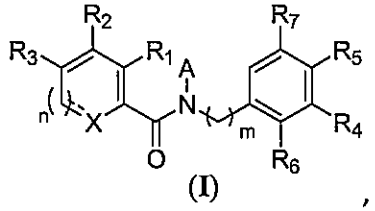
CLAIMS

1. Use of an effective amount of at least one compound of formula (I), or a hydrate, solvate, or pharmaceutically acceptable salt thereof, in the manufacture of a medicament for the treatment or prevention of HBV infection:



(I)

wherein in (**I**):

n is 0 or 1, wherein (i) if n is 0 then X is S, and (ii) if n is 1 then X is CH;

A is selected from the group consisting of hydrogen and C_{1-4} alkyl;

R^1 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, optionally substituted C_{1-4} alkenyl, CO_2R^8, $CONHR^9$, $NHCOR^{10}$, and OR^{11};

or R^1 and A are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

R^2 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, optionally substituted C_{1-4} alkenyl, $NHCOR^{10}$, and OR^{11};

or R^1 and R^2 are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms optionally containing one or two atoms independently selected from the group consisting of oxygen, sulfur and nitrogen;

R^3 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^2 and R^3 are taken together with the atom to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

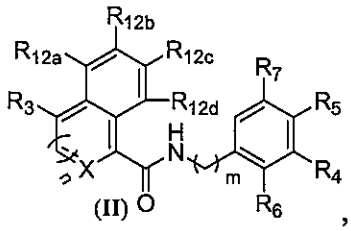
R^4, R^5, R^6 and R^7 are independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11};

R^8, R^9, R^{10} and R^{11} are each independently selected from the group consisting of hydrogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{3-7} cycloalkyl; and

m is 0 or 1;

a substituted alkyl, alkenyl, or cycloalkyl group is independently substituted with at least one selected from the group consisting of C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-8} alkenyl, C_{2-8} alkynyl, C_{3-6} cycloalkyl, -F, -Cl, -Br, -I, -CN, $-NO_2$, $-OR^{14}$, $-SR^{14}$, $-N(R^{14})_2$, $-NR^{14}C(O)R^{14}$, $-SO_2R^{14}$, $-SO_2OR^{14}$, $-SO_2N(R^{14})_2$, $-C(O)R^{14}$, $-C(O)OR^{14}$, $-C(O)N(R^{14})_2$, phenyl, or heterocyclyl, wherein each occurrence of R^{14} is independently selected from the group consisting of hydrogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-8} alkenyl, C_{2-8} alkynyl, and C_{3-6} cycloalkyl, or two R^{14} units taken together with the atom(s) to which they are bound form an optionally substituted carbocyclyl or heterocyclyl group, wherein the carbocyclyl or heterocyclyl group has 3 to 7 ring atoms, wherein the compound of formula (I) is selected from the group consisting of:

(a) a compound of formula (**II**):

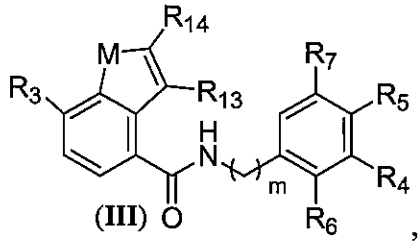


(II) , wherein in (**II**):

R^{12a}, R^{12b}, R^{12c}, and R^{12d} are each independently selected from a group consisting of hydrogen, halogen, and optionally substituted C_{1-4} alkyl; and

n is 0 and X is S;

(b) a compound of formula (**III**):



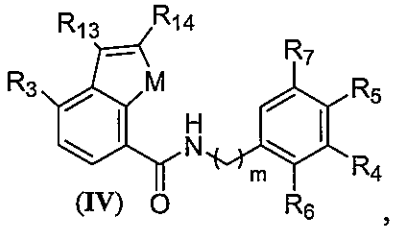
(III) , wherein in (**III**):

R^{13} and R^{14} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^{14} and R^{13} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms; and

M is selected from the group consisting of O, S, and NH;

(c) a compound of formula (**IV**):



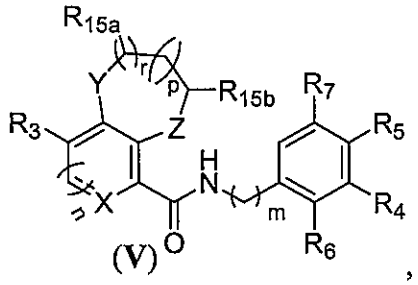
(IV) , wherein in (IV):

R^{13} and R^{14} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^{14} and R^{13} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms; and

M is selected from the group consisting of O, S, and NH;

(d) a compound of formula (V):



(V) , wherein in (V):

R^{15a} and R^{15b} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-6} alkyl, and optionally substituted C_{3-6} cycloalkyl;

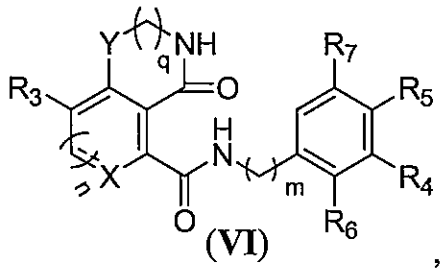
or R^{15a} and R^{15b} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

Y and Z are each independently selected from the group consisting of CH_2 and O;

p is 0 or 1; and

r is 0 or 1;

(e) a compound of formula (VI):



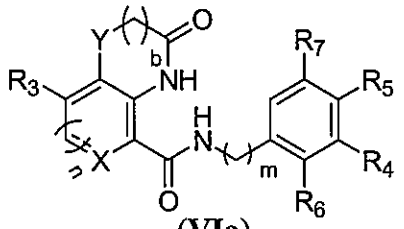
(VI)

, wherein in (**VI**):

Y is selected from the group consisting of CH_2 and O; and

q is 0, 1, or 2;

(f) a compound of formula (**VIa**):



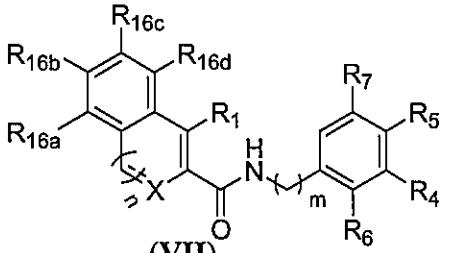
(VIa)

, wherein in (**VIa**):

Y is selected from the group consisting of CH_2 and O; and

b is 0, 1, or 2;

(g) a compound of formula (**VII**):



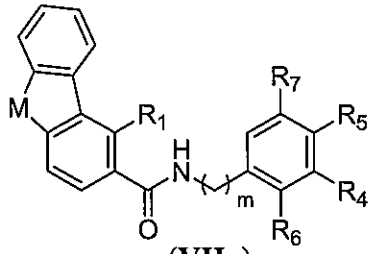
(VII)

, wherein in (**VII**):

R^{16a}, R^{16b}, R^{16c}, and R^{16d} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11}; and

n is 0 and X is S;

(h) a compound of formula (**VIIa**):

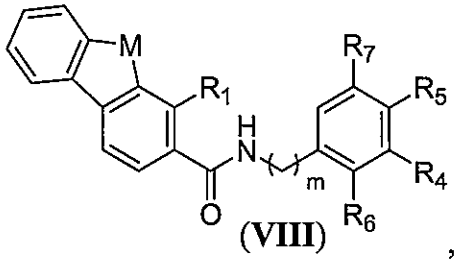


(VIIa)

, wherein in (**VIIa**):

M is selected from the group consisting of O, S, and NH;

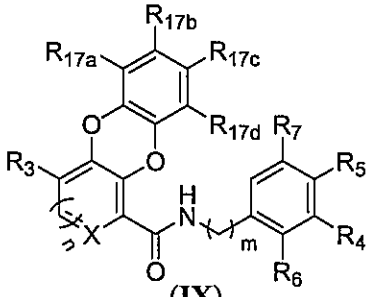
(i) a compound of formula (**VIII**):



(**VIII**) , wherein in (**VIII**):

M is selected from the group consisting of O, S, and NH;

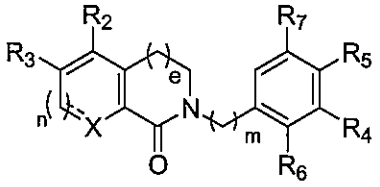
(j) a compound of formula (**IX**):



(**IX**) , wherein in (**IX**):

R^{17a}, R^{17b}, R^{17c}, and R^{17d} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11}; and

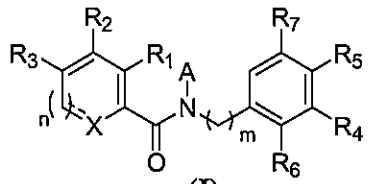
(k) a compound of formula (**IXa**):



(**IXa**) , wherein in (**IXa**):

e is 0, 1, or 2.

2. Use of an effective amount of at least one compound of formula (I), or a hydrate, solvate, or pharmaceutically acceptable salt thereof,, together with at least one pharmaceutically acceptable excipient in the manufacture of a medicament for the treatment or prevention of HBV infection:



(I)

wherein in (I):

n is 0 or 1, wherein (i) if n is 0 then X is S, and (ii) if n is 1 then X is CH;

A is selected from the group consisting of hydrogen and C_{1-4} alkyl;

R^1 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, optionally substituted C_{1-4} alkenyl, CO_2R^8, $CONHR^9$, $NHCOR^{10}$, and OR^{11};

or R^1 and A are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

R^2 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, optionally substituted C_{1-4} alkenyl, $NHCOR^{10}$, and OR^{11};

or R^1 and R^2 are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms optionally containing one or two atoms independently selected from the group consisting of oxygen, sulfur and nitrogen;

R^3 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^2 and R^3 are taken together with the atom to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

R^4, R^5, R^6 and R^7 are independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11};

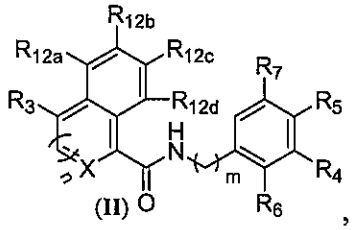
R^8, R^9, R^{10} and R^{11} are each independently selected from the group consisting of hydrogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{3-7} cycloalkyl; and

m is 0 or 1;

a substituted alkyl, alkenyl, or cycloalkyl group is independently substituted with at least one selected from the group consisting of C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-8} alkenyl, C_{2-8} alkynyl, C_{3-6} cycloalkyl, -F, -Cl, -Br, -I, -CN, $-NO_2$, $-OR^{14}$, $-SR^{14}$, $-N(R^{14})_2$, $-NR^{14}C(O)R^{14}$, $-SO_2R^{14}$, $-SO_2OR^{14}$, $-SO_2N(R^{14})_2$, $-C(O)R^{14}$, $-C(O)OR^{14}$, $-C(O)N(R^{14})_2$, phenyl, or heterocyclyl, wherein each occurrence of R^{14} is independently selected from the group consisting of hydrogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-8} alkenyl, C_{2-8} alkynyl, and C_{3-6} cycloalkyl, or two R^{14} units taken

together with the atom(s) to which they are bound form an optionally substituted carbocyclyl or heterocyclyl group, wherein the carbocyclyl or heterocyclyl group has 3 to 7 ring atoms, wherein the compound of formula (I) is selected from the group consisting of:

(a) a compound of formula (**II**):

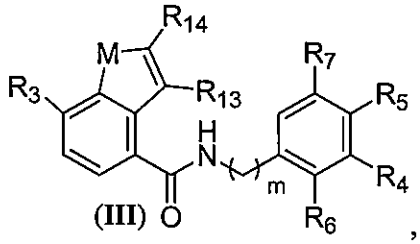


(II) , wherein in (**II**):

R^{12a}, R^{12b}, R^{12c}, and R^{12d} are each independently selected from a group consisting of hydrogen, halogen, and optionally substituted C_{1-4} alkyl; and

n is 0 and X is S;

(b) a compound of formula (**III**):



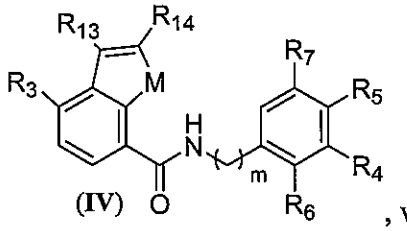
(III) , wherein in (**III**):

R^{13} and R^{14} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^{14} and R^{13} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms; and

M is selected from the group consisting of O, S, and NH;

(c) a compound of formula (**IV**):



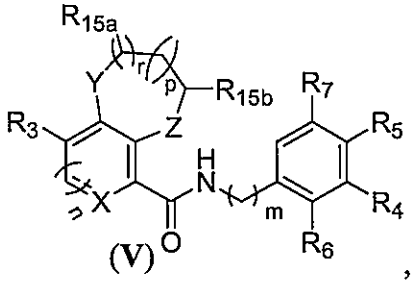
(IV) , wherein in (**IV**):

R^{13} and R^{14} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^{14} and R^{13} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms; and

M is selected from the group consisting of O, S, and NH;

(d) a compound of formula (**V**):



(**V**)

, wherein in (**V**):

R^{15a} and R^{15b} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-6} alkyl, and optionally substituted C_{3-6} cycloalkyl;

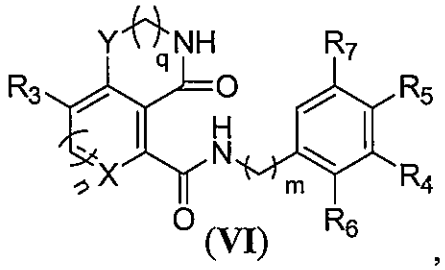
or R^{15a} and R^{15b} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

Y and Z are each independently selected from the group consisting of CH_2 and O;

p is 0 or 1; and

r is 0 or 1;

(e) a compound of formula (**VI**):



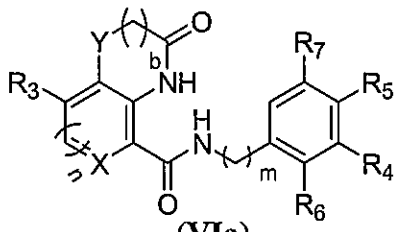
(**VI**)

, wherein in (**VI**):

Y is selected from the group consisting of CH_2 and O; and

q is 0, 1, or 2;

(f) a compound of formula (**VIa**):

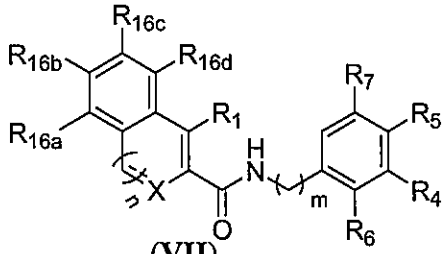


(VIa) , wherein in **(VIa)**:

Y is selected from the group consisting of CH_2 and O; and

b is 0, 1, or 2;

(g) a compound of formula **(VII)**:

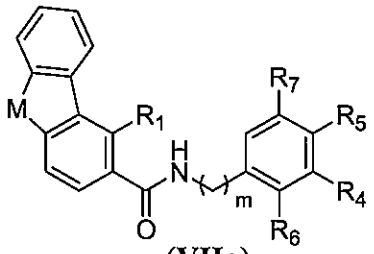


(VII) , wherein in **(VII)**:

R^{16a}, R^{16b}, R^{16c}, and R^{16d} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11}; and

n is 0 and X is S;

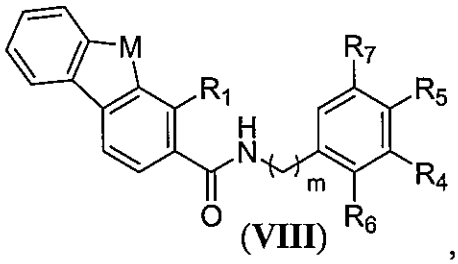
(h) a compound of formula **(VIIa)**:



(VIIa) , wherein in **(VIIa)**:

M is selected from the group consisting of O, S, and NH;

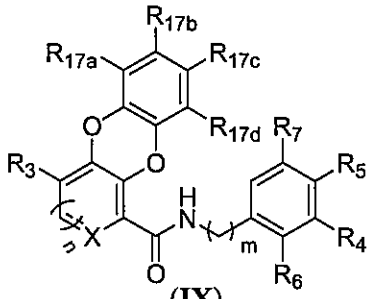
(i) a compound of formula **(VIII)**:



(VIII) , wherein in **(VIII)**:

M is selected from the group consisting of O, S, and NH;

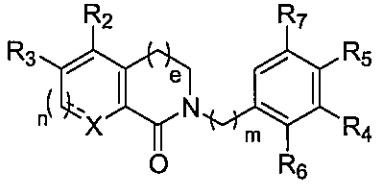
(j) a compound of formula (**IX**):



(**IX**) , wherein in (**IX**):

R^{17a}, R^{17b}, R^{17c}, and R^{17d} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11}; and

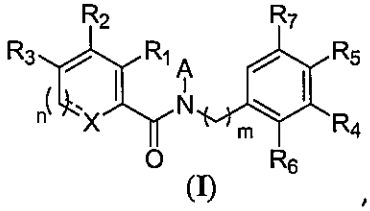
(k) a compound of formula (**IXa**):



(**IXa**) , wherein in (**IXa**):

e is 0, 1, or 2.

3. Use of an effective amount of at least one compound of formula (I), or a hydrate, solvate, or pharmaceutically acceptable salt thereof, in the manufacture of a medicament for the treatment or prevention of disease or conditions associated with HBV infection:



(**I**) ,

wherein in (**I**):

n is 0 or 1, wherein (i) if n is 0 then X is S, and (ii) if n is 1 then X is CH;

A is selected from the group consisting of hydrogen and C_{1-4} alkyl;

R^1 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, optionally substituted C_{1-4} alkenyl, CO_2R^8, $CONHR^9$, $NHCOR^{10}$, and OR^{11};

or R^1 and A are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

R^2 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, optionally substituted C_{1-4} alkenyl, $NHCOR^{10}$, and OR^{11};

or R^1 and R^2 are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms optionally containing one or two atoms independently selected from the group consisting of oxygen, sulfur and nitrogen;

R^3 is selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^2 and R^3 are taken together with the atom to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

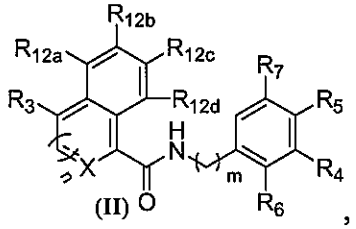
R^4, R^5, R^6 and R^7 are independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11};

R^8, R^9, R^{10} and R^{11} are each independently selected from the group consisting of hydrogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{3-7} cycloalkyl; and

m is 0 or 1;

a substituted alkyl, alkenyl, or cycloalkyl group is independently substituted with at least one selected from the group consisting of C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-8} alkenyl, C_{2-8} alkynyl, C_{3-6} cycloalkyl, -F, -Cl, -Br, -I, -CN, $-NO_2$, $-OR^{14}$, $-SR^{14}$, $-N(R^{14})_2$, $-NR^{14}C(O)R^{14}$, $-SO_2R^{14}$, $-SO_2OR^{14}$, $-SO_2N(R^{14})_2$, $-C(O)R^{14}$, $-C(O)OR^{14}$, $-C(O)N(R^{14})_2$, phenyl, or heterocyclyl, wherein each occurrence of R^{14} is independently selected from the group consisting of hydrogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{2-8} alkenyl, C_{2-8} alkynyl, and C_{3-6} cycloalkyl, or two R^{14} units taken together with the atom(s) to which they are bound form an optionally substituted carbocyclyl or heterocyclyl group, wherein the carbocyclyl or heterocyclyl group has 3 to 7 ring atoms, wherein the compound of formula (I) is selected from the group consisting of:

(a) a compound of formula (II):



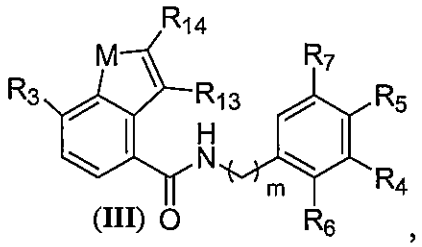
(II)

, wherein in (II):

R^{12a}, R^{12b}, R^{12c}, and R^{12d} are each independently selected from a group consisting of hydrogen, halogen, and optionally substituted C_{1-4} alkyl; and

n is 0 and X is S;

(b) a compound of formula (**III**):



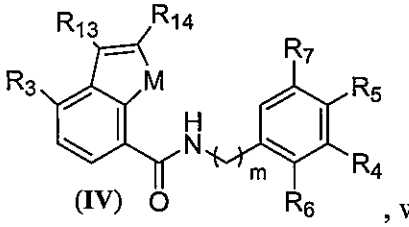
(**III**) , wherein in (**III**):

R^{13} and R^{14} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^{14} and R^{13} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms; and

M is selected from the group consisting of O, S, and NH;

(c) a compound of formula (**IV**):



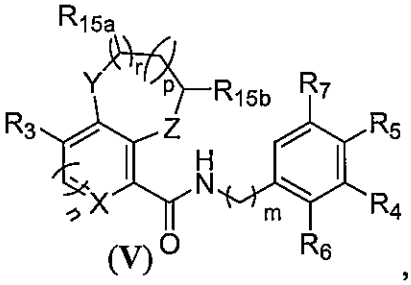
(**IV**) , wherein in (**IV**):

R^{13} and R^{14} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and optionally substituted C_{1-4} alkenyl;

or R^{14} and R^{13} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms; and

M is selected from the group consisting of O, S, and NH;

(d) a compound of formula (**V**):



(**V**) , wherein in (**V**):

R^{15a} and R^{15b} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-6} alkyl, and optionally substituted C_{3-6} cycloalkyl;

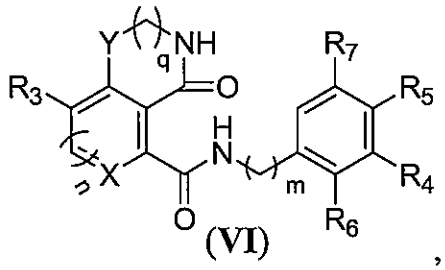
or R^{15a} and R^{15b} are taken together with the atoms to which they are bound to form an optionally substituted ring having 5-7 ring atoms;

Y and Z are each independently selected from the group consisting of CH_2 and O;

p is 0 or 1; and

r is 0 or 1;

(e) a compound of formula (**VI**):



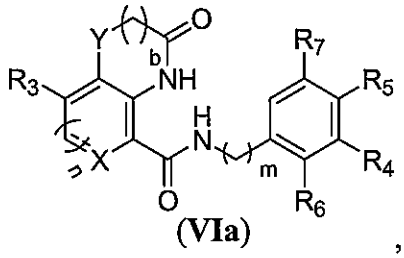
(VI)

, wherein in (**VI**):

Y is selected from the group consisting of CH_2 and O; and

q is 0, 1, or 2;

(f) a compound of formula (**VIa**):



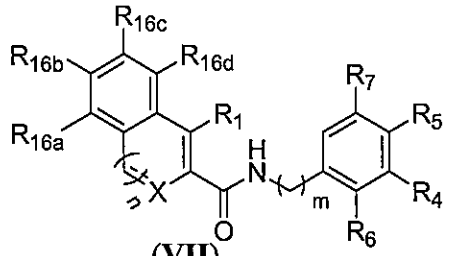
(VIa)

, wherein in (**VIa**):

Y is selected from the group consisting of CH_2 and O; and

b is 0, 1, or 2;

(g) a compound of formula (**VII**):



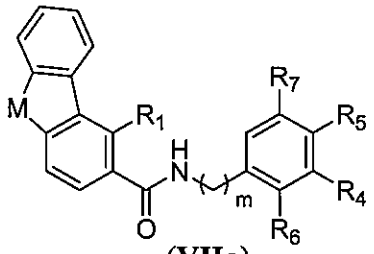
(VII)

, wherein in **(VII)**:

R^{16a}, R^{16b}, R^{16c}, and R^{16d} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11}; and

n is 0 and X is S;

(h) a compound of formula **(VIIa)**:

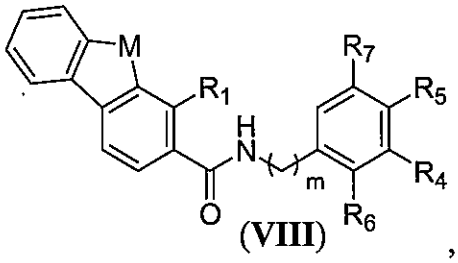


(VIIa)

, wherein in **(VIIa)**:

M is selected from the group consisting of O, S, and NH;

(i) a compound of formula **(VIII)**:

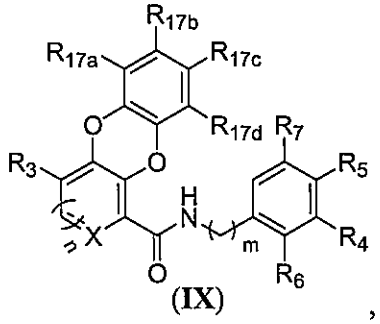


(VIII)

, wherein in **(VIII)**:

M is selected from the group consisting of O, S, and NH;

(j) a compound of formula **(IX)**:

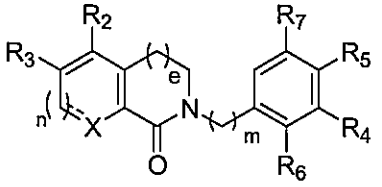


(IX)

, wherein in **(IX)**:

R^{17a}, R^{17b}, R^{17c}, and R^{17d} are each independently selected from the group consisting of hydrogen, halogen, optionally substituted C_{1-4} alkyl, and OR^{11}; and

(k) a compound of formula (**IXa**):



(IXa) , wherein in (**IXa**):

e is 0, 1, or 2.

4. The use of claim 3, wherein the at least one compound is to be administered in a composition further comprising at least one pharmaceutically acceptable excipient.