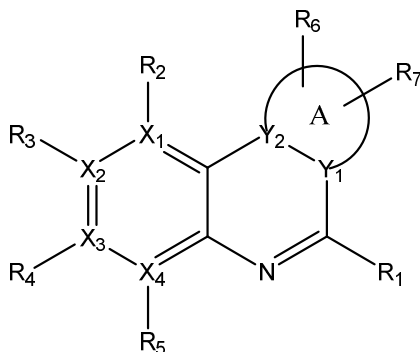


Claims

[Claim 1], A heterocyclic compound of the following Formula 1, or a pharmaceutically acceptable salt or isomer thereof:

[Formula 1]



wherein

each of X₁, X₂, X₃ and X₄ is independently C or N;

R₁ is a saturated ~~or unsaturated~~ 3-12-membered mono- or poly-heterocyclyl containing 1-3 heteroatoms (preferably the heteroatoms selected from N, O and S), wherein R₁ is unsubstituted or substituted with 1-3 substituents selected from -C₁-C₆ alkyl and -amino-C₁-C₆ alkyl;

R₂, R₃, R₄ and R₅ may be the same or different; and each of them is independently selected from -H, ~~-C₁-C₆ alkyl, -C₁-C₆ haloalkyl, -C₁-C₆ perhaloalkyl, -amino-C₁-C₆ alkyl, -C₃-C₈ cycloalkyl, -halogen (-F, -Cl, -Br, -I), -CN, -C₁-C₆ alkoxy, -C₁-C₆ haloalkoxy, -C₁-C₆ perhaloalkoxy, -C₂-C₇ alkenyl, -C₂-C₈ alkynyl, -amino, -aceto, -amido, -sulfonamide, -sulfonyl, -aminosulfonyl-C₁-C₆ alkyl, -C₁-C₆ alkylcarboxyl, -carboxyl (-COOH), -C₁-C₆ acyl, -OH, -nitro (-NO₂), -C₆-C₁₀ aryl, -heterocyclyl, and -O-C₁-C₆ alkyl-heterocyclyl~~, wherein the heterocyclyl is a saturated or unsaturated 3-6-membered heterocyclyl

containing 1-3 heteroatoms (preferably heteroatoms selected from N, O and S);
 provided that when X_1 is N, R_2 does not exist; when X_2 is N, R_3 does not exist;
 when X_3 is N, R_4 does not exist; and when X_4 is N, R_5 does not exist; and when
 all of X_1 , X_2 , X_3 and X_4 are C, R_3 is not hydrogen or fluorine (F);
 each of Y_1 and Y_2 is independently C or N;

A ring is a saturated or unsaturated 5- or 6-membered heterocycle containing
 at least 2 heteroatoms (preferably the heteroatoms selected from N, O and S);
 and

each of R_6 and R_7 is independently oxo (=O) or =NH, and one of R_6 and R_7 may
 not exist;

wherein each of the alkyl, cycloalkyl, heterocyclyl, alkoxy, alkenyl, alkynyl, acyl
 and aryl groups may be independently unsubstituted or substituted with one or
 more substituents (for example, 1-3 substituents) selected from the group
 consisting of -C₁-C₄ alkyl, -halogen (-F, -Cl, -Br, -I), -CN, -C₁-C₄ alkoxy, -amino,
 -amido, -carboxyl (-COOH), -C₁-C₆ acyl, -OH, -nitro (-NO₂), heterocyclyl and
 phenyl, wherein the heterocyclyl is a saturated or unsaturated 3-6-membered
 heterocyclyl containing 1-3 heteroatoms (preferably, the heteroatoms selected
 from N, O and S).

[Claim-2].

The heterocyclic compound, or a pharmaceutically acceptable salt or isomer
 thereof according to Claim 1, wherein

each of X_1 , X_2 , X_3 and X_4 is independently C or N;

R_1 is a saturated ~~or unsaturated~~ 3-10-membered mono- or poly-heterocyclyl
 containing 1-3 heteroatoms selected from N, O and S, wherein the heterocyclyl
 is unsubstituted or substituted with 1 or 2 substituents selected from -C₁-C₆ alkyl
 and -amino-C₁-C₆ alkyl;

R₂, R₃, R₄ and R₅ may be the same or different; and each of them is independently selected from -H, ~~-C₁-C₆ alkyl, -C₁-C₆ haloalkyl, -C₁-C₆ perhaloalkyl,~~ -amino-C₁-C₆ alkyl, -C₃-C₈ cycloalkyl, -halogen, -CN, -C₁-C₆ alkoxy, -C₁-C₆ haloalkoxy, -C₁-C₆ perhaloalkoxy, -amino, -aceto, -sulfonamino, ~~-sulfonyl,~~ -aminosulfonyl-C₁-C₆ alkyl, -C₁-C₆ alkylcarboxyl, -carboxyl, -OH, -nitro, -C₆-C₁₀ aryl, -heterocyclyl, and -O-C₁-C₆ alkyl-heterocyclyl, wherein the heterocyclyl is a saturated or unsaturated 3-6-membered heterocyclyl containing 1-3 heteroatoms selected from N, O and S;

each of Y₁ and Y₂ is independently C or N;

A ring is a saturated or unsaturated 5- or 6-membered heterocycle containing 2-4 heteroatoms selected from N, O and S; and

each of R₆ and R₇ is independently oxo or =NH, and one of R₆ and R₇ may not exist.

~~[Claim-3].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein X₁ and X₂ are C, and each of X₃ and X₄ is independently C or N.

~~[Claim-4].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein each of X₁ and X₂ is independently C or N, and X₃ and X₄ are C.

~~[Claim-5].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₁ is a saturated ~~or unsaturated~~ 3-10-membered mono- or poly-heterocyclyl containing 1-3 heteroatoms selected from N and O, wherein the heterocyclyl is unsubstituted or substituted with 1 or 2

substituents selected from -C₁-C₄ alkyl and -amino-C₁-C₄ alkyl.

~~[Claim-6].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₂, R₃, R₄ and R₅ may be the same or different; and each of them is independently selected from -H, ~~-C₁-C₆ alkyl, -C₁-C₆ haloalkyl, -C₁-C₆ perhaloalkyl,~~ -amino-C₁-C₆ alkyl, -halogen, -CN, -C₁-C₆ alkoxy, -C₁-C₆ haloalkoxy, -C₁-C₆ perhaloalkoxy, -amino, -aceto, -sulfonamino, ~~-sulfonyl,~~ -aminosulfonyl-C₁-C₆ alkyl, -C₁-C₆ alkylcarboxyl, -carboxyl, -OH, -nitro, and -heterocyclyl, wherein the heterocyclyl is a saturated or unsaturated 5 or 6-membered heterocyclyl containing 1-3 heteroatoms selected from N, O and S.

~~[Claim-7].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein A ring is a saturated or unsaturated 5- or 6-membered heterocycle containing 2 or 3 heteroatoms selected from N and S.

~~[Claim-8].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₆ is oxo or =NH, and R₇ does not exist.

~~[Claim-9].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₆ and R₇ are oxo.

~~[Claim-10].~~ The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein the heterocyclic compound is selected from the group consisting of:

8-bromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-a]pyrido[2,3-e]pyrazin-2(1H)-one;

8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

(*R*)-8-bromo-4-(3-(methylamino)pyrrolidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

(*S*)-8-bromo-4-(3-(methylamino)pyrrolidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

8-bromo-4-(hexahydropyrrolo[1,2-*a*]pyrazin-2(1*H*)-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

8-bromo-4-(4-methylpiperazin-1-yl)pyrido[2,3-*e*][1,2,4]triazolo[4,3-*a*]pyrazin-1(2*H*)-one;

8-bromo-4-(4-methylpiperazin-1-yl)pyrido[2,3-*e*][1,2,4]triazolo[1,5-*a*]pyrazin-2(1*H*)-one;

8-bromo-7-chloro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

8-bromo-7-fluoro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

4-(4-methylpiperazin-1-yl)-8-nitroimidazo[1,2-*a*]quinoxalin-2(1*H*)-one;

8-amino-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;

8-bromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;

8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;

9-bromo-5-(4-methylpiperazin-1-yl)-1*H*-[1,2,4]triazino[4,3-*a*]quinoxalin-2(3*H*)-one;

8,9-dibromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;

N-(4-(3-(methylamino)azetidin-1-yl)-2-oxo-1,2-dihydroimidazo[1,2-*a*]quinoxalin-8-yl)methanesulfonamide;

8-chloro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;

8-amino-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-
 2(1*H*)-one;
 8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one
 hydrochloride;
 3-chloro-6-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[4,3-*e*]pyrazin-8(9*H*)-one;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-
 2(1*H*)-one hydrochloride;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-
 2(1*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-2(1*H*)-
 one;
 8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-
 2(1*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)-1*H*-pyrido[2,3-*e*][1,2,4]thiadiazolo[4,3-
a]pyrazine 2,2-dioxide;
 8-chloro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-2(1*H*)-one
 hydrochloride;
 2-chloro-6-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-8(9*H*)-one;
 2-bromo-6-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-8(9*H*)-
 one;
 2-chloro-6-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-
 8(9*H*)-one; and
 2-bromo-6-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-
 8(9*H*)-one.

- ~~{Claim-11}~~. A pharmaceutical composition comprising a heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof as defined in any one of Claims 1 to 10 as an active ingredient, and a pharmaceutically acceptable carrier.
- ~~{Claim-12}~~. The pharmaceutical composition according to Claim 11, wherein the composition exhibits a human histamine 4 receptor (hH4R) inhibition activity.
- ~~{Claim-13}~~. The pharmaceutical composition according to Claim 11, wherein the composition is for use in the prevention or treatment of a disease selected from the group consisting of inflammatory diseases, autoimmune diseases, allergic diseases, ocular diseases, skin diseases, respiratory diseases, pain diseases, cardiac diseases, and human histamine 4 receptor (hH4R)-related diseases.
- ~~{Claim-14}~~. The pharmaceutical composition according to Claim 13, wherein the composition is for use in the prevention or treatment of a disease selected from the group consisting of inflammatory disorder, allergy, pain, nasal polyps, rhinitis, chronic sinusitis, nasal congestion, nasal itch, asthma, chronic obstructive pulmonary disease, rheumatoid arthritis, atopic dermatitis, psoriasis, eczema, pruritus, itchy skin, urticaria, idiopathic chronic urticaria, scleroderma, conjunctivitis, keratoconjunctivitis, ocular inflammation, dry eye, cardiac dysfunction, age-related macular degeneration, arrhythmia, atherosclerosis, multiple sclerosis, inflammatory bowel disease (colitis, Crohn's disease, ulcerative colitis), inflammatory pain, neuropathic pain, osteoarthritic pain, autoimmune thyroid disease, immune-mediated diabetes, lupus, post-operative adhesions, vestibular disorders and cancer.

15. Use of a heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof as defined in any one of Claims 1 to 10 in the manufacture of a medicament for the prevention or treatment of a disease selected from the group consisting of inflammatory diseases, autoimmune diseases, allergic diseases, ocular diseases, skin diseases, respiratory diseases, pain diseases, cardiac diseases, and human histamine 4 receptor (hH4R)-related diseases.
16. The use according to Claim 15, wherein the medicament is for the prevention or treatment of a disease selected from the group consisting of inflammatory disorder, allergy, pain, nasal polyps, rhinitis, chronic sinusitis, nasal congestion, nasal itch, asthma, chronic obstructive pulmonary disease, rheumatoid arthritis, atopic dermatitis, psoriasis, eczema, pruritus, itchy skin, urticaria, idiopathic chronic urticaria, scleroderma, conjunctivitis, keratoconjunctivitis, ocular inflammation, dry eye, cardiac dysfunction, age-related macular degeneration, arrhythmia, atherosclerosis, multiple sclerosis, inflammatory bowel disease (colitis, Crohn's disease, ulcerative colitis), inflammatory pain, neuropathic pain, osteoarthritic pain, autoimmune thyroid disease, immune-mediated diabetes, lupus, post-operative adhesions, vestibular disorders and cancer.