


(10)

with



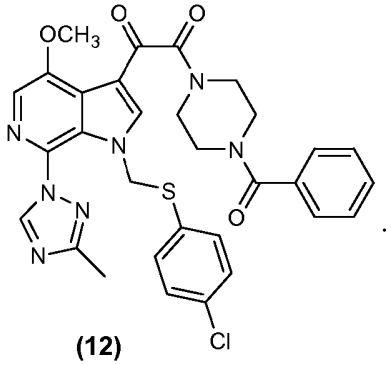
to yield the compound



(11)

;

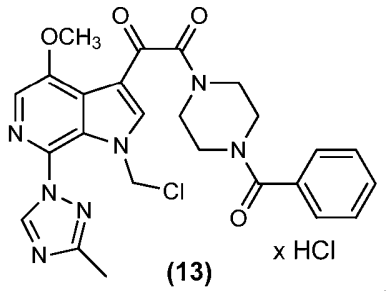
and then reacting compound 11 to produce the compound



(12)

.

Next, compound 12 is converted to the compound

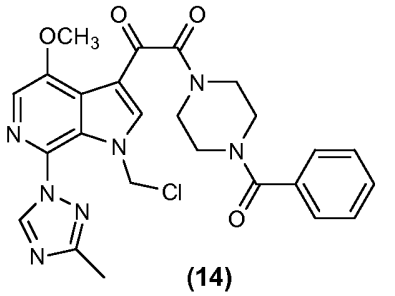


(13)

x HCl

.

Thereafter, compound 13 is converted to the compound



(14)

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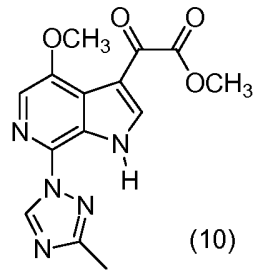
[0017] Compounds 11, 12, 13 and 14 thus constitute further embodiments of the invention.

[0018] The following Example sets forth a preferred method of the invention, but should not be construed as limiting the scope thereof:

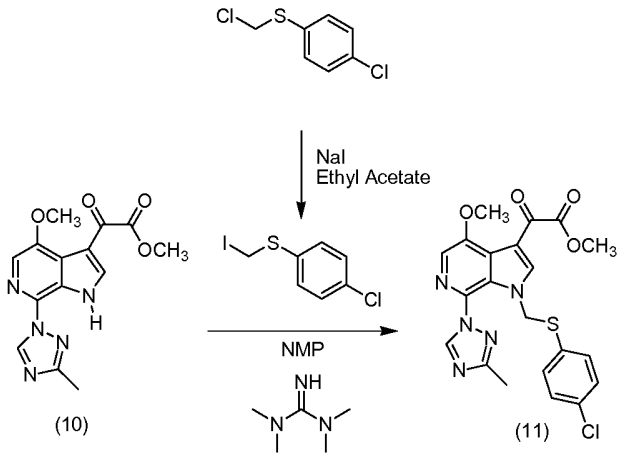
EXAMPLE

[0019] In this Example, the compound

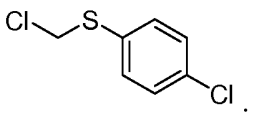


(10)

was used as the starting material. (see U.S. 20060293304, 28 Dec 2006 for producing Compound 10). Below is the summary of the procedure for converting compound 10 to compound 11:

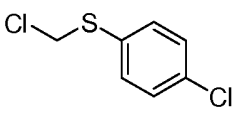


- A 20L and a 10L reaction vessel were purged with inert gas. All steps were performed under inert gas protection.
- To the 20L reactor was charged 1.80L of ethyl acetate at room temperature. To this was added 0.48 kg of the compound

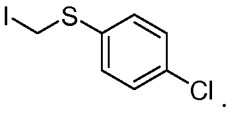


To this solution was added 0.34 kg of sodium iodide. All glassware used in the additions was then washed with 0.45L of ethyl acetate which was also charged to the 20L reactor.

- The reaction mixture was heated to 65°C internal temperature and agitated at this temperature for 3 hours.
- A sample of the reaction mixture was analyzed by ^{1}H NMR to determine conversion of

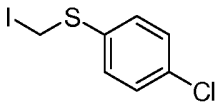


to



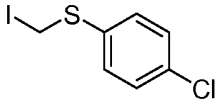
If conversion is not greater than 90%, heating is continued.

- Upon completion, the solution of

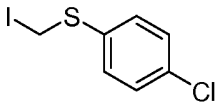


was allowed to cool to room temperature.

- To a 10L vessel is added 1.58L of *N*-Methylpyrrolidinone (NMP) followed 0.18 kg of *N,N,N',N'*-tetramethylguanidine (TMG). To this solution was charged 0.45kg of the compound 10. Finally all of the glassware used for the additions was rinsed with 0.50L of NMP.
- The mixture was agitated at room temperature for 2 hours.
- The NMP solution in the 10L reactor was then transferred to the EtOAc solution of



over 1 hour. The flask was then rinsed with 0.18L of NMP which was also added to the solution of

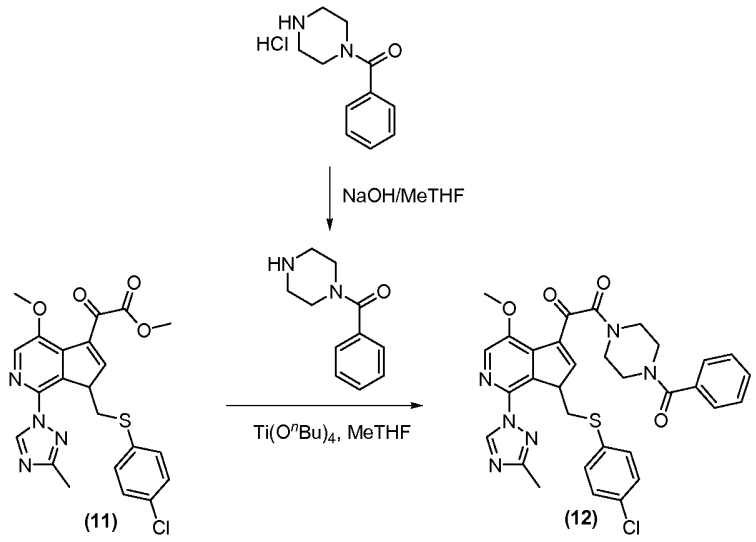


over 2 minutes.

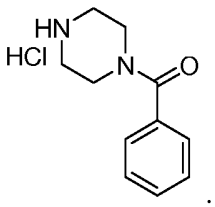
- The resulting mixture was agitated at room temperature for 1 hour.
- A sample of the reaction mixture was taken for high pressure liquid chromatography (HPLC) monitoring.
- To the reaction was added a total of 0.099 kg of TMG in 10 equal portions over 2 hours and the resulting mixture was agitated at room temperature for 14 hours.
- A sample of the reaction mixture was taken HPLC monitoring.
- To the reaction was charged 6.75L of EtOAc followed by 4.50L of 0.5 N aqueous hydrochloric acid solution (HCl). The mixture was vigorously agitated for 30 minutes and then the phases were allowed to settle and the bottom phase was discarded.
- To the remaining upper phase was added 2.50L of EtOAc, followed by the slow addition of 4.50L of 0.5N HCl. The biphasic mixture was agitated vigorously for 15 minutes and then the phases were allowed to settle and the bottom phase was discarded.
- To the remaining upper phase was added 0.50L of EtOAc, followed by the slow addition of 4.50L of 0.5N HCl. The biphasic mixture was agitated vigorously for 15 minutes and then the phases were allowed to settle and the bottom phase was discarded.
- To the remaining upper phase was added 1.10L of EtOAc followed by 4.50L of distilled water. The biphasic mixture was agitated vigorously for 15 minutes and then the phases were allowed to settle and the bottom phase was discarded.
- To the remaining upper phase was added 0.5L of EtOAc followed by 4.50L of distilled water. The biphasic mixture was agitated vigorously for 15 minutes and then the phases were allowed to settle and the bottom phase was discarded.
- The final organic stream was gradually transferred to a 10L reactor in 4.00L increments with a 1.00 L EtOAc wash of the 20L reactor and between each charge the volume of the stream was reduced to 3.60L by distillation of the solvent.
- The solvent composition was then changed from primarily EtOAc to primarily isopropyl alcohol (IPA) using a put and take distillation with a total of 9.00L of IPA and never allowing the total reaction volume to fall below 3.60L. The final solution was allowed to age for 8 hours.
- The resulting slurry was filtered in order to isolate the product. The product was then washed twice with 1.12L of IPA. The isolated product was dried at a maximum temperature of 50°C until reaching a constant weight. The yield was 0.43 kg (63.23%) of compound 11 as beige crystals.
- Analytical data: m.p. 127.0 - 128.8°C. ^{1}H-NMR (Acetic Acid, d_4) (δ, ppm): 9.01 (s, 1H), 8.06 (s, 1H), 7.93 (s, 1H),

7.25 (d, *J* = 8.5 Hz, 2H), 7.07 (d, *J* = 8.5 Hz, 2H), 5.60 (s, 2H), 4.10 (s, 3H), 3.95 (s, 3H), 2.58 (s, 3H). ^{13}C-NMR (Acetic Acid, d_4) (δ, ppm): 181.4, 165.1, 162.0, 152.1, 147.4, 142.7, 136.3 (3C), 130.6, 130.4 (2C), 129.9, 127.9, 126.8, 122.8, 114.3, 57.3, 56.7, 53.3, 13.3. HRMS: Calcd for $C_{21}H_{19}O_4N_5ClS$ $[M+1]^+$ 472.0841 found 472.0841. Elemental Analysis: C: 53.44, H: 3.84, N: 14.84, S: 6.79, Cl: 7.51; found: C: 53.53, H: 3.55, N: 14.63, S: 6.98, Cl: 7.73.

[0020] The process was then continued as follows, with a summary of the conversion of compound 11 to compound 12 set forth below:

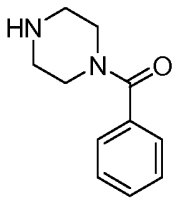


- A reaction vessel was purged with inert gas. All steps were performed under inert gas protection.
- The vessel was then charged with 8.0 L of MeTHF at 20-25 °C. Next, charged 800 g of compound



A white slurry forms. To the slurry was charged 488 ml of water and 388 ml of 1 N NaOH. No exotherm was observed.

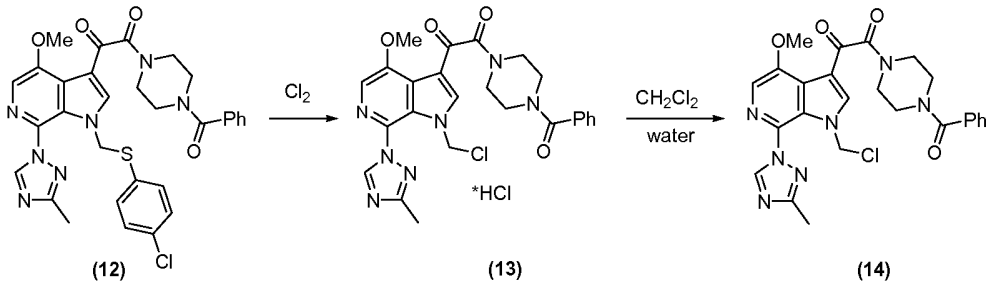
- Agitation was removed after 1 hour and the layers were allowed to settle. The bottom aqueous layer was removed. The remaining organic layer was heated to reflux and approximately 3 L of MeTHF was distilled. At this point the distillation was performed under constant volume conditions
- When a KF of < 500 ppm was obtained the mixture was allowed to cool to room temperature. The organic layer was filtered and the concentration of benzoyl piperazine was measured.
- A separate vessel was purged with inert gas.
- To the vessel was charged 5.2 L of the above solution of the compound



(1.3 eq.). This was followed by the addition of 1 kg of compound 11 was charged resulting in a white slurry. Finally, 260 ml of $Ti(O^nBu)_4$ and 800 ml of MeTHF were charged.

- The mixture was heated to reflux. After 3 hours the mixture was seeded with 2 g of the compound of formula 11. The reaction was allowed to continue to reflux.
- Upon completion, the slurry was cooled to 10 °C and allowed to agitate for 2 hours. The product was filtered, washed with 2 L of MeTHF then 3.15 L of EtOH. The product was dried at 50 °C in a vacuum oven until reaching a constant weight. The yield was 1.07 kg (80.4%) of off white crystals of compound of formula 12.
- Analytical Data: m.p. 162 °C. ^{1}H-NMR ($CDCl_3$) (δ, ppm): 2.54 (s, 3H), 3.52 (bs, 4H), 3.74 (bs, 4H), 4.08 (s, 3H), 5.52 (s, 2H), 6.96 (d, J = 8.2 Hz, 2H), 7.2 (d, J = 8.8 Hz, 2H), 7.44 (bs, 5H), 7.62 (s, 1H), 7.91 (s, 1H), 8.62 (s, 1H): ^{13}C-NMR ($CDCl_3$) (δ, ppm): 13.91, 41.6, 45.9, 56.5, 56.8, 114.3, 122.3, 125.1, 126.7, 127.0, 128.64, 129.5, 129.6, 129.8, 130.2, 134.9, 135.2, 135.7, 140.8, 145.5, 150.6, 161.9, 165.9, 170.6, 184.4; HRMS; cacld for $C_{31}H_{29}ClN_7O_4S$ $[M+1]^+$: 630.1685; found: 630.1688. Elemental Analysis: C: 59.09, H: 4.47, N: 15.56, S: 5.08, Cl: 5.62; found: C: 59.05, H: 4.28, N: 15.57, S: 5.07, Cl: 5.66.

[0021] The process was then continued as follows, with a summary of the process for the conversion of compound 12 to compound 14 set forth below:



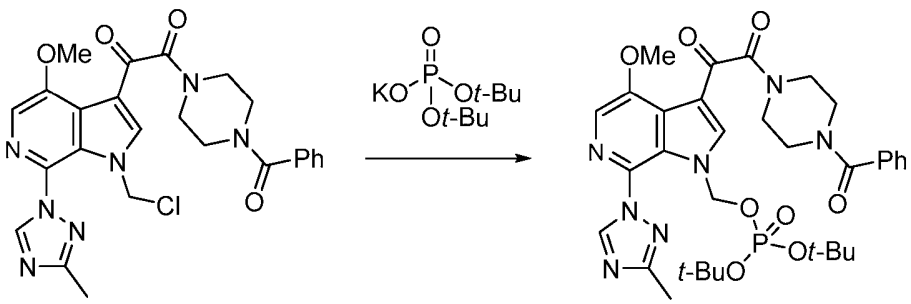
(12) (13) (14)

- A reaction vessel was purged with inert gas. All steps were performed under inert gas protection.
- The vessel was then charged with 5 L of dichloromethane at 20-25 °C. Next, 1.00 kg of the compound of formula 12 was added to the vessel to produce a colorless solution. The solution was then cooled to 0 °C (-3 to 3 °C), followed by the subsurface addition of 113 g chlorine. An orange solution was formed and the reaction was noted to be exothermic. The temperature was kept near 0 °C (-3 to 3 °C).
- A sample was taken for high pressure liquid chromatography (HPLC) monitoring, and additional chlorine charges were added as necessary.
- Upon reaction completion, solution was warmed to 15 °C.
- A solution of isopropanol (1.0 eq.) and 10 L of acetone were prepared. 5 vol % of this solution was added to the vessel over about 30 minutes to produce a thin yellow suspension. After a 30 min age, the remaining 95 vol% of the isopropanol/acetone solution was added over 2 h to produce a white suspension. This addition was slightly exothermic and some cooling was necessary (T_{max} = 25 °C). Slurry was aged at 20 °C and HPLC was utilized to monitor the crystallization progress.
- Product 13 was then filtered, and washed with 5 L of 2:1 (v:v) acetone:dichloromethane, followed by 2.5 L of acetone.
- Product 13 could then either be dried at a maximum temperature of 50 °C until reaching constant weight or the wet cake taken forward to product 3.
- For the isolation of 13, yield was 0.78 kg (88%) as white crystals.
- For the isolation of 14, a second reaction vessel was purged with inert gas.
- The vessel was then charged with 5 L of dichloromethane at 20-25 °C. Next, about 1.10 kg of the wet cake compound

of formula 13a was added to the vessel to produce a white suspension, followed by the addition of 5 L water. A biphasic solution formed and the temperature was kept near 22 °C (20 to 25 °C).

- A phase-split was conducted, and the lower, product-rich organic layer was then charged with 1.5 L ethyl acetate under constant-volume distillation conditions (pressure = 400 mbar). The resulting solution was then seeded with 13b, and aged for 30 min. 9-12 L of additional ethyl acetate were then added under constant-volume distillation conditions (pressure down to < 100 mbar).
- Slurry was aged at 20 °C and HPLC was utilized to monitor the crystallization progress.
- Product 14 was then filtered, and washed with 4 L of ethyl acetate.
- Product 14 was then dried at a maximum temperature of 50 °C until reaching constant weight.
- For the isolation of 14, yield was 0.70 kg (85%) as white crystals.
- **Analytical data for 13:** m.p. 121 °C. ^{1}H-NMR (d7-DMF) (δ, ppm): 11.17 (br s, 1H), 9.18 (s, 1H), 8.88 (s, 1H), 8.19 (s, 1H), 7.52-7.54 (m, 5H), 6.44 (s, 2H), 4.19 (s, 3H), 3.67-3.84 (m, 8H), 2.55 (s, 3H); ^{13}C-NMR (d7-DMF) (δ, ppm): 185.4, 169.9, 166.2, 161.3, 151.1, 146.6, 142.3, 136.1, 129.9, 129.5, 128.6, 127.3, 127.2, 124.7, 123.4, 116.1, 57.7, 56.9, 45.9, 41.7, 13.1; HRMS calcd for $C_{25}H_{25}ClH_7O_4$ $[M\text{-}Cl]^+$: 522.1578 found 522.1648. Elemental analysis: C: 53.77, H: 4.51, N: 17.55, Cl: 12.69, found: C: 53.05, H: 4.68, N: 17.20, Cl: 12.56.
- **Analytical data for 14:** m.p. 211 °C. ^{1}H-NMR ($CDCl_3$) (δ, ppm): 8.59 (s, 1H), 8.14 (s, 1H), 7.91 (s, 1H), 7.41 (s, 5H), 6.09 (s, 2H), 4.04 (s, 3H), 3.40-4.00 (m, 8H), 2.51 (s, 3H); ^{13}C-NMR ($CDCl_3$) (δ, ppm): 184.4, 170.6, 165.7, 162.1, 150.6, 145.6, 140.8, 134.8, 130.1, 129.6, 128.6, 127.0, 126.7, 125.1, 122.9, 116.1, 57.1, 56.8, 45.9, 41.7, 13.9; HRMS: calcd for $C_{25}H_{25}ClH_7O_4$ $[M+H]^+$:522.1578, found 522.1653. Elemental analysis: C: 57.52, H: 4.64, N: 18.78, Cl: 6.79, found C: 57.26, H: 4.60, N: 18.44, Cl 7.14.

[0022] The process was then continued as follows, with a summary of the process for the conversion of compound 14 to compound 15 set forth below:



14 **15**

- A reaction vessel was purged with inert gas. All steps were performed under inert gas protection.
- The vessel was then charged with 3 L of dichloromethane at 20-25 °C. Next, 1.00 kg of the compound of formula **14**, 0.20 kg of tetraethylammonium bromide (0.50 eq.) and 0.5 L dichloromethane were added to the vessel to produce a colorless solution. The solution was then warmed to 35 °C (33 to 37 °C), and charged with 0.57 kg of di-*tert*-butyl potassium phosphate (1.2 eq.) in 4 x 0.3 eq. portions over 1 h, followed by 0.5 L dichloromethane. A yellow suspension formed and the reaction was warmed to 40 °C (38 to 42 °C).
- A sample was taken for high pressure liquid chromatography (HPLC) monitoring, and additional di-*tert*-butyl potassium phosphate was added if necessary.
- Upon reaction completion, suspension was cooled to 20 °C.
- The vessel was then charged with 5 L water and the resulting biphasic solution was kept near 20 °C (18 to 22 °C).
- A phase-split was conducted, and the lower, product-rich organic layer was then charged with 5 L of 20:1 (v:v) *tert*-butylmethyl ether : isopropanol. The solution was then seeded with compound 15, and aged for 30 min. 11 L of additional 20:1 (v:v) *tert*-butylmethyl ether : isopropanol was then added over 3 h.
- Slurry was aged at 20 °C and HPLC was utilized to monitor the crystallization progress.
- Compound 15 was then filtered, and washed with 5 L of 4:1 (v:v) [20:1 (v:v) *tert*-butylmethyl ether : isopropanol] : dichloromethane, followed by 5 L of *tert*-butylmethyl ether.
- Compound 15 was then dried at a maximum temperature of 50 °C until reaching constant weight.
- For the isolation of compound 15, yield was 1.13 kg (85%) as white crystals.
- **Analytical data for 2:** m.p. 198 °C. ^{1}H-NMR ($CDCl_3$) (δ, ppm): 8.51 (s, 3H), 8.17 (s, 3H), 7.88 (s, 3H), 7.39 (m, 5H), 5.92 (d, *J*= 14 Hz, 2H), 4.03 (s, 3H), 3.30-3.80 (m, 8H), 2.47 (s, 3H), 1.25 (s, 18H); ^{13}C-NMR ($CDCl_3$) (δ, ppm):

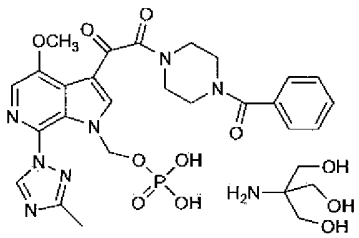
184.6, 170.5, 166.8, 161.4, 150.7, 145.3, 141.8, 134.9, 130.1, 129.5, 128.5, 127.5, 127.0, 124.6, 122.6, 115.1, 83.7 (d, *J*= 7.4 Hz), 73.55 (d, *J*= 6.6 Hz), 56.8, 45.9, 41.6, 29.5 (d, *J*= 4.4 Hz), 13.8; ^{31}P-NMR ($CDCl_3$) (δ, ppm): -10.0; HRMS: calcd for C33H43N7O8P $[M+H]^+$: 696.2832 found 696.2885. Elemental analysis: C: 56.97, H: 6.08, N: 14.09, found C: 57.00, H: 6.04, N: 14.13.

[0023] The above process may then be continued as herein set forth in the description to yield the compound of Formula I.

[0024] The compound of Formula I, once synthesized, may be utilized in compositions to treat HIV infection as set forth and described in U.S. Patent Nos. 7,745,625, 7,354,924 and 7,776,863, by way of non-limiting examples.

Claims

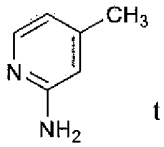
1. A method for making the compound of Formula I:



(I)

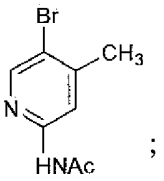
which comprises:

(a) brominating the compound



(1)

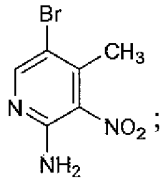
to yield the compound



(2)

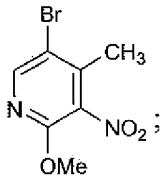
and

(b) nitrating compound 2 to yield the compound



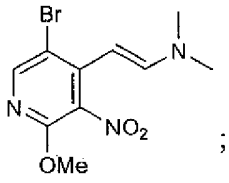
(3)

and
(c) converting the amine group on compound 3 to a methoxy group to yield compound



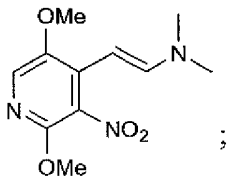
(4)

and
(d) then converting compound 4 to the compound



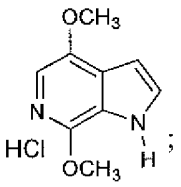
(5)

and
(e) converting compound 5 to the compound



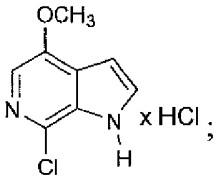
(6)

and
(f) forming a bicyclic structure from compound 6 to yield



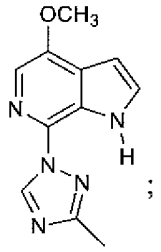
(7)

and
(g) then chlorinating compound 7 to produce



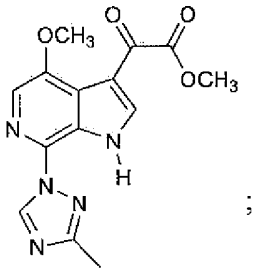
(8)

and
(h) thereafter adding a triazolyl moiety to the compound 8 to yield



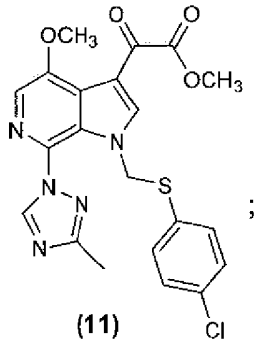
(9)

and
(i) converting compound 9 to the structure



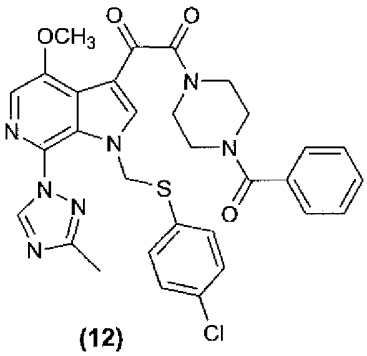
(10)

and
(j) modifying compound 10 to yield the compound



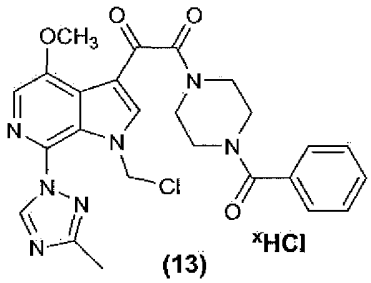
(11) ;

and
(k) reacting compound 11 to produce the compound



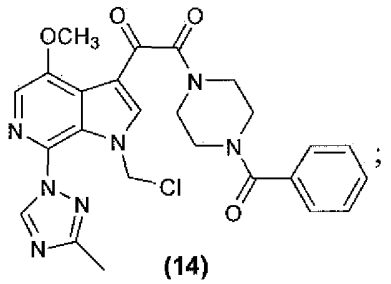
(12) ;

and
(l) then converting the compound 12 to the compound



(13) ;

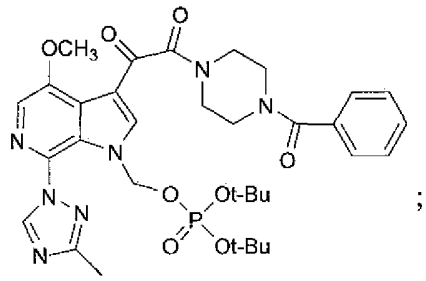
(m) then converting compound 13 to the compound



(14)

and

(n) then reacting the compound 14 to produce the compound

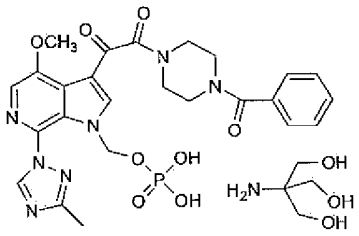


(15)

and

(o) then converting the compound 15 to the compound of Formula I.

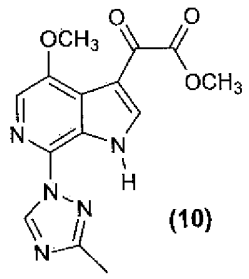
2. A method for making the compound of Formula I:



(I)

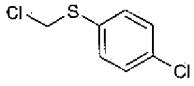
which comprises:

(i) reacting the compound

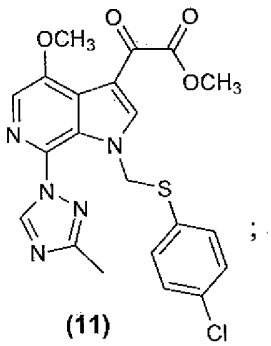


(10)

with



in the presence of TMG, NMP and NaI or K_2CO_3 and MeCNto yield the compound

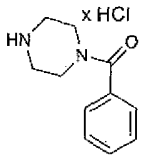


;

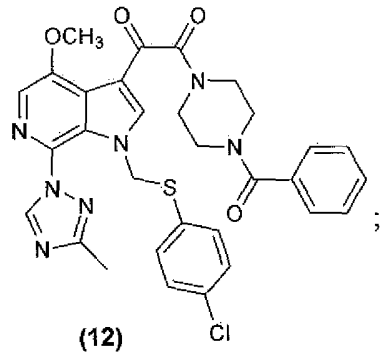
(11)

and

(ii) reacting compound 11 with



to produce the compound

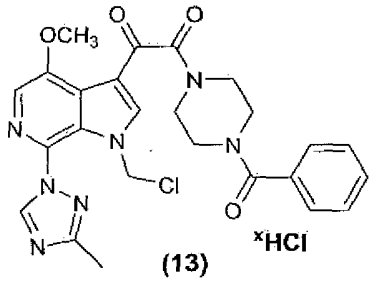


(12)

;

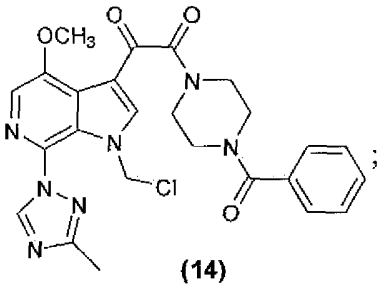
and

(iii) then converting the compound 12 to the compound



(13)

(iv) then converting the compound 13 to the compound

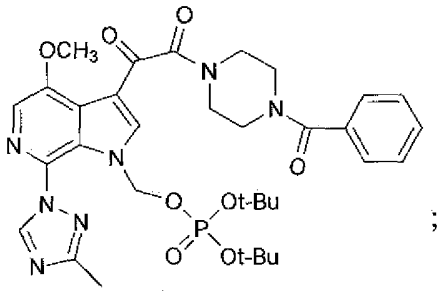


(14)

;

and

(v) then reacting the compound 14 to produce the compound



(15)

;

and
(vi) then converting the compound 15 to the compound of Formula I.

3. The method of claim 1, wherein step (a) is performed using Ac_2O.

4. The method of claim 1, wherein step (b) is performed under acidic conditions.

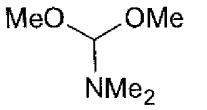
5. The method of claim 4, wherein step (b) is performed using nitric acid.

6. The method of claim 5, wherein step (b) is performed using nitric acid and sulfuric acid.

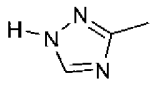
7. The method of claim 1, wherein step (c) is performed using $NaNO_2$ and TMS-Cl in alcohol.

8. The method of claim 7, wherein said alcohol is methanol.

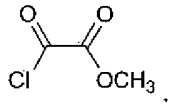
9. The method of claim 1, wherein step (d) is performed using



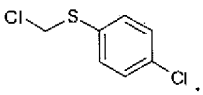
10. The method of claim 1, wherein step (h) is performed using



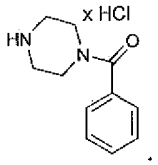
11. The method of claim 1, wherein step (i) is performed using



12. The method of claim 1, wherein step (j) is performed using

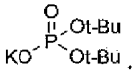


13. The method of claim 2, wherein step (ii) is performed using



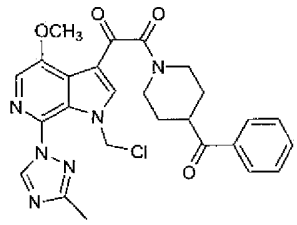
14. The method of claim 2, wherein step (iv) is performed using dichloromethane.

15. The method of claim 2, wherein step (v) is performed using



16. The method of claim 2, wherein step (vi) is performed using acetone in water and tromethamine.

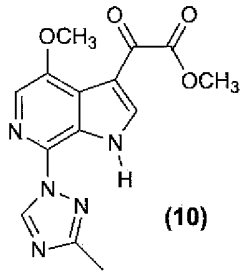
17. A method for making the compound of formula (14):



(14)

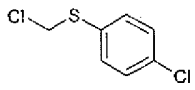
which comprises:

(i) reacting the compound

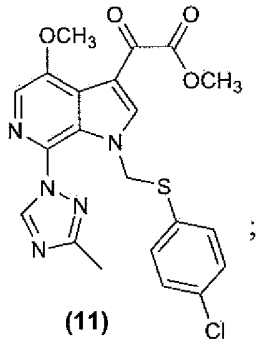


(10)

with



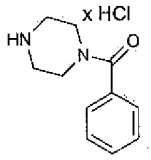
to yield the compound



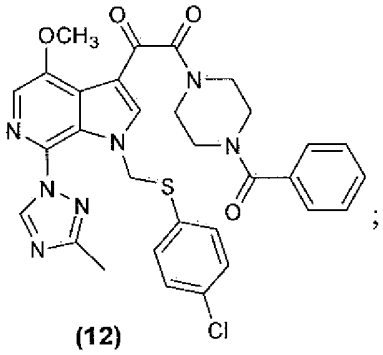
(11)

and

(ii) reacting compound 11 with



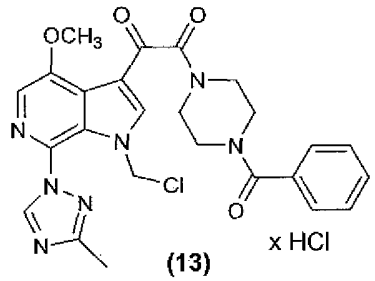
to produce the compound



(12)

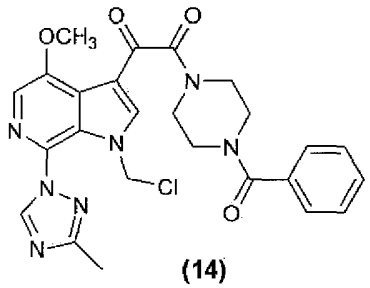
and

(iii) then converting the compound 12 to the compound



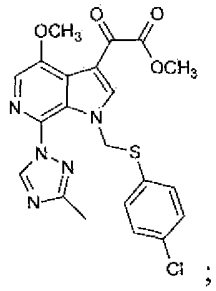
(13)

using chlorine gas;
(iv) then producing the compound 14 using dichloromethane.

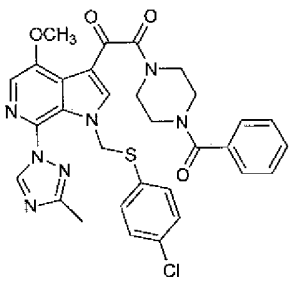


(14)

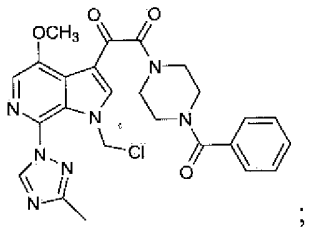
18. The compound having the following formula:



;

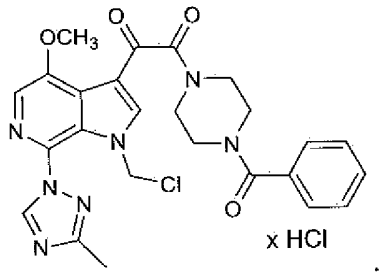


;



;

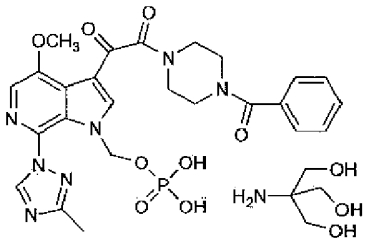
or



.

Patentansprüche

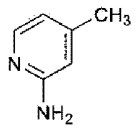
1. Verfahren zur Herstellung der Verbindung der Formel I:



(I)

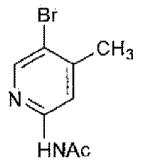
welches umfasst:

(a) Bromieren der Verbindung



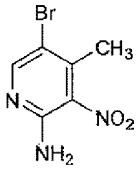
(1)

zur Bildung der Verbindung



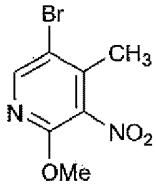
(2) ;

und
(b) Nitrieren von Verbindung 2 zur Bildung der Verbindung



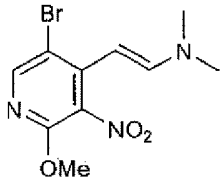
(3) ;

und
(c) Umwandeln der Amingruppe auf Verbindung 3 zu einer Methoxygruppe zur Bildung von Verbindung



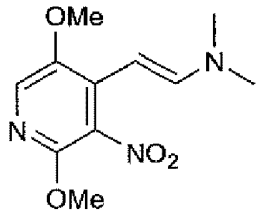
(4) ;

und
(d) dann Umwandeln von Verbindung 4 zur Verbindung und



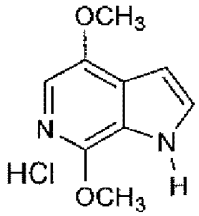
(5) ;

(e) Umwandeln von Verbindung 5 zur Verbindung



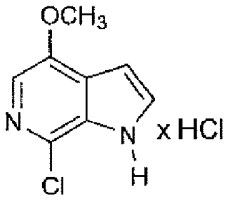
(6) ;

und
(f) Bilden einer bicyclischen Struktur aus Verbindung 6 zur Bildung von



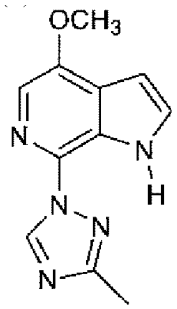
(7) ;

und
(g) dann Chlorieren von Verbindung 7 zur Produktion von und



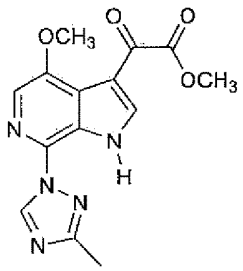
(8) ;

(h) danach Hinzufügen eines Triazolylanteils zur Verbindung 8 zur Bildung von



(9) ;

und
(i) Umwandeln von Verbindung 9 zu der Struktur

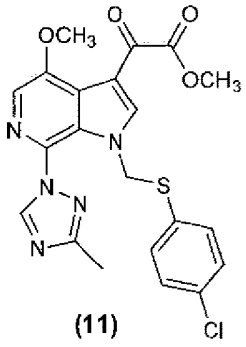


(10)

;

und

(j) Modifizieren von Verbindung 10 zur Bildung der Verbindung

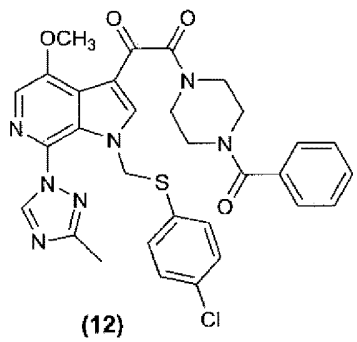


(11)

;

und

(k) Umsetzen von Verbindung 11 zur Produktion der Verbindung

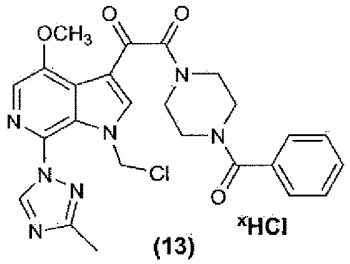


(12)

;

und

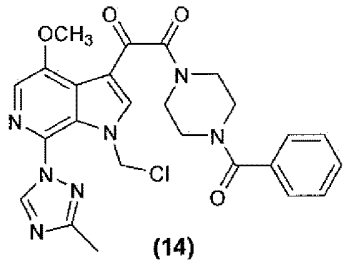
(l) dann Umwandeln der Verbindung 12 zur Verbindung



(13)

;

(m) dann Umwandeln von Verbindung 13 zur Verbindung

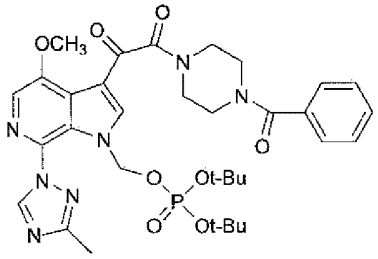


(14)

;

und

(n) dann Umsetzen der Verbindung 14 zur Produktion der Verbindung

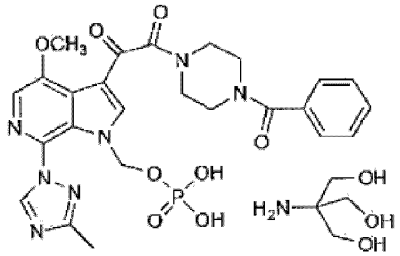


(15) ;

und

(o) dann Umwandeln der Verbindung 15 zur Verbindung der Formel I.

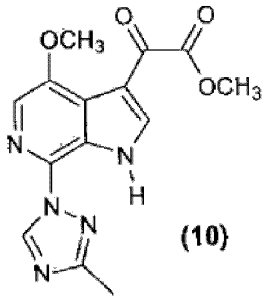
2. Verfahren zur Herstellung der Verbindung der Formel I:



(I)

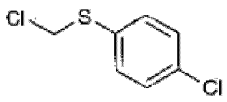
welches umfasst:

(i) Umsetzen der Verbindung

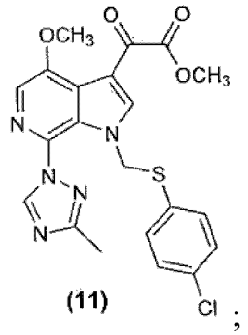


(10)

mit



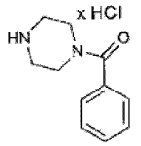
in Gegenwart von TMG, NMP und NaI oder K_2CO_3 und MeCN zur Bildung der Verbindung



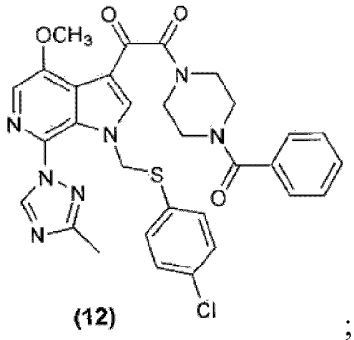
(11) ;

und

(ii) Umsetzen von Verbindung 11 mit



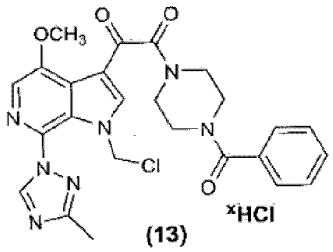
zur Produktion der Verbindung



(12) ;

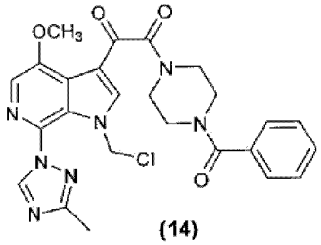
und

(iii) dann Umwandeln der Verbindung 12 zur Verbindung



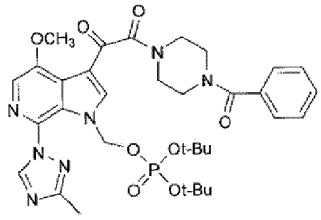
(13) ;

(iv) dann Umwandeln der Verbindung 13 zur Verbindung



(14) ;

und
(v) dann Umsetzen der Verbindung 14 zur Produktion der Verbindung



(15) ;

und
(vi) dann Umwandeln der Verbindung 15 zur Verbindung der Formel I.

3. Verfahren nach Anspruch 1, wobei Schritt (a) unter Verwendung von Ac_2O durchgeführt wird.

4. Verfahren nach Anspruch 1, wobei Schritt (b) unter sauren Bedingungen durchgeführt wird.

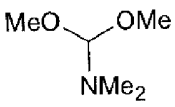
5. Verfahren nach Anspruch 4, wobei Schritt (b) unter Verwendung von Salpetersäure durchgeführt wird.

6. Verfahren nach Anspruch 5, wobei Schritt (b) unter Verwendung von Salpetersäure und Schwefelsäure durchgeführt wird.

7. Verfahren nach Anspruch 1, wobei Schritt (c) unter Verwendung von $NaNO_2$ und TMS-Cl in Alkohol durchgeführt wird.

8. Verfahren nach Anspruch 7, wobei der Alkohol Methanol ist.

9. Verfahren nach Anspruch 1, wobei Schritt (d) durchgeführt wird unter Verwendung von



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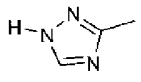
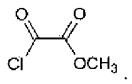
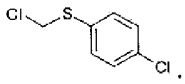
10. Verfahren nach Anspruch 1, wobei Schritt (h) durchgeführt wird unter Verwendung von



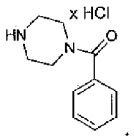
11. Verfahren nach Anspruch 1, wobei Schritt (i) durchgeführt wird unter Verwendung von



12. Verfahren nach Anspruch 1, wobei Schritt (j) durchgeführt wird unter Verwendung von

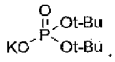


13. Verfahren nach Anspruch 2, wobei Schritt (ii) durchgeführt wird unter Verwendung von



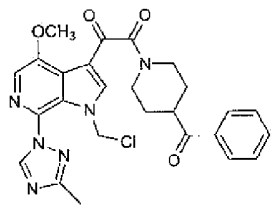
14. Verfahren nach Anspruch 2, wobei Schritt (iv) unter Verwendung von Dichlormethan durchgeführt wird.

15. Verfahren nach Anspruch 2, wobei Schritt (v) durchgeführt wird unter Verwendung von



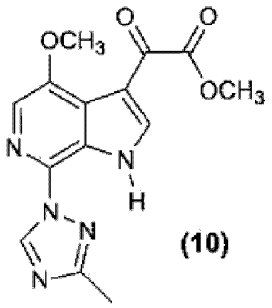
16. Verfahren nach Anspruch 2, wobei Schritt (vi) unter Verwendung von Aceton in Wasser und Tromethamin durchgeführt wird.

17. Verfahren zur Herstellung der Verbindung der Formel (14):
welches umfasst:



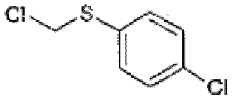
(14)

(i) Umsetzen der Verbindung

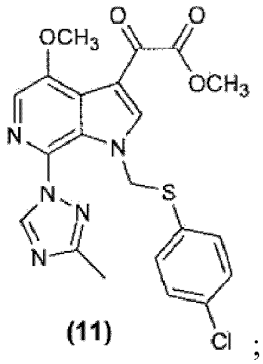


(10)

mit

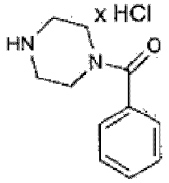


zur Bildung der Verbindung

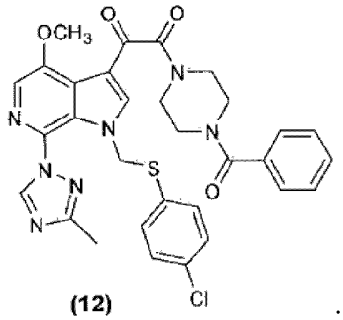


(11) ;

und
(ii) Umsetzen von Verbindung 11 mit



zur Produktion der Verbindung

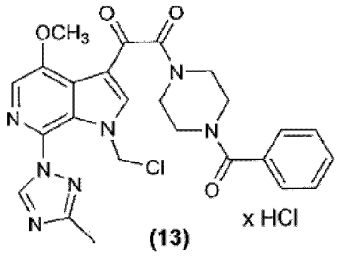


(12)

;

und

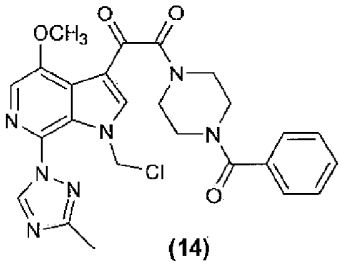
(iii) dann Umwandeln der Verbindung 12 zur Verbindung



(13)

unter Verwendung von Chlorgas;

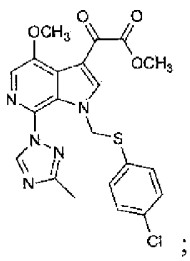
(iv) dann Produzieren der Verbindung 14



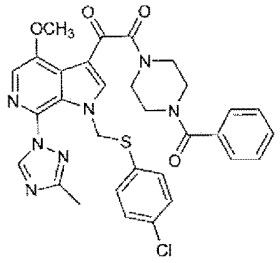
(14)

unter Verwendung von Dichlormethan.

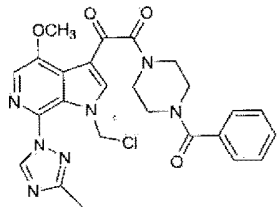
18. Verbindung mit der folgenden Formel:



;

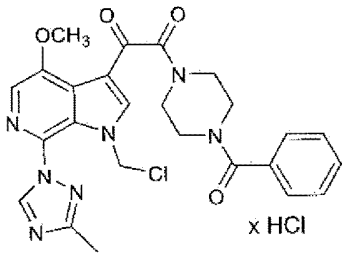


;



;

oder



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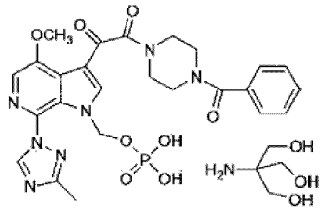
Revendications

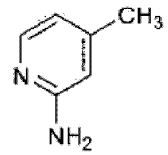
1. Procédé pour la fabrication du composé de la Formule I:



(I)

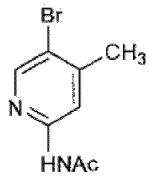
qui comprend:

(a) la bromation du composé:



(1)

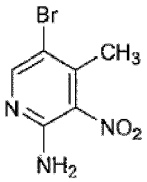
pour donner le composé



(2) ;

et

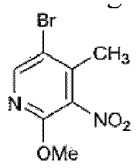
(b) la nitration du composé 2 pour donner le composé



(3) ;

et

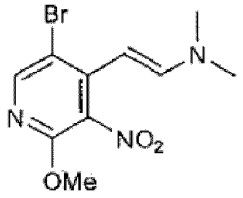
(c) la conversion du groupe amine sur le composé 3 en un groupe méthoxy pour donner le composé



(4) ;

et

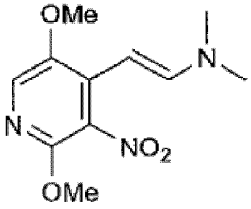
(d) ensuite la conversion du composé 4 en composé



(5) ;

et

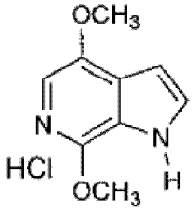
(e) la conversion du composé 5 en composé



(6) ;

et

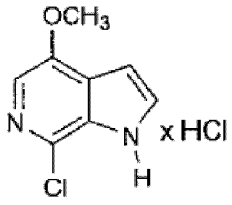
(f) la formation d'une structure bicyclique à partir du composé 6 pour donner



(7) ;

et

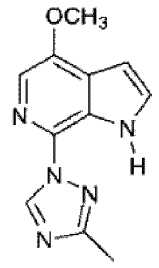
(g) ensuite la chloration du composé 7 pour produire



(8) ;

et

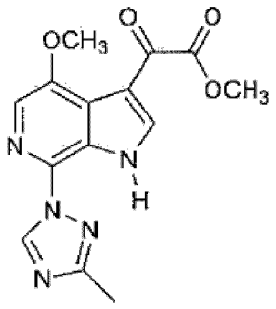
(h) par la suite l'ajout d'une fraction de triazolyle au composé 8 pour donner



(9) ;

et

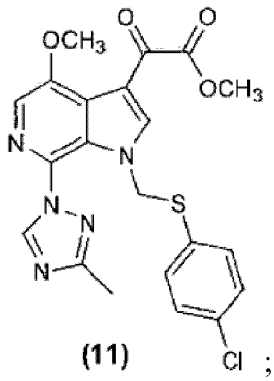
(i) la conversion du composé 9 en structure



(10) ;

et

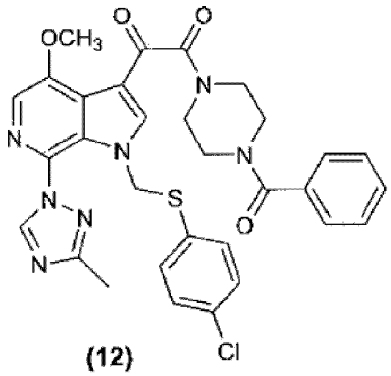
(j) la modification du composé 10 pour donner le composé



(11) ;

et

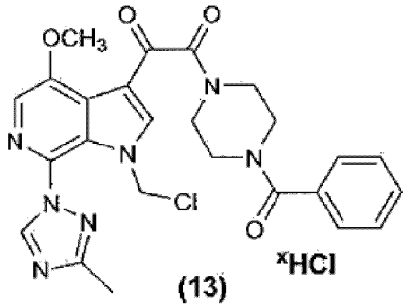
(k) la réaction du composé 11 pour produire le composé



(12) ;

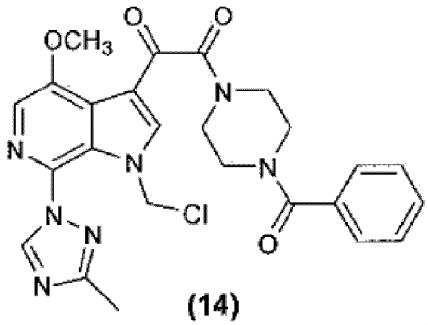
et

(l) puis la conversion du composé 12 en composé



(13) ;

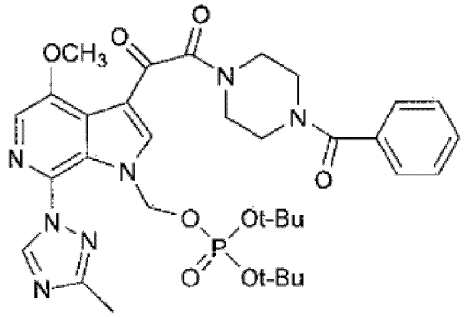
(m) puis la conversion du composé 13 en composé



(14) ;

et

(n) ensuite la réaction du composé 14 pour produire le composé



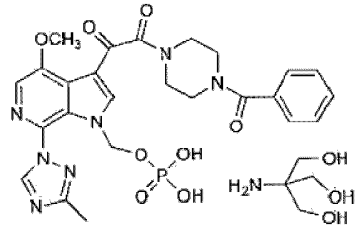
(15)

;

et

(o) ensuite la conversion du composé 15 en composé de la Formule I.

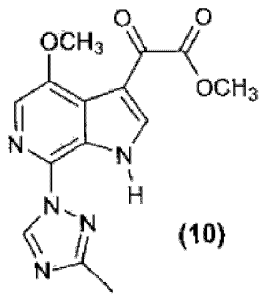
2. Procédé pour la fabrication du composé de la Formule I:



(I)

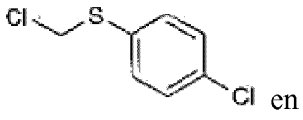
qui comprend:

(i) la réaction du composé



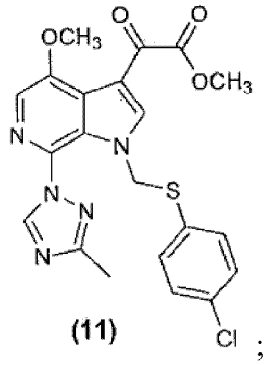
(10)

avec



en

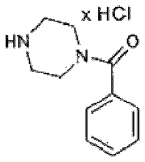
présence de TMG, NMP et NaI ou K_2CO_3 et MeCN pour donner le composé



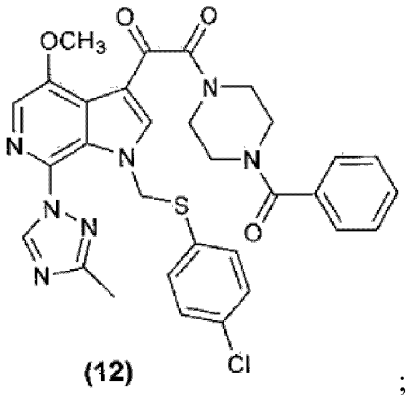
(11) ;

et

(ii) la réaction du composé 11 avec



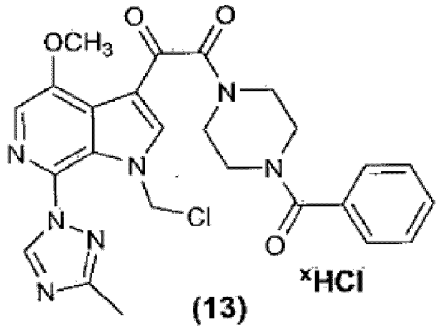
pour produire le composé



(12) ;

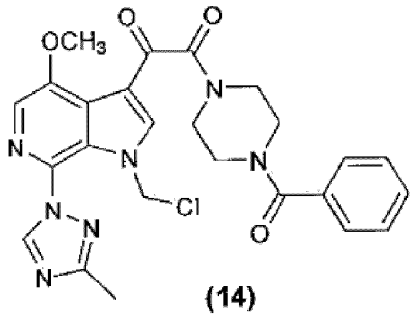
et

(iii) ensuite la conversion du composé 12 en composé



(13) ;

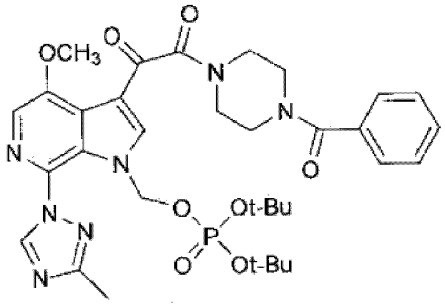
(iv) puis la conversion du composé 13 en composé



(14) ;

et

(v) puis la réaction du composé 14 pour produire le composé



(15) ; et

(vi) ensuite la conversion du composé 15 en composé de la Formule I.

3. Procédé selon la revendication 1, dans lequel l'étape (a) est effectuée en utilisant Ac_2O.

4. Procédé selon la revendication 1, dans lequel l'étape (b) est effectuée dans des conditions acides.

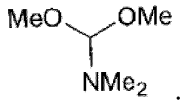
5. Procédé selon la revendication 4, dans lequel l'étape (b) est effectuée en utilisant de l'acide nitrique.

6. Procédé selon la revendication 5, dans lequel l'étape (b) est effectuée en utilisant de l'acide nitrique et de l'acide sulfurique.

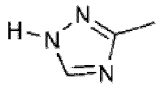
7. Procédé selon la revendication 1, dans lequel l'étape (c) est effectuée en utilisant $NaNO_2$ et TMS-Cl dans un alcool.

8. Procédé selon la revendication 7, dans lequel ledit alcool est le méthanol.

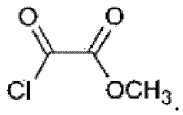
9. Procédé selon la revendication 1, dans lequel l'étape (d) est effectuée en utilisant



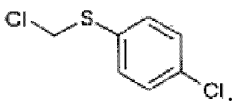
10. Procédé selon la revendication 1, dans lequel l'étape (h) est effectuée en utilisant



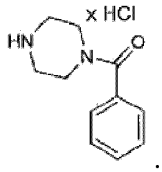
11. Procédé selon la revendication 1, dans lequel l'étape (i) est effectuée en utilisant



12. Procédé selon la revendication 1, dans lequel l'étape (j) est effectuée en utilisant

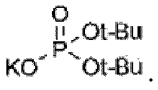


13. Procédé selon la revendication 2, dans lequel l'étape (ii) est effectuée en utilisant



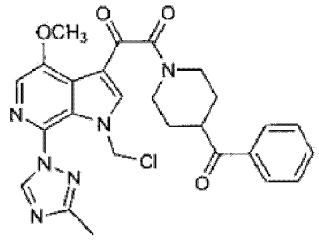
14. Procédé selon la revendication 2, dans lequel l'étape (iv) est effectuée en utilisant du dichlorométhane.

15. Procédé selon la revendication 2, dans lequel l'étape (v) est effectuée en utilisant



16. Procédé selon la revendication 2, dans lequel l'étape (vi) est effectuée en utilisant de l'acétone dans de l'eau et de la trométhamine.

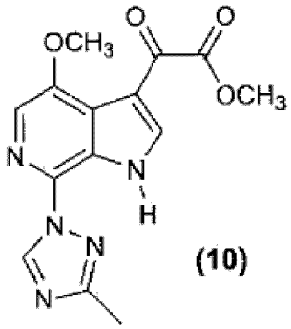
17. Procédé pour la fabrication du composé de la Formule (14):



(14)

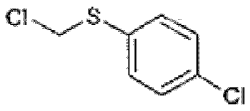
qui comprend:

(i) la réaction du composé

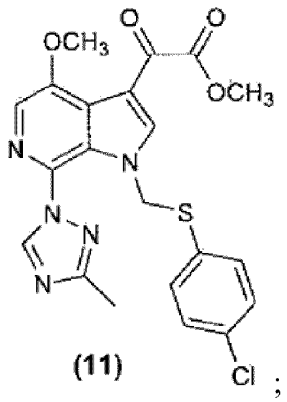


(10)

avec



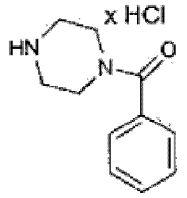
pour donner le composé



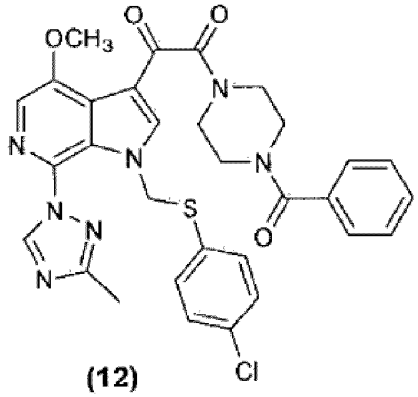
(11) ;

et

(ii) la réaction du composé 11 avec

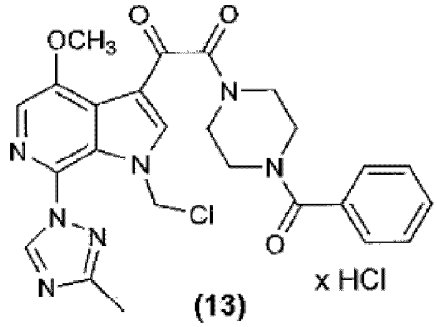


pour produire le composé



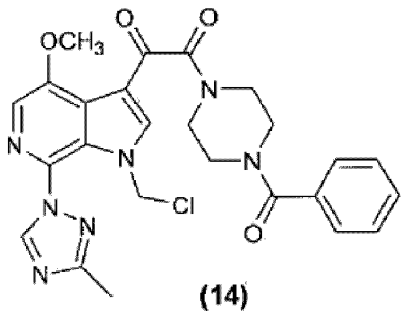
(12) ;

et
(iii) ensuite la conversion du composé 12 en composé



(13)

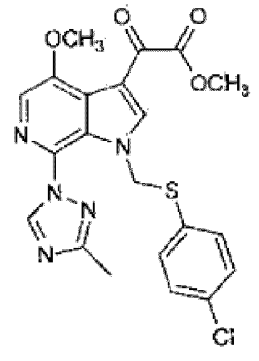
en utilisant du chlore gazeux;
(iv) ensuite la production du composé 14



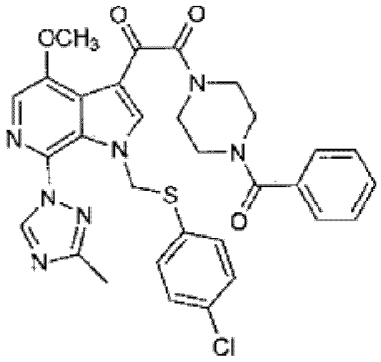
(14)

en utilisant du dichlorométhane.

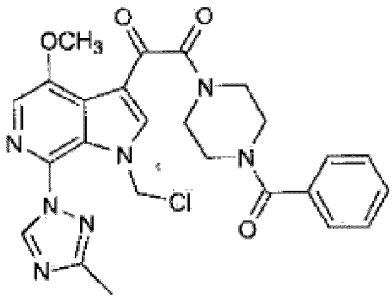
18. Composé présentant la formule suivante:



;

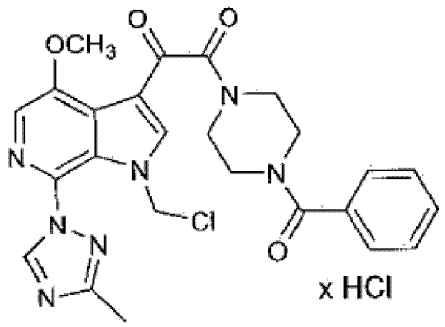


;



;

ou


OCH3
O
O
N
N
N
N
N
N
Cl
O
x HCl

REFERENCES CITED IN THE DESCRIPTION

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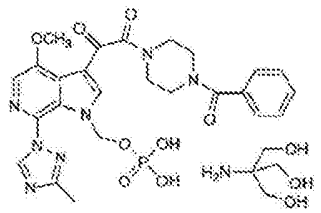
Patent documents cited in the description

- US 7745625 B **[0002] [0024]**
- US 7354924 B **[0002] [0024]**
- US 20060293304 A **[0014] [0019]**
- US 7776863 B **[0024]**

SZABADALMI IGÉNYPONTOK

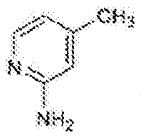
1. Eljárás képlet I szerinti vegyület előállítására:



(I)

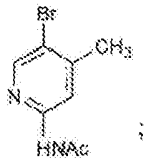
amely tartalmazza:

(a) a vegyület



(1)

brómozását, hogy a vegyületet

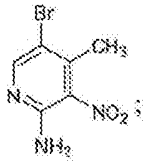


(2)

;

nyerjük, és

(b) vegyület 2 nitrálását, hogy a vegyületet

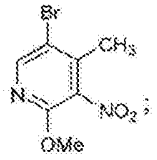


(3)

;

nyerjük és

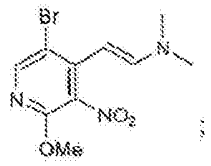
(c) az amin csoport átalakítását a vegyületen 3 metoxi csoporttá, hogy a vegyületet



(4)

nyerjük és

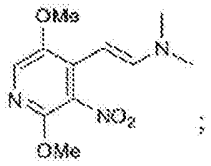
(d) azután a vegyület 4 átalakítását a vegyületté



(5)

és

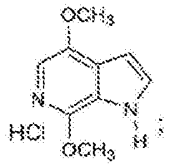
(e) a vegyület 5 átalakítását a vegyületté



(6)

és

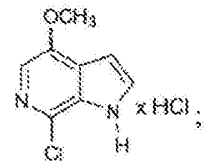
(f) biciklikus szerkezet kialakítását a vegyületből 6, hogy



(7)

-t nyerjük és

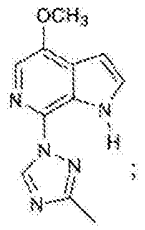
(g) azután vegyület 7 klórozását, hogy



(8)

-t állítsunk elő és

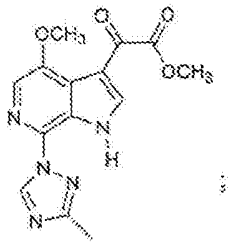
(h) azután triazolil rész hozzáadását a vegyülethez 8, hogy



(9)

-t képezzünk és

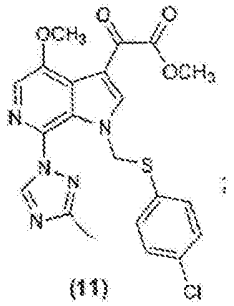
(i) vegyület 9 átalakítását a szerkezetté



(10)

és

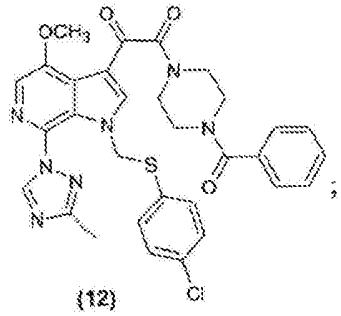
(j) vegyület 10 módosítását, hogy a vegyületet



(11)

nyerjük és

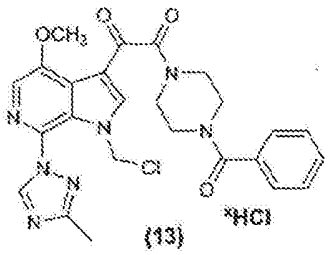
(k) reagáltatjuk a vegyületet 11, hogy a vegyületet



(12)

állítsuk elő és

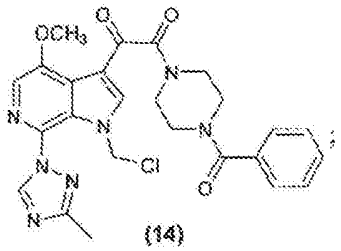
(l) azután a vegyület 12 átalakítását a vegyületté



(13)

;

(m) azután a vegyület 13 átalakítását a vegyületté

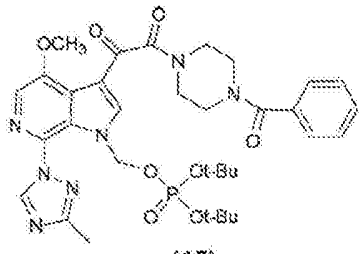


(14)

;

és

(n) azután a vegyület 14 reagáltatását a vegyület



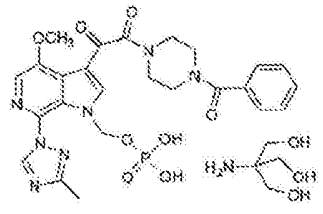
(15)

;

előállítására és

(o) azután a vegyület 15 átalakítását a képlet I szerinti vegyületté.

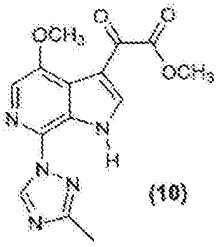
2. Eljárás képlet I szerinti vegyület előállítására:



(I)

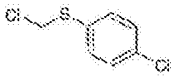
amely tartalmazza:

(i) a vegyület

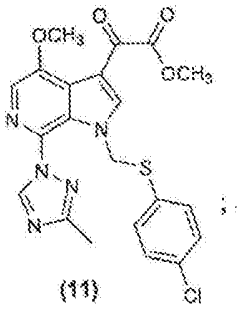


(10)

reagáltatását



-el TMG, NMP és NaI vagy K_2CO_3 és MeCN jelenlétében, hogy a vegyületet nyerjük

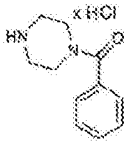


(11)

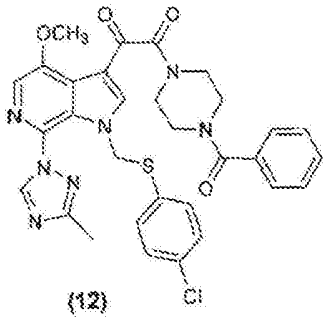
;

és

(ii) vegyület 11 reagáltatását



-el, hogy a vegyületet

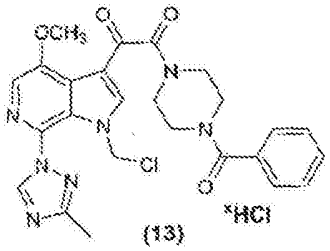


(12)

;

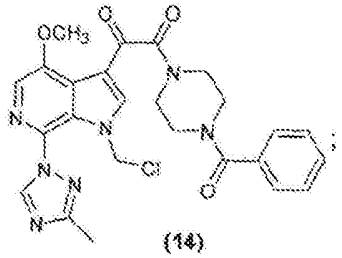
állítsuk elő és

(iii) azután a vegyület 12 átalakítását vegyületté



(13)

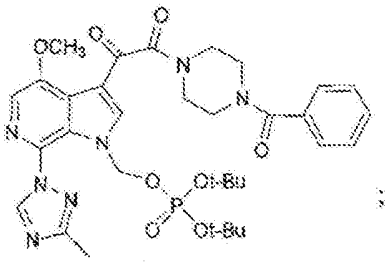
(iv) azután a vegyület 13 átalakítását vegyületté



(14)

és

(v) azután a vegyület 14 reagáltatását, hogy a vegyületet



(15)

állítsuk elö és

(vi) azután a vegyület 15 átalakítását a képlet I szerinti vegyületté.

3. Az 1. igénypont szerinti eljárás, ahol a lépés (a) Ac_2O felhasználásával van megvalósítva.

4. Az 1. igénypont szerinti eljárás, ahol a lépés (b) savas körülmények között van megvalósítva.

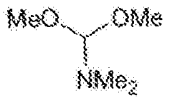
5. A 4. igénypont szerinti eljárás, ahol a lépés (b) salétromsav felhasználásával van megvalósítva.

6. Az 5. igénypont szerinti eljárás, ahol a lépés (b) salétromsav és kénsav felhasználásával van megvalósítva.

7. Az 1. igénypont szerinti eljárás, ahol a lépés (c) $NaNO_2$ és TMS-Cl alkoholban felhasználásával van megvalósítva.

8. A 7. igénypont szerinti eljárás, ahol az alkohol metanol.

9. Az 1. igénypont szerinti eljárás, ahol a lépés (d)

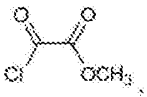


felhasználásával van megvalósítva.

10. Az 1. igénypont szerinti eljárás, ahol a lépés (h)

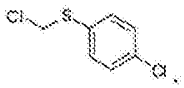
felhasználásával van megvalósítva.

11. Az 1. igénypont szerinti eljárás, ahol a lépés (i)



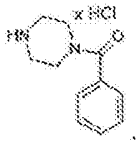
felhasználásával van megvalósítva.

12. Az 1. igénypont szerinti eljárás, ahol a lépés (j)



felhasználásával van megvalósítva.

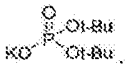
13. Az 2. igénypont szerinti eljárás, ahol a lépés (ii)



felhasználásával van megvalósítva.

14. Az 2. igénypont szerinti eljárás, ahol a lépés (iv) diklórmetán felhasználásával van megvalósítva.

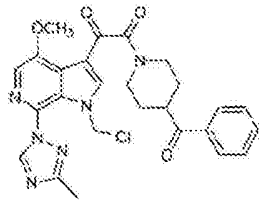
15. Az 2. igénypont szerinti eljárás, ahol a lépés (v)



felhasználásával van megvalósítva.

16. Az 2. igénypont szerinti eljárás, ahol a lépés (vi) aceton vizben és trometamine felhasználásával van megvalósítva.

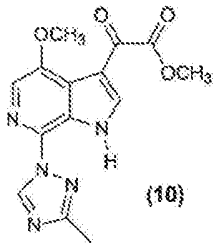
17. Eljárás képlet (14) szerinti vegyület előállítására:



(14)

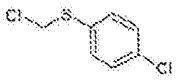
amely tartalmazza:

(i) a vegyület

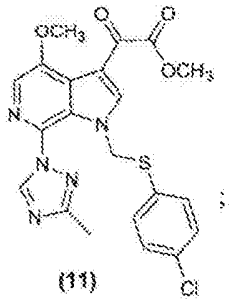


(10)

reagáltatását



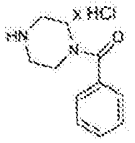
-el, hogy a vegyületet



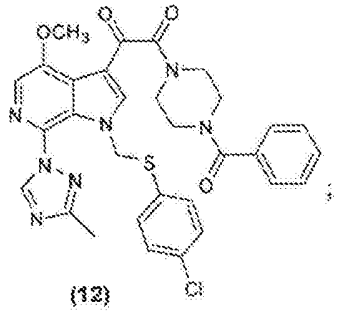
(11) ;

nyerjük és

(ii) a vegyület 11 reagáltatását



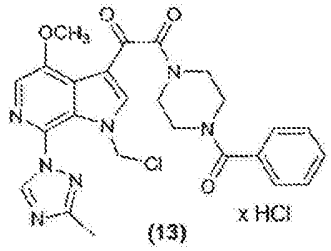
-el, hogy a vegyületet



(12)

előállítsuk és

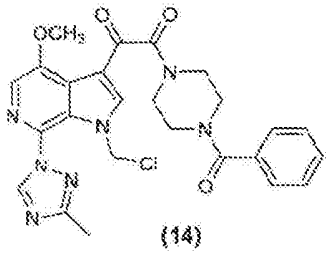
(iii) azután a vegyület 12 átalakítását a vegyületté



(13)

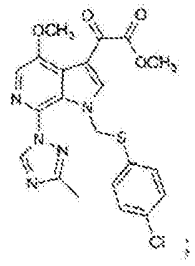
klór gáz felhasználásával;

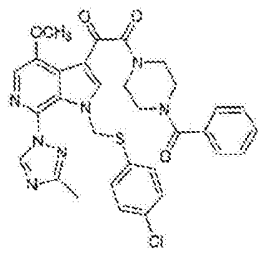
(iv) azután a vegyület 14 előállítását diklórmetán felhasználásával.



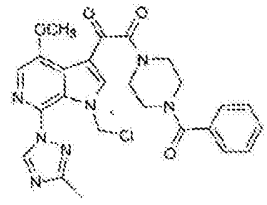
(14)

18. A következő képletű vegyület:





;



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vagy