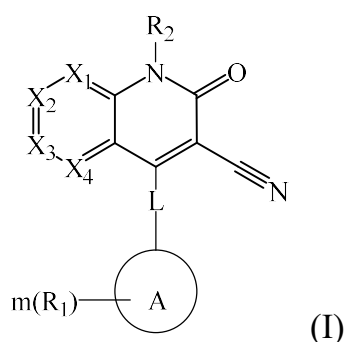


Claims

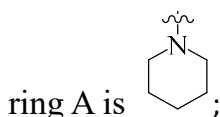
1. Use of a phosphodiesterase 9 (PDE9) inhibitor compound represented by general formula (I), pharmaceutically acceptable salts, tautomers, and deuterated compounds thereof in the manufacture of a medicament for treating heart failure diseases in mammals,



wherein X_1 and X_4 are each CH; X_2 is N, and X_3 is CR_3 ;

R_3 at each occurrence is independently selected from hydrogen, deuterium, hydroxyl, amino, carboxyl, cyano, nitro, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkylcarbonyl, wherein the C_{1-6} alkyl is not substituted or optionally substituted with one or more hydroxyl;

L is a bond;

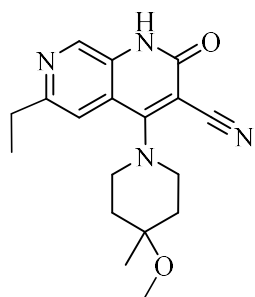


each R_1 is independently selected from hydrogen, deuterium, C_{1-6} alkyl, C_{1-6} alkoxy;

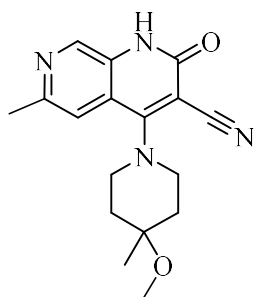
m is 1, 2 or 3; and

R_2 is hydrogen.

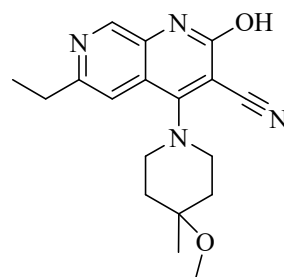
2. Use of claim 1, wherein the compound represented by the general formula (I) and pharmaceutically acceptable salts, tautomers and deuterated compounds thereof are selected from the following structures:



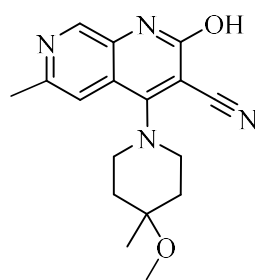
102,



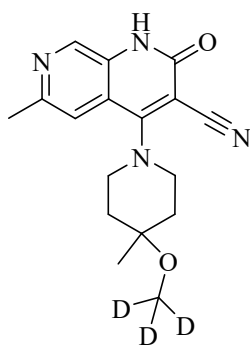
87,



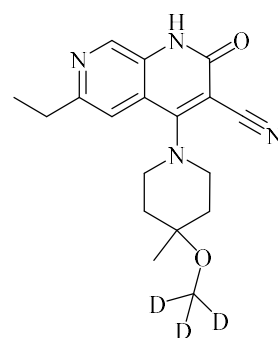
108,



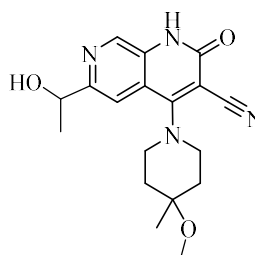
113,



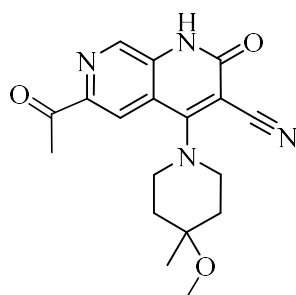
116,



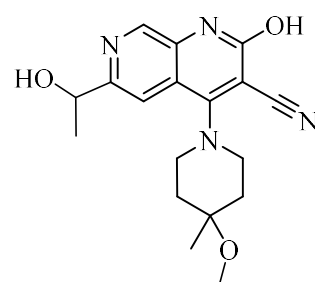
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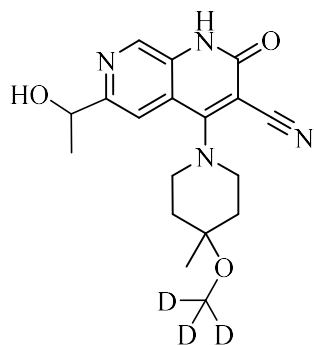
63,



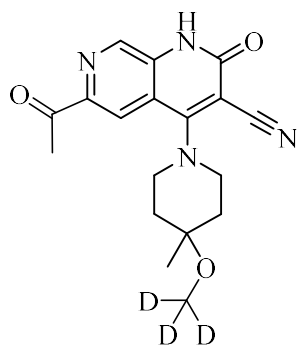
114,



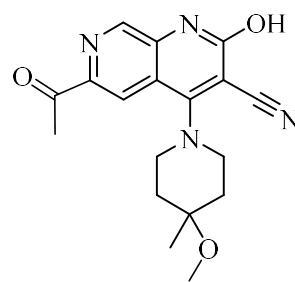
118,



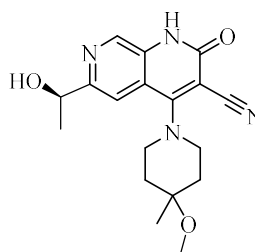
119,



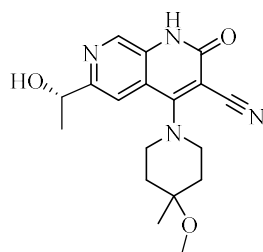
120,



121,



123, and



124.

3. Use of claim 1 or 2, wherein the medicament for treating heart failure diseases further include a second or more therapeutic agents.

4. Use of claim 1 or 2, wherein the medicament for treating heart failure diseases can be prepared into any pharmaceutically acceptable pharmaceutical preparation with a pharmaceutical carrier.

5

5. Use of claim 1 or 2, wherein the medicament is formulated into the format to be administered through oral, parenteral, transdermal, rectal, nasal, pulmonary, implantation, and topical administration.

10 6. Use of claim 1 or 2, wherein the heart failure diseases are selected from left heart failure, right heart failure, and whole heart failure; acute heart failure, chronic heart failure, and decompensated heart failure; systolic and diastolic heart failure; pre-heart failure, pre-clinical heart failure, clinical heart failure and refractory end-stage heart failure; grade I, grade II, grade III, and grade IV heart
15 failure by the New York Heart Association (NYHA) according to heart function; and heart failure with reduced left ventricular ejection fraction, heart failure with median left ventricular ejection fraction, and heart failure with preserved left ventricular ejection fraction.

20 7. Use of claim 1 or 2, wherein the heart failure diseases are selected from heart failure caused by ischemic heart disease, heart failure caused by toxic damage, immune-mediated heart failure and heart failure caused by inflammatory damage, heart failure caused by infiltrative lesion, heart failure caused by metabolic disorder, heart failure caused by genetic abnormality, heart failure caused by abnormal load,
25 and heart failure caused by arrhythmia.

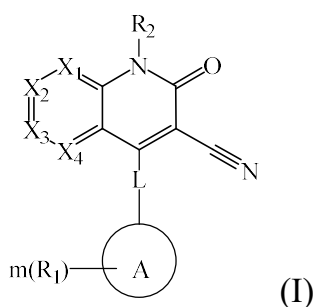
8. Use of claim 1 or 2, wherein the heart failure diseases are selected from systolic heart failure and diastolic heart failure.

30 9. Use of claim 1, wherein the mammals are humans and animals.

10. Use of claim 1 or 2, wherein the medicament is for treating heart failure by means of inhibiting the activity of PDE9, and increasing the level of cyclic guanosine monophosphate.

11. Use of claim 1 or 2, wherein the medicament is for treating heart failure by means of improving the heart function of patients or subjects with heart failure and reversing the myocardial remodeling of patients or subjects with heart failure.

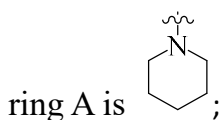
12. A kit, comprising (a) a phosphodiesterase 9 (PDE9) inhibitor compound represented by the general formula (I) and pharmaceutically acceptable salts, tautomers, and deuterated compounds thereof and (b) an instruction for use of the compound or the pharmaceutically acceptable salts or tautomers or deuterated compounds thereof in the treatment of heart failure diseases in mammals:



wherein X_1 and X_4 are each CH; X_2 is N, and X_3 is CR_3 ;

R_3 at each occurrence is independently selected from hydrogen, deuterium, hydroxyl, amino, carboxyl, cyano, nitro, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkylcarbonyl, wherein the C_{1-6} alkyl is not substituted or optionally substituted with one or more hydroxyl;

L is a bond;



each R_1 is independently selected from hydrogen, deuterium, C_{1-6} alkyl, C_{1-6} alkoxy;

m is 1, 2 or 3;

and R_2 is hydrogen.