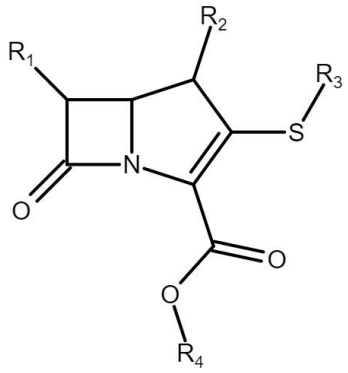
CLAIMS

What is claimed is:

1. A use of an effective amount of a compound in the manufacture of a medicament for long-acting prevention or treatment of a glucose metabolism disorder in a subject in need thereof, wherein the compound is represented by formula (I) or a pharmaceutically acceptable salt thereof:



(I),

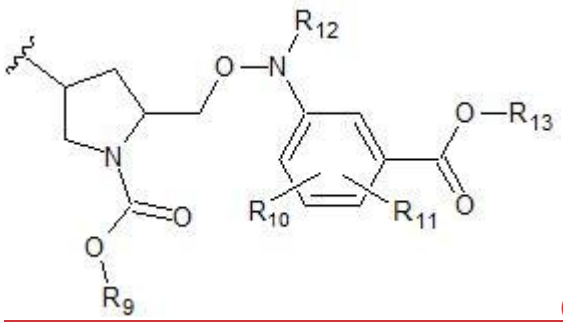
wherein:

R_1 ~~and R_3 are~~is independently H or a substituted or unsubstituted moiety selected from the group consisting of alkyl, alkenyl, alkynyl, hydroxyalkyl, fluoroalkyl, chloroalkyl, bromoalkyl, iodoalkyl, perfluoroalkyl, aryl, heteroaryl, cycloalkyl, cycloalkenyl, carboxyl, aralkyl, aralkenyl, aralkynyl, heteroaralkyl, heteroaralkenyl, heteroaralkynyl, heterocyclyl, acyl, benzyl, phenyl, aminocarbonyl, aminoalkyl, amino, hydroxyl, alkoxy, acyloxy, silyloxy, amido, imidoyl, carbamoyl, halo, thio, thioether, sulfo, sulfonic, sulfamoyl, thiazolyl, thiazolidinyl, pyrrolyl, pyrrolidinyl, triazolyl, azetidinyl and sulfonamido,

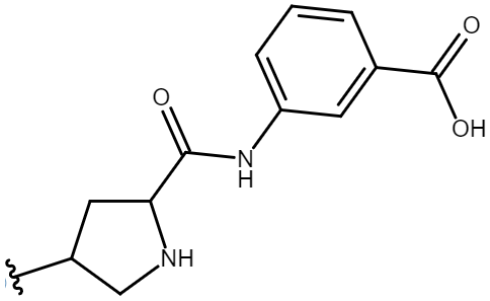
R_2 is H or (C1-C6)-alkyl, and

R_4 is H or (C1-C6)-alkyl or alkali-metal or alkali earth-metal, wherein the alkali-metal or alkali earth-metal is sodium, potassium, lithium, cesium, rubidium, barium, calcium or magnesium;

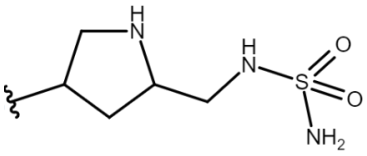
wherein R_3 is represented by one of formulas (I-a) to (I-l) below:



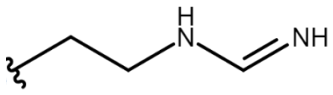
(I-a),



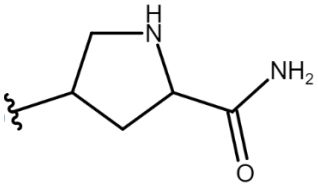
(I-b),



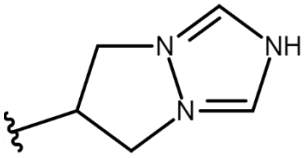
(Ic),



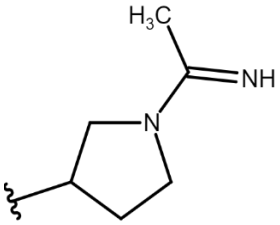
(I-d),



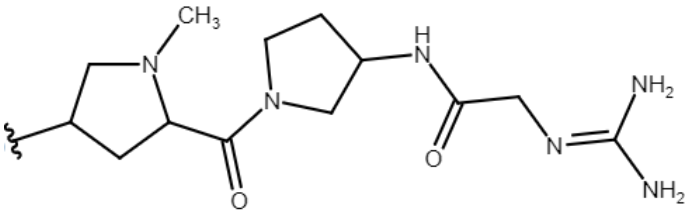
(I-e),



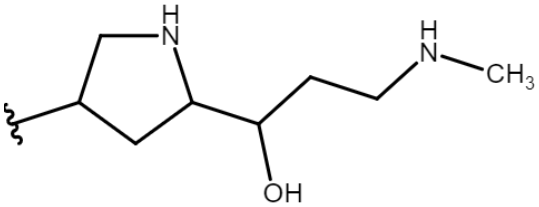
(I-f),



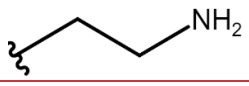
(I-g),



(I-h),

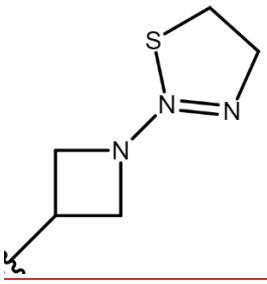


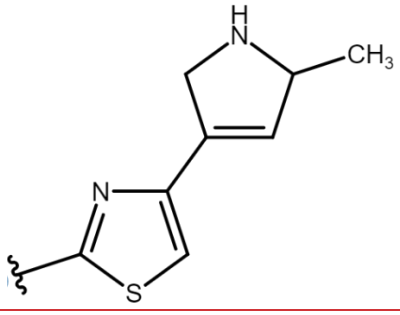
(I-i),



(I-j),

5





(I-k), and (I-l),

wherein:

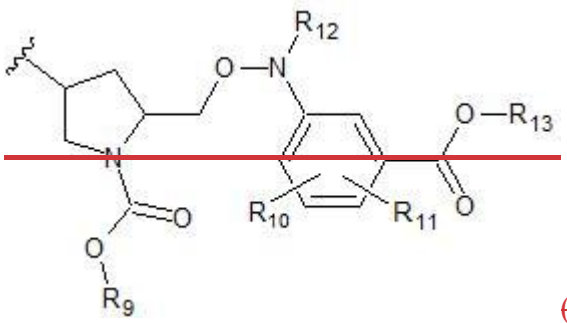
R_9 and R_{13} are independently H or (C1-C6)-alkyl or alkali-metal or alkali earth-metal, wherein the alkali-metal or the alkali earth-metal is sodium, potassium, lithium, cesium, rubidium, barium, calcium or magnesium,

R_{10} and R_{11} are independently H, halo, cyano, (C1-C6)-alkyl, nitro, hydroxy, carboxy, (C1-C6)-alkoxy, (C1-C6)-alkoxycarbonyl, aminosulphonyl, (C1-C6)-alkylaminosulphonyl, di-(C1-C6)-alkylaminosulphonyl, carbamoyl, (C1-C6)-alkylcarbamoyl, di-(C1-C6)-alkylcarbamoyl, trifluoromethyl, sulphonic acid, amino, (C1-C6)-alkylamino, di-(C1-C6)-alkylamino, (C1-C6)-alkanoylamino, (C1-C6)-alkanoyl(N-(C1-C6)-alkyl)amino, (C1-C6)-alkanesulphonamido, or (C1-C6)-alkyl-$S(O)_n$, wherein n is 0 to 2, and

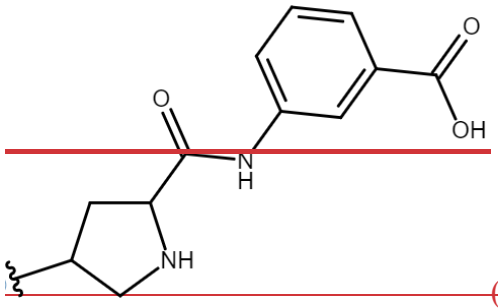
R_{12} is H or (C1-C6)-alkyl; and

wherein the long-acting prevention or treatment of the glucose metabolism disorder is prevention or treatment of a symptom of the glucose metabolism disorder for more than two days after administration of the compound.

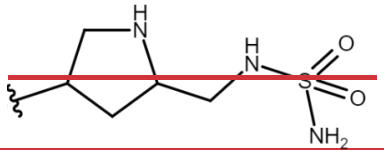
~~2. The use of claim 1, wherein R_3 is represented by one of formulas (I-a) to (I-l) below:~~



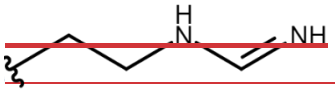
~~(I-a),~~



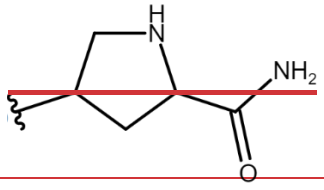
(I-b),



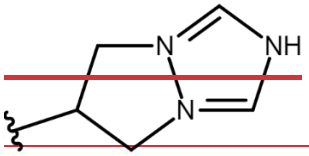
(Ic),



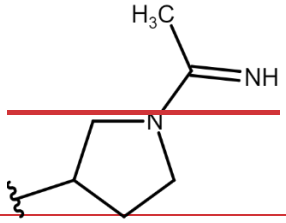
(I-d),



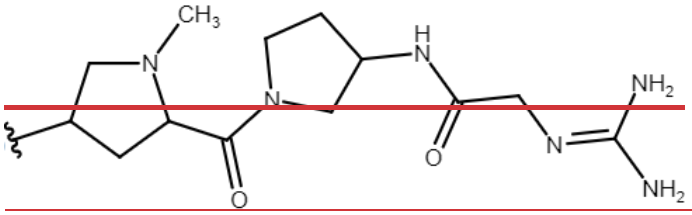
(I-e),



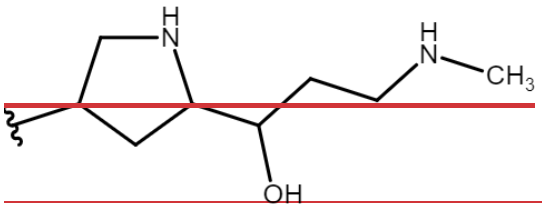
(I-f),



(I-g),



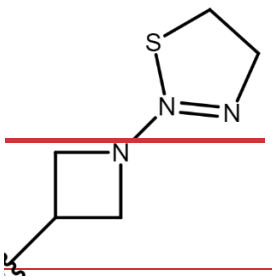
(I-h),



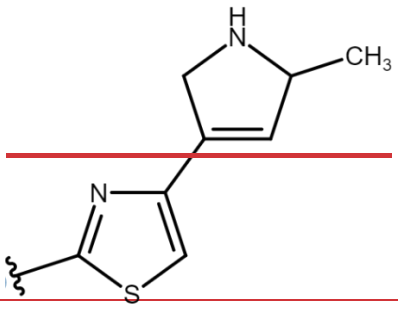
(I-i),



(I-j),



(I-k), and



(I-l),

wherein:

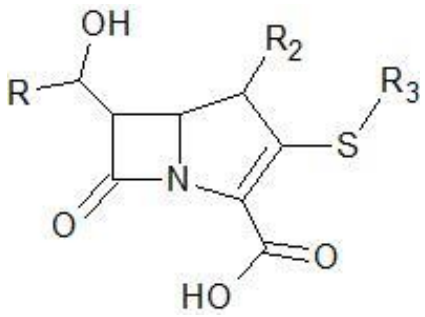
R_9 and R_{13} are independently H or (C1-C6) alkyl or alkali metal or alkali earth

~~metal, wherein the alkali-metal or the alkali earth-metal is sodium, potassium, lithium, cesium, rubidium, barium, calcium or magnesium,~~

~~R_{10} and R_{11} are independently H, halo, cyano, (C1-C6)-alkyl, nitro, hydroxy, carboxy, (C1-C6)-alkoxy, (C1-C6)-alkoxycarbonyl, aminosulphonyl, (C1-C6)-alkylaminosulphonyl, di-(C1-C6)-alkylaminosulphonyl, carbamoyl, (C1-C6)-alkylcarbamoyl, di-(C1-C6)-alkylcarbamoyl, trifluoromethyl, sulphonic acid, amino, (C1-C6)-alkylamino, di-(C1-C6)-alkylamino, (C1-C6)-alkanoylamino, (C1-C6)-alkanoyl(N-(C1-C6)-alkyl)amino, (C1-C6)-alkanesulphonamido, or (C1-C6)-alkyl-$S(O)_n$, wherein n is 0 to 2, and~~

~~R_{12} is H or (C1-C6)-alkyl.~~

~~3~~2. The use of claim 1, wherein the compound is represented by formula (II) below:

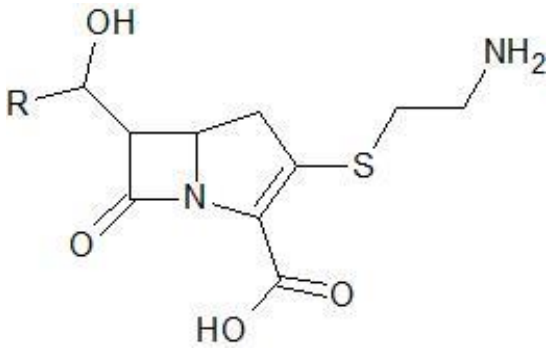


(II),

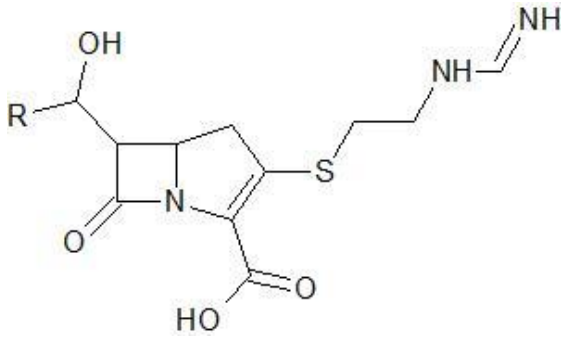
wherein R is defined as R_1 in claim 1, and R_2 and R_3 are as defined in claim 1.

~~4~~3. The use of claim ~~3~~2, wherein the compound is carbapenem.

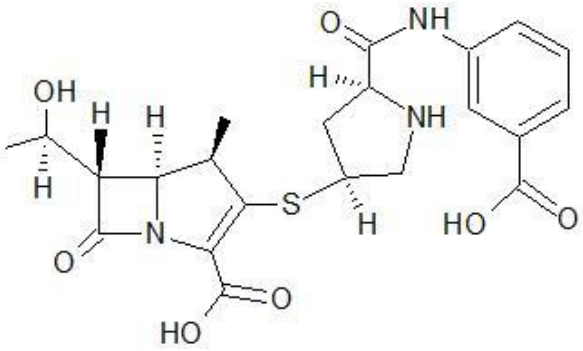
~~5~~4. The use of claim ~~4~~3, wherein the compound is represented by following formula:



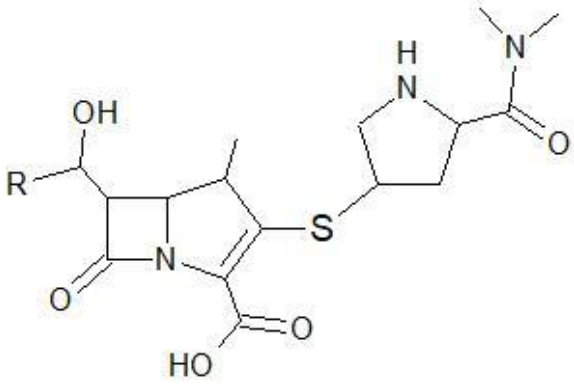
(IIA),



(IIB),



(IIC), or



(IID)

wherein R is defined as R_1 in claim 1.

~~6~~5. The use of claim ~~4~~3, wherein the compound is ertapenem, doripenem, imipenem, meropenem, biapenem, panipenem, tomopenem, lenapenem, tebipenem, razupenem, or thienpenem.

~~7~~6. The use of claim 1, wherein the glucose metabolism disorder is selected from the group consisting of obesity, overweight, hyperglycemia, hyperinsulinemia, glucose intolerance, type 1 diabetes, and type 2 diabetes.

~~8~~7. The use of claim ~~7~~6, wherein the glucose metabolism disorder is hyperglycemia and

the administration reduces a plasma glucose level in the subject.

~~9~~8. The use of claim ~~7~~6, wherein the glucose metabolism disorder is glucose intolerance and the administration increases glucose tolerance in the subject.

~~10~~9. The use of claim 1, wherein the long-acting prevention or treatment lasts for at least one week after the administration.

~~11~~10. The use of claim 1, wherein the long-acting prevention or treatment lasts for at least 6 weeks after the administration.

~~12~~11. The use of claim 1, wherein the long-acting prevention or treatment lasts for 6 to 10 weeks after the administration.

~~13~~12. The use of claim 1, wherein the subject is mammal.

~~14~~13. The use of claim 1, wherein the subject is human.

~~15~~14. The use of claim 1, wherein the subject suffers from type 1 diabetes or type 2 diabetes.