TITLE OF THE INVENTION
POTASSIUM SALT OF AN HIV INTEGRASE INHIBITOR

FIELD OF THE INVENTION

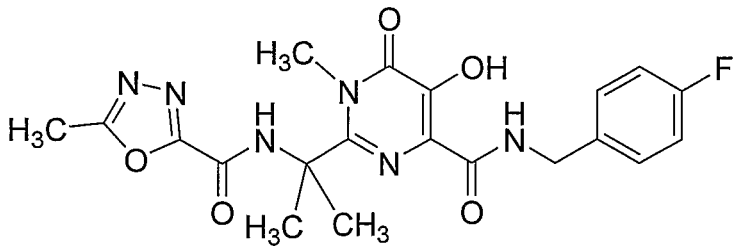
The present invention is directed to potassium salts of an HIV integrase inhibitor, Compound A as defined below. The present invention is also directed to pharmaceutical compositions containing the salts and methods for using the salts.

BACKGROUND OF THE INVENTION

The HIV retrovirus is the causative agent for AIDS. The HIV-1 retrovirus primarily uses the CD4 receptor (a 58 kDa transmembrane protein) to gain entry into cells, through high-affinity interactions between the viral envelope glycoprotein (gp 120) and a specific region of the CD4 molecule found in T-lymphocytes and CD4 (+) T-helper cells (Lasky L.A. et al., *Cell* 1987, 50: 975-985). HIV infection is characterized by an asymptomatic period immediately following infection that is devoid of clinical manifestations in the patient. Progressive HIV-induced destruction of the immune system then leads to increased susceptibility to opportunistic infections, which eventually produces a syndrome called ARC (AIDS-related complex) characterized by symptoms such as persistent generalized lymphadenopathy, fever, and weight loss, followed itself by full blown AIDS.

After entry of the retrovirus into a cell, viral RNA is converted into DNA, which is then integrated into the host cell DNA. Integration of viral DNA is an essential step in the viral life cycle. Integration is believed to be mediated by integrase, a 32 kDa enzyme, in three steps: assembly of a stable nucleoprotein complex with viral DNA sequences; cleavage of two nucleotides from the 3' termini of the linear proviral DNA; and covalent joining of the recessed 3' OH termini of the proviral DNA at a staggered cut made at the host target site. The fourth step in the process, repair synthesis of the resultant gap, may be accomplished by cellular enzymes.

The compound *N*-(4-fluorobenzyl)-5-hydroxy-1-methyl-2-(1-methyl-1-{[(5-methyl-1,3,4-oxadiazol-2-yl)carbonyl]amino}ethyl)-6-oxo-1,6-dihydropyrimidine-4-carboxamide (hereinafter designated as "Compound A") is a potent HIV integrase inhibitor. The structure of Compound A is as follows:



Compound A

Compound A is disclosed in International Publication No. WO 03/035077.

SUMMARY OF THE INVENTION

The present invention is directed to potassium salts, particularly crystalline salts, of Compound A. The potassium salts of Compound A are significantly more soluble in water compared to the free base, and one crystalline form (identified herein as Form 1) has exhibited improved pharmacokinetics in animal models over the free base. It is further noted that attempts to prepare a crystalline Na salt of Compound A have been unsuccessful, resulting only in amorphous material.

The present invention also includes methods of using the Compound A salts for inhibiting HIV integrase, for treating or prophylaxis of HIV infection, and for treating, prophylaxis of, or delaying the onset of AIDS.

The foregoing embodiments and other embodiments, aspects and features of the present invention are either further described in or will be apparent from the ensuing description, examples, and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is the X-ray powder diffraction pattern for the potassium salt of Compound A as prepared in Example 2.

Figure 2 is the DSC curve for the potassium salt of Compound A as prepared in Example 2.

Figure 3 is the X-ray powder diffraction pattern for the potassium salt of Compound A as prepared in Example 4.

Figure 4 is the DSC curve for the potassium salt of Compound A as prepared in Example 4.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides potassium salts of Compound A, pharmaceutical compositions containing the salts and methods of using the salts The Compound A potassium salts and pharmaceutical compositions containing the salts are useful for inhibiting HIV integrase, prophylaxis of infection by HIV, treating infection by HIV, delaying the onset of AIDS, prophylaxis of AIDS, and treating AIDS, in adults, children or infants. Delaying the onset of AIDS, prophylaxis of AIDS, treating AIDS, or treating or prophylaxis of infection by HIV is defined as including, but not limited to, treating a wide range of states of HIV infection: AIDS, ARC, both symptomatic and asymptomatic, and actual or potential exposure to HIV. For example, potassium salts of Compound A and pharmaceutical compositions thereof of this invention are useful in treating infection by HIV after suspected past exposure to HIV by, e.g., blood transfusion, exchange of body fluids, bites, accidental needle stick, or exposure to patient blood during surgery. The salts of the invention can also be used in "salvage" therapy; i.e., a potassium salt of Compound A can be used to treat HIV infection, AIDS, or ARC in HIV-positive subjects whose viral load achieved undetectable levels via conventional therapies (e.g., therapies employing known protease inhibitors in combination with one or more known reverse transcriptase inhibitors), and then rebounded due to the emergence of HIV mutants resistant to the known inhibitors.

Compound A is an inhibitor of HIV integrase. Compound A has been tested in an integrase inhibition assay in which strand transfer is catalyzed by recombinant integrase, and has been found to be a potent inhibitor. The strand transfer assay is described in Example 193 of WO 02/30930. Compound A has also been found to be active in an assay for the inhibition of acute HIV infection of T-lymphoid cells conducted in accordance with Vacca et al., *Proc. Natl. Acad. Sci. USA* 1994, 91: 4096-4100.

An embodiment of the present invention is a crystalline potassium salt of Compound A. Another embodiment of the present invention is an anhydrous crystalline potassium salt of Compound A. Still another embodiment of the present invention is an anhydrous crystalline potassium salt of Compound A, which is a Form 1 crystalline potassium salt of Compound A, wherein the Form 1 salt is characterized by an X-ray powder diffraction pattern obtained using copper K_α radiation (i.e., the radiation source is a combination of Cu $K_{\alpha 1}$ and $K_{\alpha 2}$ radiation) which comprises 2Θ

values (i.e., reflections at 2Θ values) in degrees of 5.9, 20.0 and 20.6. In an aspect of this embodiment, the Form 1 crystalline potassium salt of Compound A is characterized by an X-ray powder diffraction pattern obtained using copper K_α radiation which comprises 2Θ values in degrees of 5.9, 12.5, 20.0, 20.6 and 25.6. In another aspect of this embodiment, the Form 1 crystalline K salt of Compound A is as originally defined or as defined in the foregoing aspect, and further characterized by a differential scanning calorimetry curve, obtained at a heating rate of 10 °C/min in a closed cup under nitrogen, exhibiting a single endotherm with a peak temperature of about 279°C. In still another aspect of this embodiment, the Form 1 crystalline K salt is as originally defined or as defined in either of the preceding aspects, and is further characterized as being a monopotassium salt. The Form 1 crystalline potassium salt of Compound A has exhibited superior oral bioavailability and improved pharmacokinetics (e.g., improved C_{max} and AUC) in rats and dogs relative to Compound A per se.

Another embodiment of the present invention is a crystalline potassium salt of Compound A, which is a hydrated crystalline K salt. In still another embodiment, the hydrated crystalline potassium salt is a Form 2 hydrated crystalline potassium salt of Compound A, wherein the Form 2 salt is characterized by an X-ray powder diffraction pattern obtained using copper K_α radiation which comprises 2Θ values in degrees of 7.9, 13.8 and 24.5. In an aspect of this embodiment, the Form 2 crystalline potassium salt of Compound A is characterized by an X-ray powder diffraction pattern obtained using copper K_α radiation which comprises 2Θ values in degrees of 7.9, 13.8, 15.7, 24.5, and 31.5. In another aspect of this embodiment, the Form 2 crystalline K salt of Compound A is as originally defined or as defined in the foregoing aspect, and further characterized by a differential scanning calorimetry curve, obtained at a heating rate of 10 °C/min in a closed cup under nitrogen, exhibiting two broad endotherms with peak temperatures of about 146°C and 239°C and a third sharp endotherm with a peak temperature of about 276°C.

The present invention includes pharmaceutical compositions comprising a potassium salt of Compound A as originally defined above or as set forth in any of the foregoing embodiments or aspects and a pharmaceutically acceptable carrier.

The present invention also includes pharmaceutical compositions which comprise the product made by combining a potassium salt of Compound A as

originally defined above or as set forth in any of the foregoing embodiments or aspects and a pharmaceutically acceptable carrier.

The present invention also includes pharmaceutical combinations of (i) a potassium salt of Compound A as originally defined above or as set forth in any of the foregoing embodiments or aspects and (ii) an anti-HIV agent selected from the group consisting of HIV antiviral agents, immunomodulators, and anti-infective agents; wherein the Compound A K salt and the anti-HIV agent are each employed in an amount that renders the combination effective for inhibiting HIV integrase, for treating or prophylaxis of infection by HIV, or for treating, prophylaxis of, or delaying the onset of AIDS. In one embodiment, the pharmaceutical combinations include a potassium salt of Compound A and an anti-HIV agent which is an antiviral selected from the group consisting of HIV protease inhibitors, non-nucleoside HIV reverse transcriptase inhibitors and nucleoside HIV reverse transcriptase inhibitors.

A pharmaceutical combination of the present invention (i.e., a potassium salt of Compound A in combination with another anti-HIV agent) can be administered separately or together, and when administered separately, the active compounds can be given concurrently or at different times (e.g., alternately). When the active compounds are administered together (either per se or more typically in a pharmaceutical composition), they can both be part of a single composition (e.g., an admixture of the compounds optionally including one or more excipients) or they can be in separate compositions (e.g., encapsulated compositions respectively containing one of the active compounds and optionally one or more excipients) that can be packaged together or separately.

Other embodiments of the present invention include the following:

(a) A method of treating or prophylaxis of HIV infection in a subject in need thereof, which comprises administering to the subject an effective amount of a potassium salt of Compound A.

(b) A method of delaying the onset of AIDS in a subject in need thereof, which comprises administering to the subject an effective amount of a potassium salt of Compound A.

(c) A method of treating or prophylaxis of AIDS in a subject in need thereof, which comprises administering to the subject an effective amount of a potassium salt of Compound A.

(d) A method of inhibiting HIV integrase in a subject in need thereof, which comprises administering to the subject an effective amount of a potassium salt of Compound A.

(e) A method of treating or prophylaxis of HIV infection in a subject in need thereof, which comprises administering to the subject a pharmaceutical composition comprising an effective amount of a potassium salt of Compound A and a pharmaceutically acceptable carrier.

(f) A method of delaying the onset of AIDS in a subject in need thereof, which comprises administering to the subject a pharmaceutical composition comprising an effective amount of a potassium salt of Compound A and a pharmaceutically acceptable carrier.

(g) A method of treating or prophylaxis of AIDS in a subject in need thereof, which comprises administering to the subject a pharmaceutical composition comprising an effective amount of a potassium salt of Compound A and a pharmaceutically acceptable carrier.

(h) A method of inhibiting HIV integrase in a subject in need thereof, which comprises administering to the subject a pharmaceutical composition comprising an effective amount of a potassium salt of Compound A and a pharmaceutically acceptable carrier.

(i) The method of (a) or (b) or (c) or (d), wherein the potassium salt of Compound A is administered in combination with at least one anti-HIV agent selected from the group consisting of AIDS antiviral agents, immunomodulators, and anti-infective agents, wherein the Compound A K salt and the anti-HIV agent are each employed in an amount that renders the combination effective in said method.

(j) The method of (a) or (b) or (c) or (d), wherein the potassium salt of Compound A is administered in combination with at least one antiviral agent selected from the group consisting of HIV protease inhibitors, non-nucleoside HIV reverse transcriptase inhibitors and nucleoside HIV reverse transcriptase inhibitors, wherein the Compound A K salt and the antiviral agent are each employed in an amount that renders the combination effective in said method.

(k) The method of (e) or (f) or (g) or (h), wherein the pharmaceutical composition comprising the Compound A K salt is administered in combination with at least one anti-HIV agent selected from the group consisting of AIDS antiviral agents, immunomodulators, and anti-infective agents, wherein the

Compound A K salt and the anti-HIV agent are each employed in an amount that renders the combination effective in said method.

(l) The method of (e) or (f) or (g) or (h), wherein the pharmaceutical composition comprising the Compound A K salt is administered in combination with at least one antiviral agent selected from the group consisting of HIV protease inhibitors, non-nucleoside HIV reverse transcriptase inhibitors and nucleoside HIV reverse transcriptase inhibitors, wherein the Compound A K salt and the antiviral agent are each employed in an amount that renders the combination effective in said method.

Additional embodiments of the invention include the methods set forth in (a)-(l) above, wherein the potassium salt of Compound A employed therein is a Compound A potassium salt as set forth in one of the various embodiments and aspects described above.

The present invention also includes a potassium salt of Compound A of the present invention (i) for use in, (ii) for use as a medicament for, or (iii) for use in the preparation of a medicament for: (a) inhibiting HIV integrase, (b) treating or prophylaxis of infection by HIV, or (c) treating, prophylaxis of, or delaying the onset of AIDS. In these uses, the Compound A K salt of the present invention can optionally be employed in combination with one or more anti-HIV agents selected from HIV antiviral agents, anti-infective agents, and immunomodulators. Embodiments of these uses include the uses as just described wherein the potassium salt of Compound A employed therein is a Compound A potassium salt as set forth in one of the various embodiments and aspects described above.

A process for preparing a crystalline potassium salt of Compound A (alternatively referred to herein as "Process P1" or the "P1 process") comprises:

(A1-1) mixing an aqueous solution of a potassium base with a mixture comprising Compound A, water and a first amount of an alcohol to form a basic solution of Compound A and optionally filtering the solution; and (A1-2) seeding the solution formed in Step A1-1 and optionally diluting the seeded solution with a second amount of the alcohol; or

(B1-1) seeding a mixture comprising Compound A and a first amount of an organic solvent selected from the group consisting of a halogenated alkane, a dialkyl ether, dialkoxyalkane, a cyclic ether or diether, a trialkylamine, a tertiary amide, an N-alkylpyrrolidone, a dialkyl sulfoxide and an alkanenitrile; and (B1-2)

adding an aqueous solution of a potassium base to the seeded mixture of Step B1-1; and

(C1) ageing the seeded solution resulting from Step A1-2 or from Step B1-2, to provide the crystalline potassium salt of Compound A.

All of the steps of the P1 process are optionally but preferably conducted with agitation (e.g., stirring).

Compound A has limited solubility in water and in the alcohol (e.g., ethanol) and accordingly Compound A can be difficult to dissolve completely in the alcohol-water mixture. Accordingly, the Compound A-alcohol-water mixture employed in Step A1-1 is typically in the form of a slurry prior to addition of the aqueous base. During Step A1-1, the base reacts with the slurried Compound A converting it to the K salt, which is relatively quite soluble in the alcohol-water mixture, as a result of which the slurry typically is transformed into a relatively clear salt solution. The purpose of the optional filtration in Step A1-1 is to remove any undissolved or precipitated Compound A from the solution and/or to clarify the solution prior to seeding.

Compound A can be employed in Step A1-1 in any amount which will ultimately result in the formation of at least some of the desired crystalline K salt. It is preferred, however, to employ an amount of Compound A which will afford a highly super-saturated solution of the K salt upon completion of the addition of aqueous base in Step A1-1 and prior to seeding, so that the output of crystalline K salt from the process can be maximized.

The purpose of the optional dilution with the alcohol in Step A1-2 is to provide conditions favorable for the crystallization of the K salt; i.e., the K salt is less soluble in the alcohol than in water.

The alcohol employed in Step A1-1 can be any alcohol which under the conditions employed is in the liquid phase, is chemically inert, and will dissolve, suspend, and/or disperse Compound A so as to bring Compound A and the potassium base into contact and permit the crystallization of the desired K salt of Compound A. The alcohol is typically one in which Compound A has a higher solubility than the K salt of Compound A, so as to provide conditions favorable for the crystallization of the K salt of Compound A. Alcohols suitable for use in Step A1-1 include alkyl alcohols and cycloalkyl alcohols, such as C_{1-6} alkyl alcohols and C_{4-6} cycloalkyl alcohols. Suitable alcohols include, for example, methanol, ethanol, propanol, isopropanol, cyclobutanol, and cyclopentanol. In one embodiment, the alcohol is a

C_{1-4} alkyl alcohol. In another embodiment, the alcohol is methanol or ethanol. A preferred alcohol for use in Step A1-1 is ethanol.

The organic solvent employed in Step B1-1 can be any halogenated alkane, dialkyl ether, dialkoxyalkane, cyclic ether or diether, trialkylamine, tertiary amide, N-alkylpyrrolidone, dialkylsulfoxide, or alkanenitrile which under the conditions employed is in the liquid phase, is chemically inert, and will dissolve, suspend, and/or disperse Compound A so as to bring Compound A and the potassium base into contact and permit the crystallization of the desired K salt of Compound A. The physical state of the organic solvent-Compound A mixture prior to seeding will depend upon such factors as the choice of solvent, the amount of Compound A employed, and temperature. The mixture can be, for example, a solution in which Compound A is completely dissolved in the organic solvent or a slurry in which some portion (from minor to major) of Compound A remains undissolved. Some solvents (e.g., DMSO, acetonitrile, NMP and DMF) typically form solutions with Compound A (i.e., dissolve essentially all of the Compound A) for the concentrations of Compound A and under the conditions typically employed in Step B1-1. Undissolved Compound A in the B1-1 mixture will typically go into solution during addition of the aqueous base in Step B1-2 and subsequently either crystallize or remain in solution as the K salt.

The organic solvent in Step B1-1 is also typically one in which Compound A has a higher solubility than does the K salt of Compound A, so as to afford conditions favorable for the crystallization of the K salt of Compound A.

Representative examples of solvents suitable for use in Step B1-1 include carbon tetrachloride, chloroform, methylene chloride, 1,2-dichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, ethyl ether, MTBE, THF, dioxane, 1,2-dimethoxyethane, triethylamine, tri-n-propylamine, diethylisopropylamine, diisopropylethylamine, DMF, DMAC, N-methylpyrrolidone, N-ethylpyrrolidone, DMSO, acetonitrile, and propionitrile.

An embodiment of Process P1 is the process as originally set forth above, wherein the organic solvent employed in Step B1-1 is a C_{1-8} linear or branched halogenated alkane, a dialkyl ether wherein each alkyl is independently a C_{1-4} alkyl, a C_{1-4} linear or branched alkane substituted with two -O-C_{1-4} alkyl groups (which are the same or different), a C_4-C_6 cyclic ether or diether, a tri-(C_{1-4}

alkyl)amine, a N,N-di-(C_{1-4} alkyl)-C_{1-4} alkylamide, a N-(C_{1-4} alkyl)pyrrolidone, a di-(C_{1-4} alkyl)sulfoxide, or a C_2-C_4 alkanenitrile.

In another embodiment, the organic solvent employed in Step B1-1 is acetonitrile, propionitrile, THF, DMF, DMAC, N-methylpyrrolidone, or N-ethylpyrrolidone. In a preferred embodiment, the solvent is acetonitrile or NMP.

The potassium base employed in Step A1-1 or Step B1-2 suitably comprises potassium hydroxide, potassium carbonate, potassium bicarbonate, or potassium alkoxide. The term "potassium alkoxide" refers to a potassium salt of an alkyl alcohol. The potassium alkoxide is suitably the salt of a C_{1-6} alkyl alcohol (i.e., KOR where R is C_{1-6} alkyl), and is typically the salt of a C_{1-4} alkyl alcohol. Suitable potassium alkoxides include, for example, potassium methoxide, potassium ethoxide, potassium propoxide, and potassium isopropoxide. An embodiment of the P1 process is the process as originally set forth above or as set forth in a preceding embodiment, wherein, when a potassium alkoxide is employed in Step A1-1, the alcohol has the same alkyl group as the alkoxide base; i.e., MeOH is employed with KOMe, EtOH is employed with KOEt, i-PrOH is employed with potassium isopropoxide, and so forth.

Another embodiment of Process P1 is the process as originally set forth above or as set forth in a preceding embodiment, wherein the potassium base employed in Step A1-1 or Step B1-2 comprises KOH, KOMe, and KOEt. In an aspect of this embodiment, the potassium base is KOH.

The potassium base (e.g., KOH) can be employed in any proportion with respect to Compound A which results in the formation of at least some of the desired potassium salt. The base can suitably be added in an amount in a range of from about 0.1 to about 3 equivalents per equivalent of Compound A. The base is typically added in a proportion which, under the reaction conditions employed (e.g., temperature, degree of agitation, etc.), will permit conversion of at least a major portion (i.e., more than 50%) of Compound A to the desired salt. The use of excess amounts of base can lead to the formation of hydrolysis products, whereas the use of sub-equivalent amounts of base can unduly restrict the level of conversion resulting in excessive amounts of unreacted Compound A. Accordingly, the base is typically added in an amount in a range of from about 0.5 to about 1.1 equivalents per equivalent of Compound A, and is more typically added in an amount in a range of from about 0.9 to about 1.0 equivalent (e.g., from about 0.90 to about 0.98 equivalent) per equivalent of Compound A.

Any amount of seed crystal can be employed in Step A2 or Step B1-2 which will induce or assist in the crystallization of the desired crystalline form of Compound A K salt. Relatively very small amounts of crystal are typically not employed since they can be minimally effective in inducing or assisting crystallization. On the other hand, very large amounts of crystal are typically not employed, because it is wasteful of material, exceeding the amount necessary for effecting crystallization. Accordingly, the seed crystals are suitably be employed in an amount in a range of from about 0.2 to about 10 wt.% (e.g., from about 0.5 to about 10 wt.%) based on the weight of Compound A (e.g., 10 wt.% means 10 g of seed is employed per 100 g of Compound A), and is typically employed in an amount in a range of from about 1 to about 5 wt.% based on the weight of Compound A.

Steps A1-1 and A1-2 or Steps B1-1 and B1-2 can be conducted over a wide temperature range, wherein the temperature for Step A1-1 or Step B1-2 is such that Compound A is soluble in the reaction medium (i.e., a base-containing seeded solution of a suitable organic solvent as set forth above and water) and the crystalline salt of Compound A is at least partially insoluble in the medium. Each step is suitably conducted at a temperature in a range of from about 0 to about 60°C, is typically conducted at a temperature in a range of from about 20 to about 50°C, and is more typically conducted at a temperature in a range of from about 20 to about 30°C (e.g., from about 20 to about 25°C).

The ageing in Step C1 can be conducted at any temperature which leads to the formation of the desired crystalline form of Compound A K salt. Step C1 is suitably conducted at a temperature in a range of from about 0 to about 60°C, is typically conducted at a temperature in a range of from about 0 to about 50°C (e.g., from about 15 to about 50°C), and is more typically conducted at a temperature in a range of from about 0 to about 30°C (e.g., from about 20 to about 30°C).

An embodiment of the P1 process is the process as originally set forth above or as set forth in a preceding embodiment, wherein Steps A1-1, A1-2 and C1 or Steps B1-1, B1-2 and C1 are all conducted in the same temperature range. In an aspect of this embodiment, each of the steps is conducted at a temperature in a range of from about 20 to about 30°C (e.g., from about 20 to about 25°C).

Another embodiment of the P1 process is the process as originally set forth above or as set forth in a preceding embodiment, wherein Steps A1-1 and A1-2 or Steps B1-1 and B1-2 are each conducted in the same temperature range, but Step C1 is conducted at a lower temperature. In an aspect of this embodiment, Steps A1-1

and A1-2 or Steps B1-1 and B1-2 are each conducted at a temperature in a range of from about 20 to about 30°C (e.g., from about 20 to about 25°C), and Step C1 is conducted at a temperature in a range of from about 0 to about 20°C (e.g., from about 0 to about 10°C). In another aspect of this embodiment, Steps A1-1 and A1-2 or Steps B1-1 and B1-2 are each conducted at a temperature in a range of from about 20 to about 30°C (e.g., from about 20 to about 25°C), and Step C1 is conducted at a temperature in a range of from about 0 to about 10°C (e.g., from about 0 to about 5°C).

The ageing time can vary over a wide range depending upon, *inter alia*, the ageing temperature, the choice of solvent, the choice of base, and the relative amounts and concentrations of Compound A, base, and crystal seed. The ageing is typically conducted for a time sufficient to obtain 50% or more (and preferably 90% or more) of the theoretical yield of K salt from the mother liquor. In any event, the ageing time is typically in a range of from about 0.1 to about 24 hours, and is more typically in a range of from about 0.5 to about 12 hours. It is typically desirable to avoid relatively long ageing times (e.g., more than about 12 hours), since it has been observed that the level of impurities being incorporated into the crystalline product can increase with increasing ageing time.

The proportion of water to alcohol employed in Step A1-1 can vary over a wide range. On the other hand, the potassium salt of Compound A is comparatively quite soluble in water, and thus it can be desirable to limit the proportion of water employed in order to increase crystallization yield from the mother liquor. The volume to volume ratio of alcohol to water can suitably be in a range of from about 80:20 to about 20:80, is typically in a range of from about 70:30 to about 30:70, and is more typically in a range of from about 60:40 to about 40:60 (e.g., from about 55:45 to about 45:55).

In Step A1-2, the seeded solution can be diluted with a further amount of the alcohol. As noted earlier, the Compound A K salt is less soluble in the alcohol than in water, and thus dilution with the alcohol tends to provide conditions favorable for the crystallization of the K salt. The volume to volume ratio of solvent alcohol to water in the diluted, seeded solution can suitably be at least about 60:40, is typically at least about 80:20 (e.g., from about 95:5 to about 80:20), and is more typically at least about 90:10 (e.g., from about 95:5 to about 90:10).

The organic solvent and water can be present in Step B1-2 in any proportion with respect to each other that results in the formation of at least some

crystalline K salt of Compound A. As noted above, Compound A has a higher solubility in the organic solvent than does the Compound A K salt, and thus increasing the proportion of organic solvent tends to favor crystallization of the K salt. On the other hand, the Compound A K salt is typically more soluble in water than in the organic solvent, and thus it is desirable to limit the amount of water introduced into the system via addition of the aqueous base, in order to minimize the amount of salt left behind in the mother liquor during crystallization. The volume to volume ratio of organic solvent to water in the Step B1-2 solution can suitably be at least about 70:30, is typically at least about 80:20 (e.g., from about 95:5 to about 80:20), and is more typically at least about 90:10 (e.g., from about 95:5 to about 90:10).

Other embodiments of the P1 process include the process as originally set forth and as set forth in each of the preceding embodiments, wherein each of the processes further comprises:

(D1) recovering the crystalline K salt of Compound A from the aged solution. In an aspect of this embodiment, the crystalline K salt is recovered by filtration to obtain a crystalline cake, optionally washing the cake with another organic solvent which is the same or different as the alcohol employed in Step A1-1 or the organic solvent employed in Step B1-1, and drying.

Another embodiment of the P1 process is the process which comprises:

(A1-1) mixing an aqueous solution of KOH with a mixture comprising Compound A, water and a first amount of ethanol to form a basic solution of Compound A and optionally filtering the solution;

(A1-2) seeding the solution formed in Step A1-1 and diluting the seeded solution with a second amount of ethanol to obtain a diluted, seeded solution; and

(C1) ageing the diluted, seeded solution of Step A1-2, to provide the crystalline K salt of Compound A.

Aspects of the preceding embodiment include the process as just described, incorporating one or more of the following features (i) to (viii):

(i) Step A1-1 is conducted at a temperature in a range of from about 20 to about 50°C (e.g., from about 20 to about 30°C);

(ii) Step A1-2 is conducted at a temperature in a range of from about 20 to about 50°C (e.g., from about 20 to about 30°C);

(iii) Step C1 is conducted at a temperature in a range of from about 0 to about 30°C (e.g., from about 0 to about 20°C, or from about 0 to about 10°C);

(iv) in Step A1-1, the basic solution has a volume to volume ratio of ethanol to water in a range of from about 70:30 to about 30:70;

(v) in Step A1-2, the diluted, seeded solution has a volume to volume ratio of ethanol to water of at least about 80:20;

(vi) seed crystals are employed in an amount in a range of from about 0.2 to about 5 wt.% (or from about 1 to about 5 wt.%) based upon the total weight of Compound A;

(vii) KOH is employed in an amount in a range of from about 0.9 to about 1.1 equivalents (e.g., from about 0.9 to about 0.98 equivalent) per equivalent of Compound A; and

(viii) the process further comprises step D1, which is recovering the crystalline K salt of Compound A (e.g., by separating the crystalline K salt from the aged solution by filtration to obtain a crystalline cake, optionally washing the cake with a third amount of ethanol, and drying).

Still another embodiment of the P1 process is the process which comprises:

(B1-1) seeding a solution comprising Compound A and acetonitrile;

(B1-2) adding an aqueous solution of KOH to the seeded solution formed in Step B1-1; and

(C1) ageing the solution of Step B1-2, to provide the crystalline K salt of Compound A.

Aspects of the preceding embodiment include the process as just described, incorporating one or more of the following features (i) to (viii):

(i) Step B1-1 is conducted at a temperature in a range of from about 20 to about 50°C (e.g., from about 20 to about 30°C);

(ii) Step B1-2 is conducted at a temperature in a range of from about 20 to about 50°C (e.g., from about 20 to about 30°C);

(iii) Step C1 is conducted at a temperature in a range of from about20 to about 50°C (e.g., from about 20 to about 30°C);

(iv) the seeded solution obtained in Step B1-2 has a volume to volume ratio of acetonitrile to water of at least about 90:10;

(v) seed crystals are employed in an amount in a range of from about 0.2 to about 5 wt.% (or from about 1 to about 5 wt.%) based upon the total weight of Compound A; and

(vi) KOH is employed in an amount in a range of from about 0.9 to about 1.1 equivalents (e.g., from about 0.9 to about 0.98 equivalent) per equivalent of Compound A; and

(vii) the process further comprises Step D1, which is recovering the crystalline K salt of Compound A (e.g., by separating the crystalline K salt from the aged solution by filtration to obtain a crystalline cake, washing the cake with acetonitrile, and drying).

Additional embodiments of the P1 process include the process as originally set forth and as set forth in each of the preceding embodiments, wherein crystal seed employed in the process comprises Form 1 crystalline potassium salt of Compound A and the crystalline salt resulting from the process comprises Form 1 crystalline potassium salt of Compound A.

The seeding step set forth above in Process P1 is optional in the sense that crystalline Compound A K salt can be obtained without seeding. Seeding is preferred, however, as a means of inducing or assisting crystallization generally and of preparing specific crystalline forms (e.g., Form 1) particularly.

As noted above, the present invention includes administration of an effective amount of a potassium salt of Compound A (either alone or as the active component of a pharmaceutical composition) for inhibiting HIV integrase, for the treatment or prophylaxis of HIV infection, or for the treatment, prophylaxis, or delay in the onset of AIDS to a subject in need of such inhibition, treatment, prophylaxis, or delay. The present invention also includes the use of a potassium salt of Compound A in combination with an anti-HIV agent.

The term "administration" and variants thereof (e.g., "administering" a compound) in reference to a Compound A K salt of the invention mean providing the salt to the individual in need of inhibition, treatment or prophylaxis. When a potassium salt of Compound A is provided in combination with one or more other active agents (e.g., antiviral agents useful for treating or prophylaxis of HIV infection or AIDS), "administration" and its variants are each understood to include provision of the compound or prodrug and other agents at the same time (separately or together) or at different times.

As used herein, the term "composition" is intended to encompass a product comprising the specified ingredients, as well as any product which results, directly or indirectly, from combining the specified ingredients.

By "pharmaceutically acceptable" is meant that the ingredients of the pharmaceutical composition must be compatible with each other and not deleterious to the recipient thereof.

The term "subject" as used herein refers to an animal, preferably a mammal, most preferably a human, who has been the object of treatment, observation or experiment.

The term "effective amount" as used herein means that amount of active compound or pharmaceutical agent that elicits the biological or medicinal response in a tissue, system, animal or human that is being sought by a researcher, veterinarian, medical doctor or other clinician. The effective amount can be a "therapeutically effective amount" for the alleviation of the symptoms of the disease or condition being treated. The effective amount can also be a "prophylactically effective amount" for prophylaxis of the symptoms of the disease or condition being prevented. The term also includes herein the amount of active compound sufficient to inhibit HIV integrase and thereby elicit the response being sought (i.e., an "inhibition effective amount"). In the present invention, the active ingredient (i.e., Compound A) is administered as a potassium salt, and references to the amount of active ingredient are to the free phenol form of Compound A.

The term "anti-HIV agent" means an agent which is effective in one or more of the following uses: inhibiting integrase or another enzyme required for HIV replication or infection, prophylaxis of HIV infection, treating HIV infection, delaying the onset of AIDS, prophylaxis of AIDS, or treating AIDS. Suitable anti-HIV agents include HIV/AIDS antiviral agents, anti-infective agents, and immunomodulators. Suitable anti-HIV agents include those listed in Table 1 as follows:

ANTIVIRALS

Drug Name	Manufacturer (Tradename and/or Location)	Indication (Activity)
abacavir GW 1592 1592U89	Glaxo Welcome (ZIAGEN®)	HIV infection, AIDS, ARC (nucleoside reverse transcriptase inhibitor)
abacavir + lamivudine + zidovudine	GlaxoSmithKline (TRIZIVIR®)	HIV infection, AIDS, ARC (nucleoside reverse transcriptase inhibitors)

acemannan	Carrington Labs (Irving, TX)	ARC
ACH 126443	Achillion Pharm.	HIV infections, AIDS, ARC (nucleoside reverse transcriptase inhibitor)
acyclovir	Burroughs Wellcome	HIV infection, AIDS, ARC, in combination with AZT
AD-439	Tanox Biosystems	HIV infection, AIDS, ARC
AD-519	Tanox Biosystems	HIV infection, AIDS, ARC
adefovir dipivoxil GS 840	Gilead	HIV infection, AIDS, ARC (reverse transcriptase inhibitor)
AL-721	Ethigen (Los Angeles, CA)	ARC, PGL, HIV positive, AIDS
alpha interferon	GlaxoSmithKline	Kaposi's sarcoma, HIV, in combination w/Retrovir
AMD3100	AnorMed	HIV infection, AIDS, ARC (CXCR4 antagonist)
amprenavir 141 W94 GW 141 VX478 (Vertex)	GlaxoSmithKline (AGENERASE®)	HIV infection, AIDS, ARC (protease inhibitor)
ansamycin LM 427	Adria Laboratories (Dublin, OH) Erbamont (Stamford, CT)	ARC
antibody which neutralizes pH labile alpha aberrant interferon	Advanced Biotherapy Concepts (Rockville, MD)	AIDS, ARC
AR177	Aronex Pharm	HIV infection, AIDS, ARC
beta-fluoro-ddA	Nat'l Cancer Institute	AIDS-associated diseases
BMS-232623 (CGP-73547)	Bristol-Myers Squibb/ Novartis	HIV infection, AIDS, ARC (protease inhibitor)
BMS-234475 (CGP-61755)	Bristol-Myers Squibb/ Novartis	HIV infection, AIDS, ARC (protease inhibitor)

capravirine (AG-1549, S-1153)	Pfizer	HIV infection, AIDS, ARC (non-nucleoside reverse transcriptase inhibitor)
CI-1012	Warner-Lambert	HIV-1 infection
cidofovir	Gilead Science	CMV retinitis, herpes, papillomavirus
curdlan sulfate	AJI Pharma USA	HIV infection
cytomegalovirus immune globin	MedImmune	CMV retinitis
cytovene ganciclovir	Syntex	sight threatening CMV peripheral CMV retinitis
delavirdine	Pharmacia-Upjohn (RESCRIPTOR®)	HIV infection, AIDS, ARC (non-nucleoside reverse transcriptase inhibitor)
dextran Sulfate	Ueno Fine Chem. Ind. Ltd. (Osaka, Japan)	AIDS, ARC, HIV positive asymptomatic
ddC (zalcitabine, dideoxycytidine)	Hoffman-La Roche (HIVID®)	HIV infection, AIDS, ARC (nuclesodie reverse transcriptase inhibitor)
ddI (didanosine, dideoxyinosine)	Bristol-Myers Squibb (VIDEX®)	HIV infection, AIDS, ARC; combination with AZT/d4T (nucleoside reverse transcriptase inhibitor)
DPC 681 & DPC 684	DuPont	HIV infection, AIDS, ARC (protease inhibitors)
DPC 961 & DPC 083	Bristol-Myers Squibb (from DuPont Pharma)	HIV infection AIDS, ARC (non-nucleoside reverse transcriptase inhibitors)
EL10	Elan Corp, PLC (Gainesville, GA)	HIV infection
efavirenz (DMP 266)	Bristol-Myers Squibb (SUSTIVA®) Merck (STOCRIN®)	HIV infection, AIDS, ARC (non-nucleoside RT inhibitor)
famciclovir	Novartis (FAMVIR®)	herpes zoster, herpes simplex

emtricitabine FTC	Gilead (EMTRIVA®) Emory University	HIV infection, AIDS, ARC (nucleoside reverse transcriptase inhibitor)
emivirine	Gilead (from Triangle Pharmaceuticals) (COACTINON®)	HIV infection, AIDS, ARC (non-nucleoside reverse transcriptase inhibitor)
enfuvirtide T-20	Trimeris & Roche (FUZEON®)	HIV infection, AIDS, ARC (fusion inhibitor)
HBY097	Hoechst Marion Roussel	HIV infection, AIDS, ARC (non-nucleoside reverse transcriptase inhibitor)
fosamprenavir	Glaxo Smith Kline	HIV infection, AIDS, ARC (prodrug of amprenavir)
hypericin	VIMRx Pharm.	HIV infection, AIDS, ARC
recombinant human interferon beta	Triton Biosciences (Almeda, CA)	AIDS, Kaposi's sarcoma, ARC
interferon alfa-n3	Interferon Sciences	ARC, AIDS
indinavir (sulfate salt)	Merck (CRIXIVAN®)	HIV infection, AIDS, ARC, asymptomatic HIV positive, (protease inhibitor)
ISIS 2922	ISIS Pharmaceuticals	CMV retinitis
JE2147/AG1776	Agouron	HIV infection, AIDS, ARC (protease inhibitor)
KNI-272	Nat'l Cancer Institute	HIV-assoc. diseases
lamivudine, 3TC	GlaxoSmithKline (EPIVIR®)	HIV infection, AIDS, ARC (nucleoside reverse transcriptase inhibitor)
lamivudine + zidovudine	GlaxoSmithKline (COMBIVIR®)	HIV infection, AIDS, ARC (nucleoside reverse transcriptase inhibitor)
lobucavir	Bristol-Myers Squibb	CMV infection
lopinavir (ABT-378)	Abbott	HIV infection, AIDS, ARC (protease inhibitor)
lopinavir + ritonavir (ABT-378/r)	Abbott (KALETRA®)	HIV infection, AIDS, ARC (protease inhibitor)
mozenavir (DMP-450)	AVID (Camden, NJ)	HIV infection, AIDS, ARC (protease inhibitor)

nelfinavir	Agouron (VIRACEPT®)	HIV infection, AIDS, ARC (protease inhibitor)
nevirapine	Boeheringer Ingleheim (VIRAMUNE®)	HIV infection, AIDS, ARC (non-nucleoside reverse transcriptase inhibitor)
novapren	Novaferon Labs, Inc. (Akron, OH)	HIV inhibitor
peptide T octapeptide sequence	Peninsula Labs (Belmont, CA)	AIDS
PRO 140	Progenics	HIV infection, AIDS, ARC (CCR5 co-receptor inhibitor)
PRO 542	Progenics	HIV infection, AIDS, ARC (attachment inhibitor)
trisodium phosphonoformate	Astra Pharm. Products, Inc	CMV retinitis, HIV infection, other CMV infections
PNU-140690	Pharmacia Upjohn	HIV infection, AIDS, ARC (protease inhibitor)
probucol	Vyrex	HIV infection, AIDS
RBC-CD4	Sheffield Med. Tech (Houston TX)	HIV infection, AIDS, ARC
ritonavir (ABT-538)	Abbott (NORVIR®)	HIV infection, AIDS, ARC (protease inhibitor)
saquinavir	Hoffmann-LaRoche (FORTOVASE®)	HIV infection, AIDS, ARC (protease inhibitor)
stavudine; d4T didehydrodeoxy-thymidine	Bristol-Myers Squibb (ZERIT®)	HIV infection, AIDS, ARC (nucleoside reverse transcriptase inhibitor)
T-1249	Trimeris	HIV infection, AIDS, ARC (fusion inhibitor)
TAK-779	Takeda	HIV infection, AIDS, ARC (injectable CCR5 receptor antagonist)
tenofovir	Gilead (VIREAD®)	HIV infection, AIDS, ARC (nucleotide reverse transcriptase inhibitor)

tipranavir (PNU-140690)	Boehringer Ingelheim	HIV infection, AIDS, ARC (protease inhibitor)
TMC-120 & TMC-125	Tibotec	HIV infections, AIDS, ARC (non-nucleoside reverse transcriptase inhibitors)
TMC-126	Tibotec	HIV infection, AIDS, ARC (protease inhibitor)
valaciclovir	GlaxoSmithKline	genital HSV & CMV infections
virazole ribavirin	Viratek/ICN (Costa Mesa, CA)	asymptomatic HIV positive, LAS, ARC
zidovudine; AZT	GlaxoSmithKline (RETROVIR®)	HIV infection, AIDS, ARC, Kaposi's sarcoma in combination with other therapies (nucleoside reverse transcriptase inhibitor)

IMMUNO-MODULATORS

Drug Name	Manufacturer	Indication
AS-101	Wyeth-Ayerst	AIDS
Bropirimine	Pharmacia Upjohn	advanced AIDS
Acemannan	Carrington Labs, Inc. (Irving, TX)	AIDS, ARC
CL246,738	American Cyanamid Lederle Labs	AIDS, Kaposi's sarcoma
EL10	Elan Corp, PLC (Gainesville, GA)	HIV infection
FP-21399	Fuki ImmunoPharm	blocks HIV fusion with CD4+ cells
Gamma Interferon	Genentech	ARC, in combination w/TNF (tumor necrosis factor)
Granulocyte Macrophage Colony Stimulating Factor	Genetics Institute Sandoz	AIDS
Granulocyte Macrophage Colony Stimulating Factor	Hoeschst-Roussel Immunex	AIDS

Granulocyte Macrophage Colony Stimulating Factor	Schering-Plough	AIDS, combination w/AZT
HIV Core Particle Immunostimulant	Rorer	seropositive HIV
IL-2 Interleukin-2	Cetus	AIDS, in combination w/AZT
IL-2 Interleukin-2	Hoffman-La Roche Immunex	AIDS, ARC, HIV, in combination w/AZT
IL-2 Interleukin-2 (aldeslukin)	Chiron	AIDS, increase in CD4 cell counts
Immune Globulin ntravenous (human)	Cutter Biological (Berkeley, CA)	pediatric AIDS, in combination w/AZT
IMREG-1	Imreg (New Orleans, LA)	AIDS, Kaposi's sarcoma, ARC, PGL
IMREG-2	Imreg (New Orleans, LA)	AIDS, Kaposi's sarcoma, ARC, PGL
Imuthiol Diethyl Dithio Carbamate	Merieux Institute	AIDS, ARC
Alpha-2 Interferon	Schering Plough	Kaposi's sarcoma w/AZT, AIDS
Methionine- Enkephalin	TNI Pharmaceutical (Chicago, IL)	AIDS, ARC
MTP-PE Muramyl-Tripeptide	Ciba-Geigy Corp.	Kaposi's sarcoma
Granulocyte Colony Stimulating Factor	Amgen	AIDS, in combination w/AZT
Remune	Immune Response Corp.	immunotherapeutic
rCD4 Recombinant Soluble Human CD4	Genentech	AIDS, ARC
rCD4-IgG hybrids		AIDS, ARC
Recombinant Soluble Human CD4	Biogen	AIDS, ARC
Interferon Alfa 2a	Hoffman-La Roche	Kaposi's sarcoma, AIDS, ARC, in combination w/AZT
SK&F106528 Soluble T4	Smith Kline	HIV infection

Thymopentin	Immunobiology Research Institute	HIV infection
Tumor Necrosis Factor; TNF	Genentech	ARC, in combination w/gamma Interferon
etanercept	Immunex Corp (ENBREL®)	rheumatoid arthritis
infliximab	Centocor (REMICADE®)	rheumatoid arthritis and Crohn's disease

ANTI-INFECTIVES

Drug Name	Manufacturer	Indication
Clindamycin with Primaquine	Pharmacia Upjohn	PCP
Fluconazole	Pfizer	cryptococcal meningitis, candidiasis
Pastille Nystatin Pastille	Squibb Corp.	prevention of oral candidiasis
Ornidyl Eflornithine	Merrell Dow	PCP
Pentamidine Isethionate (IM & IV)	LyphoMed (Rosemont, IL)	PCP treatment
Trimethoprim		antibacterial
Trimethoprim/sulfa		antibacterial
Piritrexim	Burroughs Wellcome	PCP treatment
Pentamidine isethionate for inhalation	Fisons Corporation	PCP prophylaxis
Spiramycin	Rhone-Poulenc	cryptosporidia diarrhea
Intraconazole-R51211	Janssen Pharm.	histoplasmosis; cryptococcal meningitis
Trimetrexate	Warner-Lambert	PCP

OTHER

Drug Name	Manufacturer	Indication
Daunorubicin	NeXstar, Sequus	Karposi's sarcoma

Recombinant Human Erythropoietin	Ortho Pharm. Corp.	severe anemia assoc. with AZT therapy
Recombinant Human Growth Hormone	Serono	AIDS-related wasting, cachexia
Leukotriene B4 Receptor Antagonist	-	HIV infection
Megestrol Acetate	Bristol-Myers Squibb	treatment of anorexia assoc. w/AIDS
Soluble CD4 Protein and Derivatives	-	HIV infection
Testosterone	Alza, Smith Kline	AIDS-related wasting
Total Enteral Nutrition	Norwich Eaton Pharmaceuticals	diarrhea and malabsorption, related to AIDS

For the purpose of inhibiting HIV integrase, treating or prophylaxis of HIV infection or treating, prophylaxis of or delaying the onset of AIDS, a potassium salt of Compound A of the present invention can be administered by any means that produces contact of the active agent with the agent's site of action. The potassium salt can be administered by any conventional means available for use in conjunction with pharmaceuticals, either as individual therapeutic agents or in a combination of therapeutic agents. It can be administered alone, but is typically administered with a pharmaceutical carrier selected on the basis of the chosen route of administration and standard pharmaceutical practice. A Compound A K salt of the invention can, for example, be administered orally, parenterally (including subcutaneous injections, intravenous, intramuscular, intrasternal injection or infusion techniques), by inhalation spray, or rectally, in the form of a unit dosage of a pharmaceutical composition containing an effective amount of the K salt and conventional non-toxic pharmaceutically-acceptable carriers, adjuvants and vehicles. Liquid preparations suitable for oral administration (e.g., suspensions, syrups, elixirs and the like) can be prepared according to techniques known in the art and can employ any of the usual media such as water, glycols, oils, alcohols and the like. Solid preparations suitable for oral administration (e.g., powders, pills, capsules and tablets) can be prepared according to techniques known in the art and can employ such solid excipients as starches, sugars, kaolin, lubricants, binders, disintegrating agents and the like. Parenteral compositions can be prepared according to techniques known in the art and

typically employ sterile water as a carrier and optionally other ingredients, such as a solubility aid. Injectable solutions can be prepared according to methods known in the art wherein the carrier comprises a saline solution, a glucose solution or a solution containing a mixture of saline and glucose. Further description of methods suitable for use in preparing pharmaceutical compositions of the present invention and of ingredients suitable for use in said compositions is provided in Remington's Pharmaceutical Sciences, 18th edition, edited by A. R. Gennaro, Mack Publishing Co., 1990.

In a preferred embodiment, the potassium salt of Compound A is administered orally in a pharmaceutical composition comprising the Compound A K salt and hydroxypropylmethylcellulose (e.g., HPMC 2910), wherein the composition is compressed into a tablet. In another preferred embodiment, the potassium salt of Compound A is administered orally in a pharmaceutical composition comprising the Compound A K salt, a poloxamer (e.g., poloxamer 407), hydroxypropylmethylcellulose (e.g., HPMC K4M), and lactose (e.g., lactose hydrous spray dried), wherein the composition is compressed into a tablet.

A potassium salt of Compound A can be administered orally in a dosage range (all doses disclosed herein are on an active ingredient basis) of 0.001 to 1000 mg/kg of mammal (e.g., human) body weight per day in a single dose or in divided doses. One preferred dosage range is 0.01 to 500 mg/kg body weight per day orally in a single dose or in divided doses. Another preferred dosage range is 0.1 to 100 mg/kg body weight per day orally in single or divided doses. For oral administration, the compositions can be provided in the form of tablets or capsules containing 1.0 to 1000 milligrams of the active ingredient, particularly 1, 5, 10, 15, 20, 25, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900 and 1000 milligrams of the active ingredient for the symptomatic adjustment of the dosage to the patient to be treated. A preferred dosage of the potassium salt of Compound A (e.g., Form 1) for adult humans is oral administration in the form of capsules or tablets in an amount of from 100 mg to 600 mg twice per day. The specific dose level and frequency of dosage for any particular patient can vary and will depend upon a variety of factors including the patient's age, body weight, general health, sex, and diet; the mode and time of administration; rate of excretion; drug combination; and the severity of the particular condition.

Abbreviations used herein include the following: AIDS = acquired immunodeficiency syndrome; ARC = AIDS related complex; AUC = area under the

curve for a plot of plasma concentration v. time to last sampling (e.g., 24 hours); Bz = benzoyl; C_{max} = maximum plasma concentration; DIEA = diisopropylethylamine; DMAC = N,N-dimethylacetamide; DMADC = dimethylacetylene dicarboxylate; DME = 1,2-dimethoxyethane; DMF = N,N-dimethylformamide; DMSO = dimethylsulfoxide; DSC = differential scanning calorimetry; Eq. = equivalent(s); EtOAc = ethyl acetate; EtOH = ethanol; HIV = human immunodeficiency virus; HPLC = high-performance liquid chromatography; i-Pr = isopropyl; IPA = isopropyl alcohol; KF = Karl Fisher titration for water; KOEt = potassium ethoxide; LC = liquid chromatography; LCAP = LC area percent; LCWP = LC weight percent; Me = methyl; MeCN = acetonitrile; MeOH = methanol; MSA = methanesulfonic acid; MTBE = methyl tertiary butyl ether; MW = molecular weight; NMM = N-methylmorpholine; NMP = N-methylpyrrolidone; NMR = nuclear magnetic resonance; t-Bu = tert-butyl; TG = thermogravimetric; THF = tetrahydrofuran; XRPD = x-ray powder diffraction.

Unless expressly stated to the contrary, all ranges cited herein are inclusive. For example, a temperature range of from about 15°C to about 80°C means the temperature can be about 15°C, or about 80°C, or any value in between.

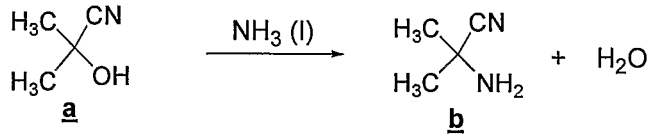
The following examples serve only to illustrate the invention and its practice. The examples are not to be construed as limitations on the scope or spirit of the invention.

A reference herein to "equivalent" or "equivalents" means molar equivalent(s).

EXAMPLE 1

Preparation of Compound A and its Form 1 Crystalline Potassium Salt

Step 1: Strecker Amine Formation

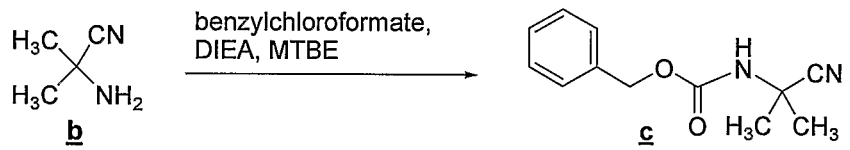


a [MW = 85.1] **b** [MW = 84.1]

Material	MW	Eq.	Moles	Mass	Volume	density (g/mL)
acetone cyanohydrin (a)	85.1	1.0	129.3	11.0 kg	11.8 L	0.932
MTBE		4.0			44 L	
ammonia (g)	17.03	1.5	193.9	3.30 kg	4.9 L	0.674

Acetone cyanohydrin (11.5 kg, 12.3 L) was charged to a 5-gallon autoclave and the vessel placed under 5 psi nitrogen pressure. The autoclave was cooled to 10 °C, and ammonia gas (~3.44 kg), pressurized to 30 psi, was fed into the vessel until the reaction reached complete conversion as determined by GC assay (less than 0.5% **a**). The resulting suspension was transferred to a polyjug and the autoclave rinsed with MTBE (approximately 17 L). The reaction mixture and rinse were then charged to a 100-L extractor followed by MTBE (15 L), the mixture agitated, and the layers carefully separated. The aqueous layer was back-extracted with MTBE (5 L) and the layers carefully separated. The organic layers were combined and charged to a 100 L flask, equipped with a batch concentrator, through an in-line filter, and the batch was concentrated (15-20 °C, low vacuum) to about 20 L to remove any excess ammonia. The aminonitrile was obtained in 97 % assay yield (11.1 kg) by NMR as a solution in MTBE.

Step 2: Addition of Benzyloxycarbonyl (CBz) Protective Group



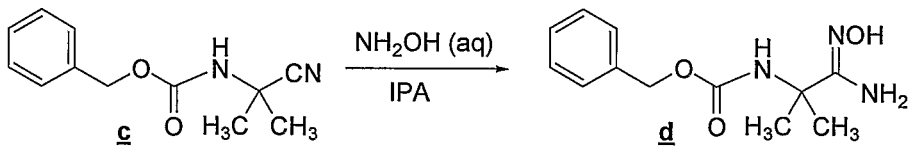
b [MW = 84.1]

c [MW = 218.25]

Material	MW	Eq.	Moles	Mass	Volume
aminonitrile (**b**)	84.1		52.85	4.44 assay kg	
benzylchloroformate	170.6	1.2	63.4	10.8 kg	
DIEA	129.25	1.3	68.7	8.88	
MTBE					62.5 L

To a visually clean 100-L flask containing a 5-L addition funnel, thermocouple and nitrogen inlet was charged a 59 wt.% solution of cyanoamine **b** in MTBE (4.44 assay kg). The solution was further diluted with MTBE (62.5 L) to bring the concentration to approximately 15 mL/g. Benzylchloroformate (1.20 equiv, 10.42 kg, 61.10 mol) was then charged in over 15 minutes via the addition funnel at such a rate as to maintain the batch temperature below 35 °C. DIEA (1.3 equiv, 8.88 kg, 68.70 mol) was then added over 1.5 hours to the yellow slurry while maintaining the batch temperature below 35 °C. The slurry became slightly more soluble as DIEA was added but two phases were observed when stirring was stopped. The reaction mixture was aged for 16 hours at 20-25 °C, after which DI water (20 L, 4.5 mL/g) was charged into the batch. The batch was then transferred to a 100-L extractor and the phases were separated. The organic layer was then washed with 3 x 10 L of water and then 15 L of brine. The organic layer was transferred via a 10 μm inline filter to a 100 L round bottom flask and subsequently solvent switched to 90:10 heptane:MTBE. Crystallization occured during the solvent switch and the resulting white crystalline product was filtered and washed with 3 x 5 L of 90:10 heptane:MTBE. A total of 10.1 kg of product (88% yield) was obtained in greater than 99 HPLC A%. A total of 26.7 kg of product was obtained in 3 batches with an average isolated yield of 86%.

Step 3: Amidoxime Formation

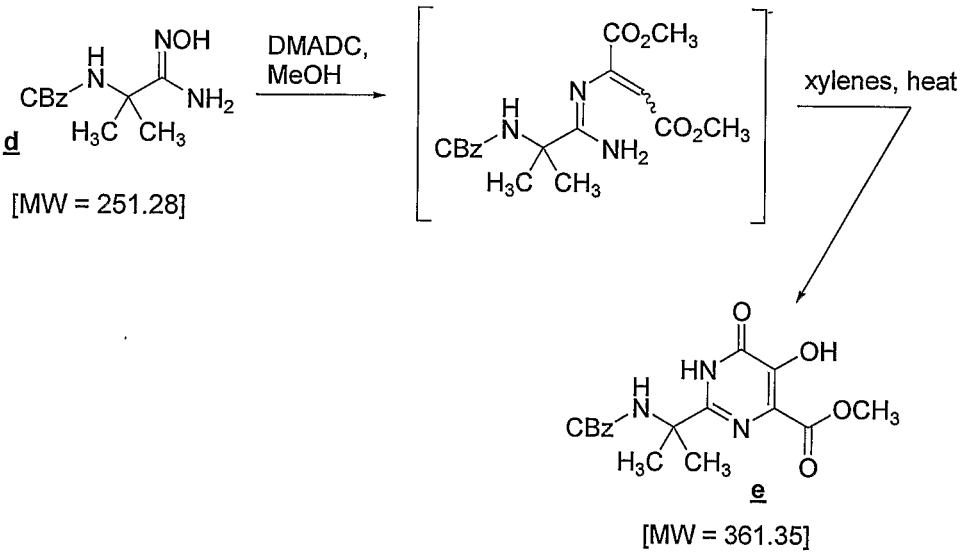


c [MW = 218.25] **d** [MW = 251.28]

Material	MW	Eq.	Mass	Volume
protected aminonitrile (c)	218.25	1	15 g	
NH_2OH (50 wt.% in water)		1.2		5.05 mL
IPA				40 mL + 10 mL
n-heptane				40 mL + 50 mL

A solution of aminonitrile (15 g) in IPA (40 mL) was warmed to 60 °C with stirring and NH_2OH in water (5.05 mL) was added at this temperature over the course of 20 minutes. The clear mixture was then aged at 60 °C for 3 hours, wherein product began to crystallize out of solution at this temperature after 2 hours. The slurry was then cooled to 0°-5°C and n-heptane (40 mL) was added dropwise over 20 minutes. After stirring for 2 hours at 0°-5°C, the slurry was filtered and the cake was washed with a 20 % IPA in heptane solution (60 mL), and then dried under vacuum with a nitrogen stream at room temperature to give pure amide oxime in 88% yield.

Step 4: Formation of Hydroxypyrimidinone



d

[MW = 251.28]

e

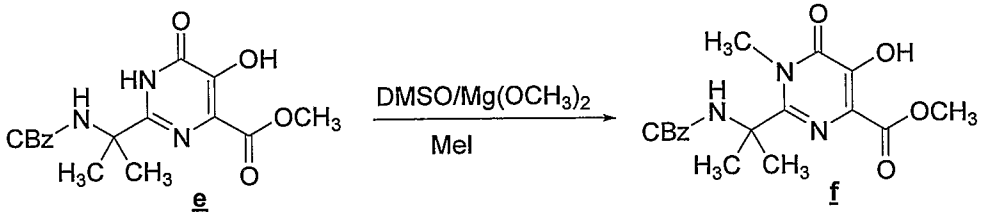
[MW = 361.35]

Material	MW	Eq.	Mass	Volume	Density (g/mL)
amidoxime (**d**)	251.28	1	2.9 kg		
DMADC	142.11	1.08	1.77		1.16
MeOH				12 L + 6 L	
xylenes				15 L	
MTBE				9 L	

To a slurry of amidoxime (2.90 kg) in methanol (12 L) was added dimethyl acetylenedicarboxylate (1.77 kg) over 20 minutes. A slow exotherm ensued such that the temperature of the slurry increased from 20°C to 30°C over 15-20 minutes. After 1.5 hours, HPLC indicated greater than 95% conversion to the intermediate cis/ trans adducts. The solvent was then switched to xylenes under reduced pressure (maximum temperature = 50°C), wherein 2 volumes [2 x 7.5 L] were added and reduced to a final volume of 7.5 L. The reaction mixture was then heated to 90°C and kept at this temperature for 2 hours, while flushing the remaining MeOH out with a nitrogen sweep. The temperature was then increased in 10°C increments over 3.5 hours to 125°C and held at this temperature for 2 hours. The temperature was then finally increased to 135°C for 5 hours. The reaction mixture was then cooled to 60°C and MeOH (2.5 L) was added. After 30 minutes MTBE (9 L) was added slowly to build a seed bed. The batch was then cooled to 0°C for 14 hours, and then further cooled to -5°C and aged 1 hour before filtration. The solids were displacement washed with 10% MeOH/MTBE (6 L then 4 L; pre-chilled to 0°C) and dried on the filter pot under a nitrogen sweep to afford 2.17 kg (51.7 % corrected yield; 99.5 wt %).

HPLC method: Column: Zorbax C-8 4.6 mm x 250 mm; 40% ACN/ 60% 0.1% H_3PO_4 to 90% ACN / 10% 0.1% H_3PO_4 over 12 minutes, hold 3 minutes then back to 40% ACN over 1 minute. Retention times: amidoxime **d** - 2.4 minutes, DMAD-6.7 minutes, intermediate adducts – 8.4 and 8.6 minutes (8.4 minute peak cyclizes faster), product **e** - 5.26 minutes, xylenes – several peaks around 10.4 -10.7 minutes.

Step 5: *N*-Methylation



e

[MW = 361.35]

f

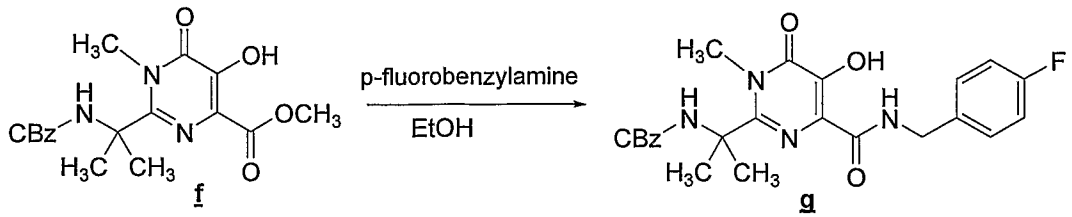
[MW = 375.38]

Material	MW	Eq.	Mass	Volume
pyrimidine diol (e)	361.35	1	2 kg	
$Mg(OMe)_2$, 8 wt.% in MeOH		2	11.95 kg	13.4 L
MeI		4	3.14 kg	1.38 L
DMSO				16 L
2M HCl				20 L
MeOH				14 L
Na bisulfite 5 wt.% in water				2 L
water				60 L

To a solution of the pyrimidine diol e (2 kg) in DMSO (16 L) was added a solution of $Mg(OMe)_2$ in MeOH (11.95 kg), after which excess MeOH was evaporated under vacuum (30 mm Hg) at 40°C for 30 minutes. The mixture was then cooled down to 20°C, after which MeI (1.38 L) was added and the mixture stirred at 20-25°C for 2 hours, and then at 60°C for 5 hours under pressure in a closed flask. HPLC showed that the reaction was complete. The mixture was then cooled to 20°C, after which MeOH (14 L) was added, followed by the slow addition of 2 M HCl (20 L) [exotherm] over 60 minutes. Sodium bisulfite (5 wt.%, 2 L) was then added to quench excess I_2, with the solution turning white. Water (40 L) was then added over 40 minutes and the slurry stirred for 40 minutes in an ice bath, and then filtered. The filter cake was washed first with water (20 L) and then with MTBE:MeOH 9/1 (30 L) to remove O-methylated by-product. HPLC showed less than 0.5 A% O-methylated product after washing. The solid was dried overnight at room temperature under

vacuum with an N_2 stream to give 1.49 kg of *N*-methyl pyrimidone (70 % yield, corrected for purity of starting material and product).

Step 6: Amine coupling



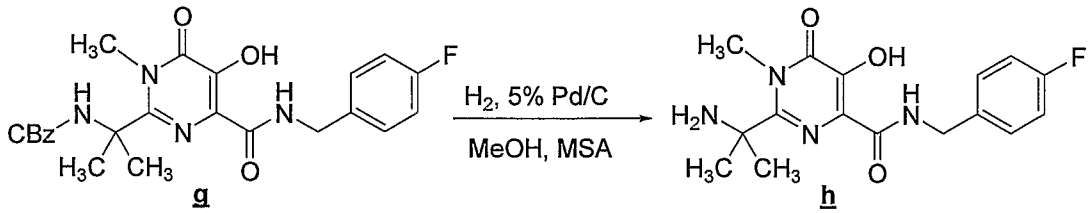
[MW = 375.38] [MW = 468.48]

Material	MW	Eq.	Mass	Volume
N-methylpyrimidinone (**f**)	375.38	1	1.4 kg	
4-fluorobenzylamine	125.15	2.2	1.05 kg	
EtOH				14 L
water				14 L
acetic acid				0.55 L

To a slurry of *N*-methylated pyrimidinone **f** (1.4 kg) in EtOH (14 L) at 4°C was slowly added 4-fluorobenzylamine (1.05 kg) over 15 minutes, wherein an exotherm to 9°C was observed during addition of the first 1 mole equivalent of the amine. The slurry became very thick and vigorous stirring was required. The reaction was warmed to 72°C over 2 hours and maintained at this temperature for 1 hour and 45 minutes. The solution became extremely viscous at 45°C where a small exotherm was observed to 50°C, after which the slurry slowly freed up and became homogeneous after 1 hour at 72°C. An HPLC sample assay (HPLC method was similar to that employed in Step 4 above) at the end of the reaction showed less than 0.5 A% N-methylated pyrimidinone. The reaction was then cooled to 60°C and acetic acid (0.55L) was added over 30 minutes, followed by the addition of water (6.7 L) over 30 min and then the addition of seed (3.0g) to initiate crystallization. After 30 min at 60°C, more water (7.3 L) was added over 30 minutes and the reaction mixture allowed to cool to ambient temperature overnight. After 13 hours, the temperature

was at 20°C, at which point the reaction mixture was filtered and the slurry washed with 50% water/EtOH (2 x 4 L). The solids were dried on the filter pot under vacuum/N_2 flow to a constant weight to afford a white solid product (1.59 kg; 90 % corrected yield; 99% LCWP and 99.7% LCAP as determined by HPLCmethod similar to that employed in Step 4 above.)

Step 7: Hydrogenation of Cbz-amide



g [MW = 468.48]

h [MW = 334.35]

Material	MW	mmoles	Mass	Volume
CBz amide (g)	468.48	21.33	10 g	
MeOH				80 mL
5% Pd/C (50% wet)			0.15 g	
MSA	96.1	22.4		1.45 mL
water				8 mL
cake wash (4:1 MeOH:H_2O				20 mL
1 N NaOH		22.4		22.4 mL
final cake wash (water)				30 mL

A stainless steel hydrogenation vessel was preconditioned with MeOH, Pd/C catalyst and MSA under the reaction conditions described below. Cbz-amide g (10g) was then slurried in MeOH (80 mL) in the preconditioned vessel. MSA (1.45 mL) was added to the slurry in one portion at room temperature. 5% Pd/C (0.15g, 50% wet) was also added to the hydrogenation vessel. Hydrogen was charged to the vessel in three successive vacuum/hydrogen purge cycles, after which the mixture was hydrogenated at 40 psig for 3-4 hour at 50°C. Following hydrogenation, water (8 mL) was added to the reaction mixture, the mixture was stirred, and the catalyst was

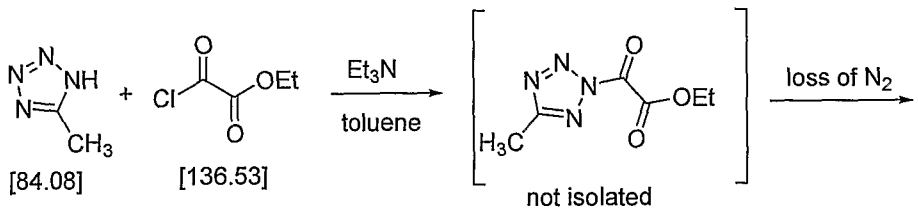
filtered and washed with 4:1 MeOH:water (20 mL). The pH of combined filtrates was adjusted to pH 7 to 8.0 by slow addition of 1 N NaOH (22.4 mL), which precipitated a solid. The slurry was stirred at 0-5 °C for 4 hours and the solid filtered, washed with water (30 mL), collected and dried in vacuo at 50°C. The product amine (as hydrate) was obtained as a white crystalline solid (7.7g) in 96% yield (corrected for KF), 89%LCWP, 99.8% LCAP, KF=11 wt.%

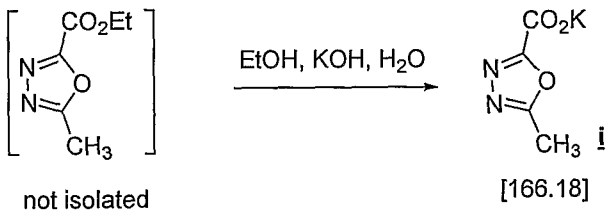
HPLC Method A (product assay): column: 25 cm x 4.6 mm Zorbax RX-C8; mobile phase: A =0.1% H_3PO_4, B = CH_3CN, 0 minutes (80% A/ 20% B), 20 minutes (20% A/ 80% B), 25 minutes (20% A/ 80% B); flow: 1.0 mL/minute; wavelength: 210 nm; column temperature: 40 °C; retention times: des-fluoroamine byproduct - 5.5 min, amine product - 5.85 minutes, toluene - 16.5 minutes, Cbz-amide - 16.82 minutes.

HPLC Method B (product purity): column: 25 cm x 4.6 mm YMC-basic; mobile phase: A =25 mmol KH_2PO_4 adjusted to pH=6.1, B = CH_3CN, 0 minutes (90% A/ 10% B), 30 minutes (30% A/ 70% B), 35 minutes (30% A/ 70% B); flow: 1 mL/minute; wavelength: 210nm; column temperature: 30 °C; retention times: des-fluoroamine - 9.1 minutes, amine - 10.1 minutes, toluene - 24.2 minutes, Cbz amide - 25.7 minutes.

Step 8: Oxadiazole Coupling

Part A: Preparation of Oxadiazole K Salt

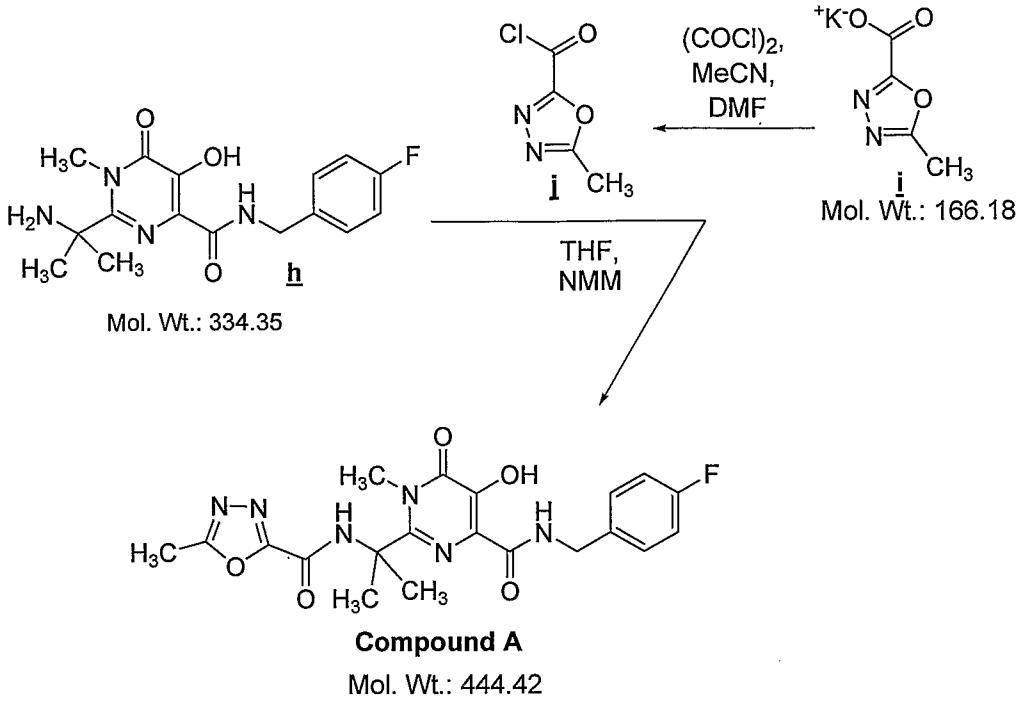




Material	Eq.	Mole	Mass	Volume	Density
5-methyltetrazole (96 wt.%)	1.0	28.54	2.5 kg (2.4 kg)		
ethyloxalyl chloride	1.03	29.4	4.014 kg	3.29 L	1.22
triethylamine	1.05	29.97	3.033 kg	4.21 L	0.72
toluene				74 L	
EtOH (punctilious)				61 L	
MTBE				15 L	
KOH aq. *20 wt.%)				8 L	
10% brine				5 L	

Ethyl oxalylchloride (4.01 kg) was slowly added to a mixture of 5-methyltetrazole (2.50 kg), triethylamine (3.03 kg) in toluene (32 L) at 0°C at such a rate that the temperature stays below 5°C. The resulting slurry was stirred for 1 hour at 0-5°C then the triethylamine/HCl salt was filtered off. The solid was washed with 27 L of cold toluene (5°C). The combined filtrates were kept at 0°C and were slowly added to a hot solution of toluene (50°C, 15L) over 40-50 minutes (N_2 gas evolution), then the solution was aged at 60-65°C for 1 hour. After cooling at 20°C, the toluene solution was washed with 5 L of 10% brine, then solvent switched to ethanol (reduced to 8 L, then 17 L of EtOH was added, then concentrated down to 8 L, then 33 liters of EtOH were added to adjust final volume of 41 L). The ethanol solution was cooled to 10°C and KOH aq. (8.0 L) was added over 30 minutes, and the resulting thick slurry was then stirred for 40 minutes at room temperature while the oxadiazole K salt crystallized out. The solid was filtered off, washed with 11 L of EtOH and finally with 15 L of MTBE. The solid was dried overnight under vacuum at 20°C with a nitrogen stream to yield 4.48 kg (90.8 %) of the K-salt **i**.

Part B: Oxadiazole Coupling



Reagent	Mass	mL	Moles	Eq.
oxadiazole K salt **i**	33.8 g (96.1 wt%)		0.20	2.2
MeCN		280 mL		
DMF	0.33			
oxalyl chloride	23.7 g	16.3 mL	0.19	2.1
free amine **h**	30 g (99 wt%)		0.089	1
THF		821 mL		
NMM	21.56 g	23.4 mL	0.21	2.4
NH_4OH (30% in H_2O)	62.3 g	69 mL	0.53	6
HCl (2N)		500 mL		
IPA		920 mL		
water		400 mL		
MeOH		300 mL		

A 500 mL round bottom flask was charged with oxadiazole K salt **i** (33.8 g) followed by MeCN (280 mL) and DMF (0.33 mL) with strong stirring. The resulting slurry was then cooled down to 0-5°C and oxalyl chloride (23.7 g) was added over the course of 20 minutes in order to maintain the internal temperature at less than 5°C. The resulting acyl chloride-containing slurry was then aged for 1 hour.

To a 2 L round bottom flask the free amine **h** (30 g) was added followed by THF (821 mL). The resulting slurry was cooled down to 0-5°C, after which NMM (21.56 g) was added and the slurry so obtained was stirred for 10 minutes at the cold temperature. The previously prepared acyl chloride-containing slurry was added slowly to the free amine slurry over the course of 20 minutes such that the temperature did not exceed 5 °C. The slurry was then aged for 1.5 hours at 0-5°C. At this time HPLC showed no more amine **h** (<0.5 % LCAP, 100% conversion). The reaction mixture was then quenched with NH_4OH (30 % in water) (69 mL) which was added over the course of 3 minutes. The resulting yellow slurry was then stirred for an additional hour at temperatures less than 10°C. The yellow slurry was then acidified to pH 2-3 with HCl (2N) (500 mL). To the resulting red wine colored solution, IPA (920 mL) was added. The low boiling point organic solvents were then evaporated under reduced pressure (40 torr) at room temperature to a final solution volume of 1100 mL, at which volume crystalline Compound A began to precipitate. Water (400 mL) was then added to this new slurry over the course of 10 minutes, and the slurry aged overnight at room temperature. The aged slurry was filtered and the solid obtained was washed with water (170 mL), followed by a swish wash with cold MeOH (300 mL, previously cooled in an ice bath), and finally by a swish wash with water (700 mL). The solid so obtained was dried overnight under vacuum and nitrogen stream to give 35.5 g of Compound A (91% yield).

Step 9: Formation of a crystalline potassium salt of Compound A

Acetonitrile (50 mL) and anhydrous Compound A (5.8 g, 97.4 wt.%) were charged at room temperature to a jacketed 125 mL round bottom flask equipped with a mechanical stirrer and equipped with a nitrogen inlet (i.e., the crystallization was conducted under nitrogen). The resulting slurry was agitated at 45°C until the solids were completely in solution. Form 1 crystalline Compound A K salt was then charged to the solution as seed (0.184 g, 3 wt% to theoretical K salt). Aqueous KOH

30% w/v solution (0.98 eq., 2.33 mL, 0.0125 moles) was then added with the following charge profile while maintaining batch at 45°C:

0.466 mL over 5 hours, 0.0932 mL/hr (20 mol%)

1.864 mL over 7 hours, 0.2663 mL/hr (80 mol%)

The resulting slurry was cooled to 20°C and aged at 20°C until the concentration of Compound A in the mother liquor was measured to be less than 4 g/L. The batch was filtered, the cake washed with MeCN (3 x 12 mL), and then dried under vacuum at 45°C, with a small nitrogen sweep, until the amount of MeCN and water present as determined by thermogravimetric analysis was less than 1 wt.%. The K salt of Compound A was obtained in >99 A% by HPLC analysis.

EXAMPLE 2

Form 1 Crystalline Potassium Salt of Compound A

Part A: Preparation

Ethanol (147 mL), water (147 mL), and Compound A (97.9 g assay by HPLC) were charged to a 1 L round bottom flask equipped with mechanical stirrer, addition funnel, nitrogen inlet (i.e., run conducted under nitrogen), and a thermocouple. Aqueous KOH (45% w/w, 0.98 eq., 18.5 mL, 216 mmoles) was added to the suspension over 10 minutes at 21 °C. The resulting suspension was agitated for 0.5 hour resulting in the dissolution of a majority of the solids, after which the batch was filtered through a 1 μm filter directly into a 5 L round bottom flask equipped with mechanical stirrer, addition funnel, nitrogen inlet, and thermocouple. The 1 L flask was rinsed with 1:1 (v/v) water/EtOH (48 mL) and the rinse was filtered into the 5 L crystallization vessel. The filtered solution was seeded with crystalline Form 1 Compound A K salt (200 mg) at room temperature and then aged for 1 hour to build a good seed bed, after which the suspension was diluted with EtOH (1.57 L) at 20 °C over 1.5 hour. The batch was then cooled to about 4 °C and aged until the concentration of Compound A in the mother liquor was measured to be 4.7 g/L. The batch was filtered, the crystallization vessel rinsed with 50 mL EtOH into the filter,the cake washed with EtOH (4 x 100 mL), and then dried under vacuum and a nitrogen tent until the amount of EtOH present by NMR was about 0.4 mol% relative to the potassium salt. The potassium salt of Compound A was obtained in 88% yield (91.5 g assay by HPLC, 99 area % by HPLC analysis).

Part B: Characterization

An XRPD pattern of a K salt prepared in the manner described in Part A was generated on a Philips Analytical X'Pert Pro X-ray powder diffractometer using a continuous scan from 2.5 to 40 degrees 2 Θ over about 12 minutes (i.e., 0.02° step size with 40 seconds/step), 2 RPS stage rotation, and a gonio scan axis. Copper K-Alpha 1 ($K_{\alpha 1}$) and K-Alpha 2 ($K_{\alpha 2}$) radiation was used as the source. The experiment was run under ambient conditions. The XRPD pattern is shown in Figure 1. 2Θ values and the corresponding d-spacings include the following:

Peak No.	d-spacing (Å)	2 Theta
1	14.9	5.9
2	7.1	12.5
3	4.4	20.0
4	4.3	20.6
5	3.5	25.6

A K salt prepared in the manner described in Part A was also analyzed by a TA Instruments DSC 2910 differential scanning calorimeter at a heating rate of 10°C/min from room temperature to 350°C in a crimped pinhole aluminum pan in a nitrogen atmosphere. The DSC curve, shown in Figure 2, exhibited a single, sharp endotherm with a peak temperature of about 279°C and an associated heat of fusion of about 230.0 J/gm. The endotherm is believed to be due to melting.

A thermogravimetric analysis was performed with a Perkin-Elmer Model TGA 7 under nitrogen at a heating rate of 10°C/min from room temperature to about 350 °C. The TG curve showed a 0.3% weight loss during heating to 250 °C.

Hygroscopicity data was obtained on a VTI Symmetrical Vapor Sorption Analyzer Model SGA-1. Data was collected at room temperature from 5-95% relative humidity and back, 5% relative humidity change per step. Equilibrium conditions were 0.01 weight percent change in 5 minutes with a maximum equilibration time of 180 minutes. The data indicated that the material had a 1.8% weight increase when equilibrated at 95% RH at 25 °C. When equilibrated back down to 5% RH, the material returned back to approximately its dry weight. An XRPD analysis of the material after the hygroscopicity experiment showed that the material had not changed phases.

K salt prepared as described in Part A was also assayed by HCl titration using a Brinkmann Metrohm 716 DMS Titrino. The assay results indicated the salt was a monopotassium salt.

EXAMPLE 3

Form 1 Crystalline Potassium Salt of Compound A

Compound A (45 g) was dissolved in 50:50 v/v EtOH:MeCN (434 mL) at 35°C to give a solution with a concentration of 96 g/L. A solution of KOEt in EtOH (38 g, 24 wt.% KOEt) was mixed with EtOH (342 g) to give a 2.4 wt.% solution of the ethoxide in ethanol. A seed bed (Form 1 crystalline K salt of Compound A) was prepared by adding the K salt (9.1 g) to 70:30 ethanol:aceontitrile (177 mL), after which the seeds were wet milled for 30 minutes using an IKA Model T50 wet mill to provide a seed bed of approximately 48,600 particle counts (i.e., a particle size range of from 1 to 500 μm) and a mean particle size of 10.4 μm.

Seed slurry (186 mL) was charged to a crystallizer, and all of EtOH:MeCN solution of Compound A was charged to a jacketed syringe pump. The syringe pump jacket was maintained at 45°C and the crystallizer jacket was maintained at 37°C to provide a 35°C batch temperature. The Compound A solution and the KOEt solution were then concurrently added to the crystallizer while maintaining the batch temperature at 35°C. For the first 5 hours of the addition, the Compound A solution was added at a rate of 0.29 mL/minute, and the KOEt solution was added at a rate of 0.23 mL/minute, after which the charge rates were changed for the next 7 hours to 0.83 mL per minute for the Compound A solution and 0.66 mL/minute for the KOEt solution. At the end of the 7 hours (12 hours total addition time), all of the Compound A solution had been charged, and the KOEt addition was continued at 0.66 mL/minute until all of the solution was charged. Following the addition,, the batch was cooled from 35°C to 20°C over 3 hours, then aged at 20°C for 2.5 hour and filtered. After filtration, the resulting cake was washed with EtOH (3 x 45 mL) in a displacement/slurry/displacement wash sequence, then blown with nitrogen for 1 hour, and then dried overnight in a vacuum oven at 45°C, to afford an isolated yield of crystalline Compound A K salt of 94%.

EXAMPLE 4

Form 2 Crystalline Potassium Salt of Compound A

Solid KOH (47.9 mg) and Compound A (402.4 mg) were added to acetone (8 mL), and the resulting solution was sonicated using a Fisher Scientific Ultrasonic Model FS3OH at 40kHz for several minutes until a precipitate formed. Sample was then suction filtered to dryness.

An XRPD pattern of the isolated crystalline potassium salt prepared in the manner just described was obtained using the same instrument and settings employed in Example 2. The XRPD pattern is shown in Figure 3. 2Θ values and the corresponding d-spacings include the following:

Peak No.	d-spacing (Å)	2 Theta
1	11.2	7.9
2	6.4	13.8
3	5.7	15.7
4	3.6	24.5
5	2.8	31.5

K salt prepared in the manner just described was analyzed by a TA Instruments DSC 2920 differential scanning calorimeter at a heating rate of 10°C/min from room temperature to 350°C in a crimped pinhole aluminum pan in a nitrogen atmosphere. The DCS curve, shown in Figure 4, exhibited a broad endotherm at about 146 °C that is believed to be due to desolvation (associated heat of fusion = 9.66 J/gm), a broad endotherm at about 238°C believed to be due to a phase change to Form 1 (heat of fusion = 21.16 J/gm), followed by a sharp endotherm at about 276 °C believed to be due to the melting of Form 1 (heat of fusion = 124.6 J/gm). The difference in peak temperature and heat of fusion here as compared to the corresponding values obtained for Form 1 in Example 2 may be due, *inter alia*, to differences in the crystalline samples (e.g., differences in impurity level or crystal imperfections) and/or to incomplete conversion to Form 1 in this DSC scan and some subsequent decomposition during the melting of Form 1.

Thermogravimetric analyses performed in the manner described in Example 2 were done on several samples of the crystalline K salt prepared in the manner described in this Example. The results indicate that the material (crystalline Form 2) is a variable solvate that loses from about 1.6 to about 3.5 % volatiles during

heating up to 200 °C. TG-mass spectroscopy and KF titrations done on the samples indicate that Form 2 contains water. The source of the water found in Form 2 might be water present as an impurity in the acetone and/or solid KOH used in the crystallization procedure. When Form 2 was heated beyond the desolvation temperature and allowed to age, it rehydrated readily. XRPD studies have shown that, when Form 2 is heated beyond the desolvation temperature but below the transition temperature for the conversion to Form 1, the phase was unchanged, indicating that Form 2 may be isomorphous. Samples of Form 2 heated above 240 °C and then analyzed by XRPD were found to have partially converted to Form 1.

EXAMPLE 5

Tablet Formulation Containing Form 1 Crystalline Potassium Salt of Compound A

Part A -

Ingredient	Amount per Tablet (mg)	Amt per batch (wt. percent)
Compound A K salt[1]	111.2	27.8
(on free phenol basis)	(100)	(25.0)
microcrystalline cellulose (AVICEL PH-102)	189.6	47.4
lactose monohydrate	63.2	15.8
croscarmellose sodium	12.0	3.0
HPMC 2910 (6 centipoise)	20.0	5.0
magnesium stearate (intragranular)	2.0	0.5
magnesium stearate (extragranular)	2.0	0.5

[1] Form 1 crystalline monopotassium salt of Compound A; conversion factor (including purity) = 1.112.

Compressed tablets containing 100 mg of Compound A on a free phenol basis were prepared by blending all of the ingredients listed above, except for the extragranular magnesium stearate, in a blender (Turbula® Type T2F shaker-mixter, Basel, Switzerland) for 10 minutes. Portions of the blended material weighing approximately 1 gram were compressed into compacts (or slugs) in a benchtop press (Auto Carver Model Auto "C", Catalog No. 3888, Carver, Inc., Wabash, Indiana) using 1 x 0.5 inch rectangular tooling to12 MPa (4 KN). The slugs were then sized

into granules by passing them through a sieve with 1 mm openings. The granules were blended with the extragranular magnesium stearate in the Turbula blender for 5 minutes, and the lubricated granules were compressed into tablets using the Auto Carver press with 13/32-inch standard concave round tooling.

Part B -

Ingredient	Amount per Tablet (mg)	Amt per batch (wt. percent)
Compound A K salt[1]	110	27.5
(on free phenol basis)	(100)	(25.0)
microcrystalline cellulose (AVICEL PH-102)	175.2	43.8
microcrystalline cellulose (AVICEL PH-105)	9.2	2.3
lactose monohydrate	61.6	15.4
croscarmellose sodium	12.0	3.0
HPMC 2910 (6 centipoise)	20.0	5.0
magnesium stearate (intragranular)	4.0	1.0
magnesium stearate (extragranular)	8.0	2.0

[1] Form 1 crystalline monopotassium salt of Compound A; conversion factor (including purity) = 1.112.

Compressed tablets having the composition set forth in the above table were prepared using a procedure similar to that set forth in Part A.

EXAMPLE 6

Tablet Formulation Containing Form 1 Crystalline Potassium Salt of Compound A

Ingredient	Amount per Tablet (mg)	Amt per batch (wt. percent)
Compound A K salt[1]	434.4	50.0
(on free phenol basis)	(400)	(46.0)
microcrystalline cellulose (Avicel PH102)	112.9	13.0
lactose hydrous spray dried	26.06	3.0

anhydrous dibasic calcium phosphate	73.85	8.50
HPMC K4M	26.06	3.0
poloxamer 407 (micronized grade)[2]	173.8	20.0
sodium stearyl fumarate	8.69	1.0
magnesium stearate	13.03	1.50

[1] Form 1 crystalline monopotassium salt of Compound A; conversion factor = 1.086.

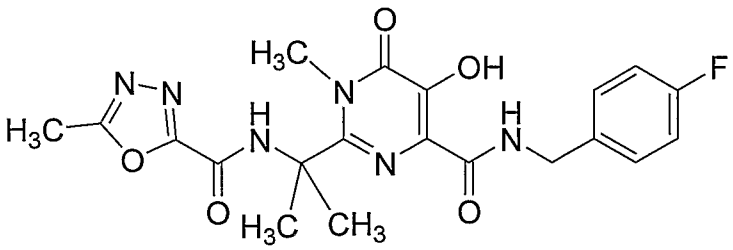
[2] Obtained from BASF. Median particle size = 50 μm.

Compressed tablets containing 400 mg of Compound A on a free phenol basis were prepared by a roller compaction and tablet compression process train. Poloxamer 407, magnesium stearate, and sodium stearyl fumarate were pre-screened through No. 30 and No. 60 mesh size screens in succession, and then blended with all of the other ingredients, except for the extragranular magnesium stearate, in a Patterson-Kelly (PK) V-blender for 5 minutes. The blended material was then sieved through a No. 35 screen mesh to break up agglomerates, and the sieved material was then blended further in the same PK blender for about 15-20 minutes. The blend was then roller compacted using a Freund Type TF mini roller compactor at a roll pressure of 40 Kgf/cm^2, roll speed of 3 rpm and screw speed of 10 rpm. The resulting ribbon was milled in a small Quadro Comil fitted with a round impeller, screen size 39R (i.e., round hole size 0.039 inches; approximately mesh size No. 20) and operated at 1700 rpm. The resulting granules were then blended with 0.5% extragranular magnesium stearate in the PK blender for 5 minutes to produce the final blend. The lubricated granules were then compressed into tablets using a rotary tablet press with plain oval shaped tooling at a compression force necessary to achieve a tablet hardness of 16 to 20 kiloponds (i.e., 156.9 to 196.1 Newtons) as measured by using a Key model HT-300 hardness tester.

While the foregoing specification teaches the principles of the present invention, with examples provided for the purpose of illustration, the practice of the invention encompasses all of the usual variations, adaptations and/or modifications that come within the scope of the following claims.

WHAT IS CLAIMED IS:

1. A potassium salt of Compound A, wherein Compound A is of formula:



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2. The potassium salt of Compound A according to claim 1, which is a crystalline potassium salt.

3. The crystalline potassium salt of Compound A according to claim 2, which is an anhydrous crystalline potassium salt.

4. The anhydrous crystalline potassium salt of Compound A according to claim 3, which is characterized by an X-ray powder diffraction pattern obtained using copper K_α radiation which comprises 2Θ values in degrees of 5.9, 20.0 and 20.6.

5. The anhydrous crystalline potassium salt of Compound A according to claim 4, which is characterized by an X-ray powder diffraction pattern obtained using copper K_α radiation which comprises 2Θ values in degrees of 5.9, 12.5, 20.0, 20.6 and 25.6.

6. The anhydrous crystalline potassium salt of Compound A according to claim 5, which is further characterized by a differential scanning calorimetry curve, obtained at a heating rate of 10 °C/min in a closed cup under nitrogen, exhibiting a single endotherm with a peak temperature of about 279°C .

7. The anhydrous crystalline potassium salt of Compound A according to any one of claims 4 to 6, which is a monopotassium salt.

8. The crystalline potassium salt of Compound A according to claim 2, which is a hydrated crystalline potassium salt, which is characterized by an X-ray powder diffraction pattern obtained using copper $K_{\alpha 1}$ radiation which comprises 2Θ values in degrees of 7.9, 13.8, 15.7, 24.5, and 31.5.

9. A pharmaceutical composition comprising an effective amount of a potassium salt of Compound A as recited in any one of claims 1 to 8 and a pharmaceutically acceptable carrier.

10. A potassium salt of Compound A according to any one of claims 1 to 8, for use in the preparation of a medicament for inhibiting HIV integrase, for treating or prophylaxis of infection by HIV or for treating, prophylaxis of or delaying the onset of AIDS in a subject in need thereof.