COMBINED THERAPY AGAINST TUMORS COMPRISING SUBSTITUTED ACRYLOYL DISTAMYCIN DERIVATIVES, TAXANES AND/OR ANTIMETABOLITES

The present invention relates to the field of cancer treatment and provides an antitumor composition comprising a substituted acryloyl distamycin derivative, more particularly an α-bromo- or α-chloro-acryloyl distamycin derivative, an antimicrotubule agent and/or an antimetabolite, having a synergistic antineoplastic effect.

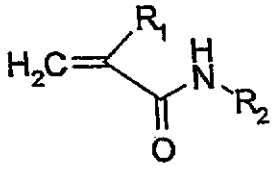
Distamycin A and analogues thereof, hereinafter referred to as distamycin and distamycin-like derivatives, are known in the art as cytotoxic agents useful in antitumor therapy.

Distamycin A is an antibiotic substance with antiviral and antiprotozoal activity, having a polypyrrole framework [*Nature* 203: 1064 (1964); *J. Med. Chem.* 32: 774-778 (1989)].

The international patent applications WO 90/11277, WO 98/04524, WO 98/21202, WO 99/50265, WO 99/50266 and WO 01/40181 (claiming priority from British patent application No. 9928703.9), all in the name of the applicant itself and herewith incorporated by reference, disclose acryloyl distamycin derivatives wherein the amidino moiety of distamycin is optionally replaced by nitrogen-containing ending groups such as, for instance, cyanamidino, N-methylamidino, guanidino, carbamoyl, amidoxime, cyano and the like, and/or wherein the polypyrrole framework of distamycin, or part of it, is replaced by varying carbocyclic or heterocyclic moieties.

The present invention provides, in a first aspect, a pharmaceutical composition for use in antineoplastic therapy in mammals, including humans, comprising a pharmaceutically acceptable carrier or excipient;

- an acryloyl distamycin derivative of formula (I):



(I)

wherein:

R_1 is a bromine or chlorine atom;

R_2 is a distamycin or distamycin-like framework; or a pharmaceutically acceptable salt thereof; and

an antimicrotubule agent and/or an antimetabolite.

The present invention includes, within its scope, the pharmaceutical compositions comprising any of the possible isomers covered by the compounds of formula (I), both considered separately or in admixture, as well as the metabolites and the pharmaceutically acceptable bio-precursors (otherwise known as pro-drugs) of the compounds of formula (I).

In the present description, unless otherwise specified, with the term distamycin or distamycin-like framework R_2 we intend any moiety structurally closely related to distamycin itself, for instance by optionally replacing the ending amidino moiety of distamycin and/or its polypyrrole framework, or part of it.

Antimicrotubule agents and antimetabolites are widely known in the art as antitumor agents; see, for a general reference, Cancer, Principles and Practice of Oncology, Lippincott-Raven Ed. (1997), 432-452 and 467-483

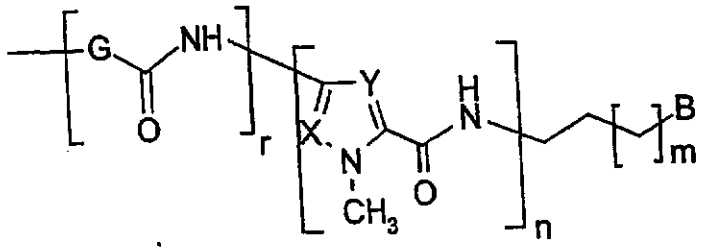
According to a preferred embodiment of the invention, herewith provided are the above pharmaceutical compositions wherein the antimicrotubule agents are, for instance, taxanes, e.g. paclitaxel or docetaxel; vinca alkaloids, e.g. vincristine, vinblastine, vindesine, vinorelbine; and estramustine, optionally encapsulated within liposomes.

Preferred antimetabolites are, for instance, antifolates, e.g. metotrexate, trimetrexate, tomudex; 5-fluoropyrimidines, e.g. 5-FU, floxuridine, ftorafur and capecitabine; cytidine analogs, e.g. cytarabine, azacitidine and gemcitabine.

Particularly preferred antimicrotubule agents are paclitaxel and estramustine whereas preferred antimetabolites are 5-fluorouracil or gemcitabine.

According to another preferred embodiment of the invention, herewith provided are the

above pharmaceutical compositions wherein, within the acryloyl distamycin derivative of formula (I), R_1 has the above reported meanings and R_2 is a group of formula (II) below:



(II)

wherein

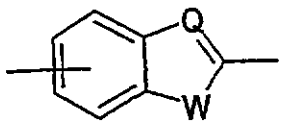
m is an integer from 0 to 2;

n is an integer from 2 to 5;

r is 0 or 1;

X and Y are, the same or different and independently for each heterocyclic ring, a nitrogen atom or a CH group;

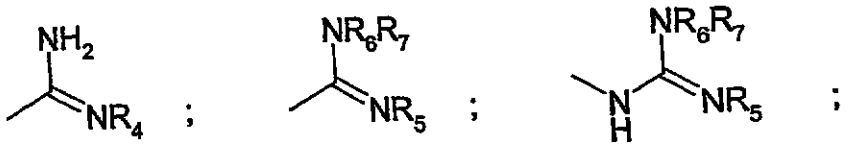
G is phenylene, a 5 or 6 membered saturated or unsaturated heterocyclic ring with from 1 to 3 heteroatoms selected among N, O or S, or it is a group of formula (III) below:

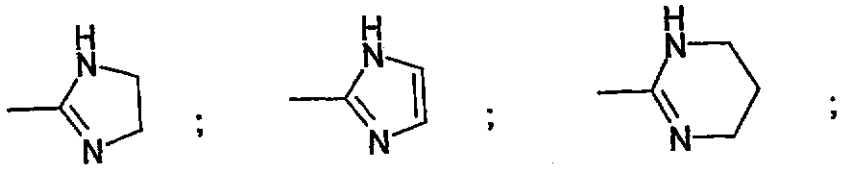


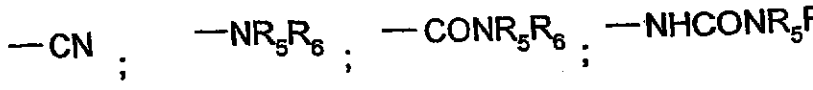
(III)

wherein Q is a nitrogen atom or a CH group and W is an oxygen or sulfur atom or it is a group NR_3 wherein R_3 is hydrogen or C_1-C_4 alkyl;

B is selected from the group consisting of





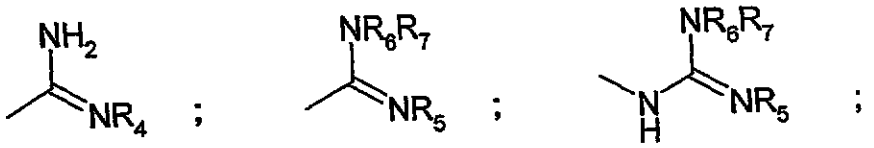


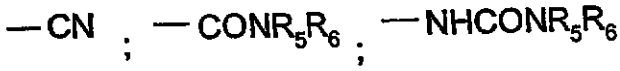
wherein R_4 is cyano, amino, hydroxy or C_1-C_4 alkoxy; R_5, R_6 and R_7, the same or different, are hydrogen or C_1-C_4 alkyl.

In the present description, unless otherwise specified, with the term C_1-C_4 alkyl or alkoxy group we intend a straight or branched group selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, isobutoxy, sec-butoxy or tert-butoxy.

Even more preferred are the pharmaceutical compositions of the invention comprising the above acryloyl distamycin derivative of formula (I) wherein R_1 is bromine or chlorine; R_2 is the above group of formula (II) wherein r is 0, m is 0 or 1, n is 4 and B has the above reported meanings.

Still more preferred, within this class, are the pharmaceutical compositions comprising the compounds of formula (I) wherein R_1 is bromine or chlorine; R_2 is the above group of formula (II) wherein r is 0, m is 0 or 1, n is 4, X and Y are both CH groups and B is selected from:





wherein R_4 is cyano or hydroxy and R_5, R_6 and R_7, the same or different, are hydrogen or C_1-C_4 alkyl.

Pharmaceutically acceptable salts of the compounds of formula (I) are those with pharmaceutically acceptable inorganic or organic acids such as, for instance, hydrochloric, hydrobromic, sulfuric, nitric, acetic, propionic, succinic, malonic, citric, tartaric, methanesulfonic, p-toluenesulfonic acid and the like.

Examples of preferred acryloyl distamycin derivatives of formula (I), within the compositions object of the invention, optionally in the form of pharmaceutically acceptable salts, preferably with hydrochloric acid, are:

1. N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-

yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;

2. N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}propyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
3. N-(5-{[(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
4. N-(5-{[(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-imidazole-2-carboxamide hydrochloride;
5. N-(5-{[(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-3-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrazole-5-carboxamide hydrochloride;
6. N-(5-{[(5-{[(5-{[(3-amino-3-oxopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-3-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrazole-5-carboxamide;
7. N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-chloroacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
8. N-(5-{[(5-{[(3-{[amino(imino)methyl]amino}propyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
9. N-(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride; and

10. N-{5-[({5-[({5-[({3-[(aminocarbonyl)amino]propyl}amino)carbonyl]-1-methyl-1H-pyrrol-3-yl}amino)carbonyl]-1-methyl-1H-pyrrol-3-yl}amino)carbonyl]-1-methyl-1H-pyrrol-3-yl}-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide.

The above compounds of formula (I), either specifically identified as such or by means of the general formula, are known or easily prepared according to known methods as reported, for instance, in the aforementioned international patent applications WO 90/11277, WO 98/04524, WO 98/21202, WO 99/50265 and WO 99/50266 and WO 01/40181.

The present invention further provides a product comprising an acryloyl distamycin derivative of formula (I), as defined above, an antimicrotubule agent and/or an antimetabolite, as a combined preparation for simultaneous, separate or sequential use in antitumor therapy.

Particularly preferred, in this respect, is a product comprising N-(5-{[(5-{[(5-{[(2-[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride (internal code PNU 166196) and gemcitabine, as a combined preparation for simultaneous, separate or sequential use in antitumor therapy.

A further aspect of the present invention is to provide a method of treating a mammal, including humans, suffering from a neoplastic disease state, which method comprises administering to said mammal the above acryloyl distamycin derivative of formula (I), an antimicrotubule agent and/or an antimetabolite, in amounts effective to produce a synergistic antineoplastic effect.

The present invention also provides a method for lowering the side effects caused by antineoplastic therapy with an antineoplastic agent in a mammal in need thereof,

including humans, the method comprising administering to said mammal a combined preparation comprising an acryloyl distamycin derivative of formula (I), an antimicrotubule agent and/or an antimetabolite, in amounts effective to produce a synergistic antineoplastic effect.

By the term "synergistic antineoplastic effect", as used herein, it is meant the inhibition of the growth tumor, preferably the complete regression of the tumor, by administering an effective amount of the combination comprising an acryloyl distamycin derivative of formula (I), an antimicrotubule agent and/or an antimetabolite to mammals, including humans.

By the term "administered " or "administering", as used herein, it is meant parenteral and/or oral administration; the term "parenteral" means intravenous, subcutaneous and intramuscular administration.

In the method of the present invention, the acryloyl distamycin derivative may be administered simultaneously with the antimicrotubule agent or with the antimetabolite. Alternatively, the two drugs may be administered sequentially in either order.

When the acryloyl distamycin derivative is administered with both the antimicrotubule agent and the antimetabolite, according to an embodiment of the invention, the drugs are preferably administered sequentially, in any order.

In this respect, it will be appreciated that the actual preferred method and order of administration will vary according to, inter alias, the particular formulation of the acryloyl distamycin of formula (I) being used, the particular formulation of the antimicrotubule agent and/or the antimetabolite being used, the particular tumor model being treated as well as the particular host being treated.

To administer the acryloyl distamycin derivative of formula (I), according to the method of the invention, the course of therapy generally employed comprises doses varying from about 0.05 to about 100 mg/m^2 of body surface area and, more preferably, from about 0.1 to about 50 mg/m^2 of body surface area.

For the administration of the taxanes, according to the method of the invention, the course of therapy generally employed comprises doses varying from about 1 to about

1000 mg/m^2 of body surface area and, more preferably, from about 10 to about 500 mg/m^2 of body surface area.

For the administration of the vinca alkaloids, according to the method of the invention, the course of therapy generally employed comprises doses varying from about 0.1 to about 1000 mg/m^2 of body surface area and, more preferably, from about 0.5 to about 100 mg/m^2 of body surface area.

For the administration of the antimetabolite according to the invention, the course of therapy generally employed comprises doses varying from about 0.1 to about 10 g/m^2 of body surface area and, more preferably, from about 1 to about 5 g/m^2 of body surface area.

The antineoplastic therapy of the present invention is particularly suitable for treating breast, ovary, lung, colon, kidney, stomach, pancreas, liver, melanoma, leukemia and brain tumors in mammals, including humans.

In a further aspect, the present invention is directed to a composition comprising an effective amount of an acryloyl distamycin derivative of formula (I), as defined above, an antimicrotubule agent and/or an antimetabolite, in the preparation of a medicament for use in the prevention or treatment of metastasis or in the treatment of tumors by inhibition of angiogenesis.

As stated above, the effect of an acryloyl distamycin derivative of formula (I) with an antimicrotubule agent and/or an antimetabolite, is significantly increased without a parallel increase of toxicity. In other words, the combined therapy of the present invention enhances the antitumoral effects of the acryloyl distamycin derivative and of the other drug, being either an antimicrotubule, an antimetabolite or a combination thereof and, hence, provides the most effective and least toxic treatment for tumors.

The superadditive effects of the combined preparations of the invention are shown, for instance, by the following *in vivo* antitumor activity data which are intended to illustrate the present invention without posing any limitation to it.

Table 1 shows the antileukemic activity on disseminated L1210 murine leukemia obtained by combining N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride, as a representative compound of formula (I) - internal code PNU 166196, with gemcitabine.

At the dose of 15 mg/kg of gemcitabine alone (day +1 after tumor injection, 2 h after PNU 166196 administration) and at the dose of 0.7 mg/kg of PNU 166196 alone (days +1,6) were associated, without toxicity, ILS% values of 50 and 58, respectively. Combining gemcitabine and PNU 166196 at the same doses with the same schedule, an increase of activity with ILS% values of 127 were observed, thus indicating a synergistic effect.

Table 1: Antileukemic activity against disseminated L1210[1] murine leukemia of an acryloyl distamycin derivative (I) in combination with gemcitabine.

Compound	Treatment schedule	Dose[2] (mg/kg/day)	ILS%[3]	Tox[4]
PNU 166196	iv +1,6	0.78	58	0/10
Gemcitabine	iv +1 (*)	15	50	0/10
PNU 166196 + Gemcitabine	iv +1,6 iv +1(*)	0.78 + 15	127	0/10

1) L1210 leukemia cells (10^5/mouse) are injected iv on day 0.

2) Treatment is given starting on day 1 after tumor transplantation (day 0).

3) Increase in life span: [(median survival time of treated mice/median survival time of controls)x 100]-100

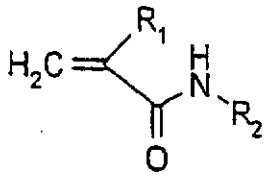
4) Number of toxic deaths/number of mice.

(*) treatment 2 h after PNU 166196 administration.

CLAIMS

1. A pharmaceutical composition comprising a pharmaceutically acceptable carrier or excipient and, as active ingredient,

- an acryloyl distamycin derivative of formula (I):



(I)

wherein:

R_1 is a bromine or chlorine atom;

R_2 is a distamycin or analogues thereof; or a pharmaceutically acceptable salt thereof; and

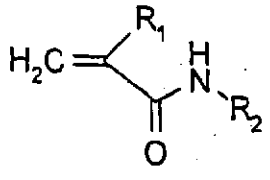
- an antimetabolite.

wherein the acryloyl distamycin derivative and antimetabolite are present in amounts effective to produce a synergistic antineoplastic effect.

2. A pharmaceutical composition according to claim 1 wherein the antimetabolite is selected from antifolates, including methotrexate, tomudex and trimetrexate; 5-fluoropyrimidine derivatives, including 5-fluorouracil, floxuridine, ftorafur and capecitabine; and cytidine analogs, including cytarabine, azacitidine and gemcitabine.

3. A pharmaceutical composition according to claim 2 wherein the antimetabolite is selected from 5-fluorouracil or gemcitabine.

4. A pharmaceutical composition according to claim 1 comprising an acryloyl distamycin derivative of formula (I)

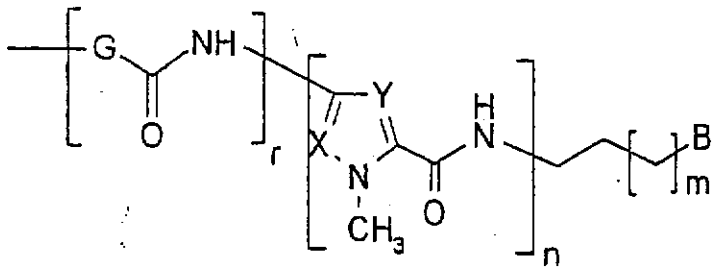


(I)

wherein:

R_1 is a bromine or chlorine atom;

R_2 is a group of formula (II)



(II)

wherein

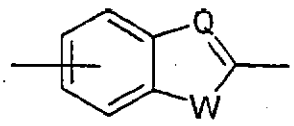
m is an integer from 0 to 2;

n is an integer from 2 to 5;

r is 0 or 1;

X and Y are, the same or different and independently for each heterocyclic ring, a nitrogen atom or a CH group;

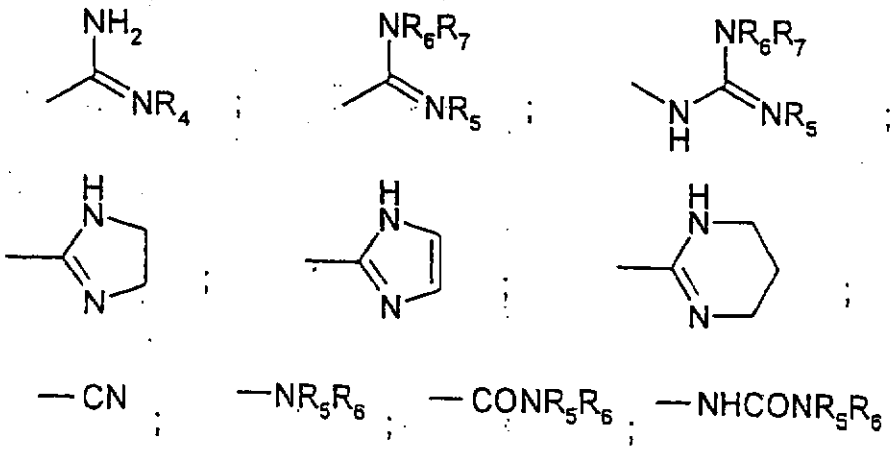
G is phenylene, a 5 or 6 membered saturated or unsaturated heterocyclic ring with from 1 to 3 heteroatoms selected among N, O or S, or it is a group of formula (III) below:



(III)

wherein Q is a nitrogen atom or a CH group and W is an oxygen or sulfur atom or it is a group NR_3 wherein R_3 is hydrogen or C_1-C_4 alkyl;

B is selected from the group consisting of

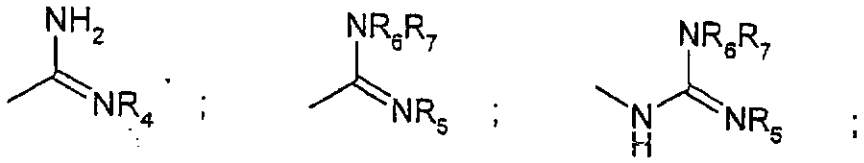


wherein R_4 is cyano, amino, hydroxy or C_1-C_4 alkoxy; R_5, R_6 and R_7, the same or different, are hydrogen or C_1-C_4 alkyl.

5. A pharmaceutical composition according to claim 4 comprising an acryloyl distamycin derivative of formula (I) wherein R_1, R_2 and B are as defined in claim 4, r is

0, m is 0 or 1 and n is 4.

6. A pharmaceutical composition according to claim 5 comprising an acryloyl distamycin derivative of formula (I) wherein R_1 and R_2 are as defined in claim 4, r is 0, m is 0 or 1, n is 4, X and Y are both CH groups and B is selected from:



$-CN$; $-CONR_5R_6$; $-NHCONR_5R_6$

wherein R_4 is cyano or hydroxy and R_5, R_6 and R_7, the same or different, are hydrogen or C_1-C_4 alkyl.

7. A pharmaceutical composition according to claim 1 comprising an acryloyl distamycin derivative, optionally in the form of a pharmaceutically acceptable salt, selected from the group consisting of:

1. N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
2. N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}propyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
3. N-(5-{[(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;
4. N-(5-{[(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-

3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-imidazole-2-carboxamide hydrochloride;

5. N-(5-{[(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-3-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrazole-5-carboxamide hydrochloride;

6. N-(5-{[(5-{[(5-{[(3-amino-3-oxopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-3-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrazole-5-carboxamide;

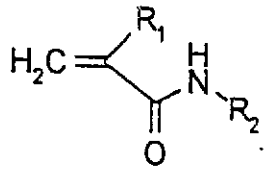
7. N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-chloroacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;

8. N-(5-{[(5-{[(3-{[amino(imino)methyl]amino}propyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride;

9. N-(5-{[(5-{[(3-amino-3-iminopropyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide hydrochloride; and

10. N-{5-[({5-[({5-[({3-[(aminocarbonyl)amino]propyl}amino)carbonyl]-1-methyl-1H-pyrrol-3-yl}amino)carbonyl]-1-methyl-1H-pyrrol-3-yl}amino)carbonyl]-1-methyl-1H-pyrrol-3-yl}-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide.

8. Products comprising an acryloyl distamycin derivative of formula (I):



(I)

wherein:

R_1 is a bromine or chlorine atom;

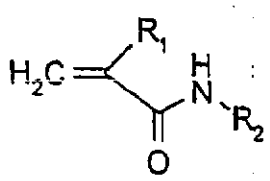
R_2 is a distamycin or analogues thereof; or a pharmaceutically acceptable salt thereof, and an antimetabolite, as a combined preparation for simultaneous, separate or

sequential use in the treatment of tumors.

9. Products according to claim 8 wherein the antimetabolite is selected from antifolates, including methotrexate, tomudex and trimetrexate; 5-fluoropyrimidine derivatives, including 5-fluorouracil, floxuridine, ftorafur and capecitabine; and cytidine analogs, including cytarabine, azacitidine and gemcitabine.

10. Products according to claim 9 wherein the antimetabolite is selected from 5-fluorouracil or gemcitabine.

11. Products according to claim 8 comprising an acryloyl distamycin derivative of formula (I)

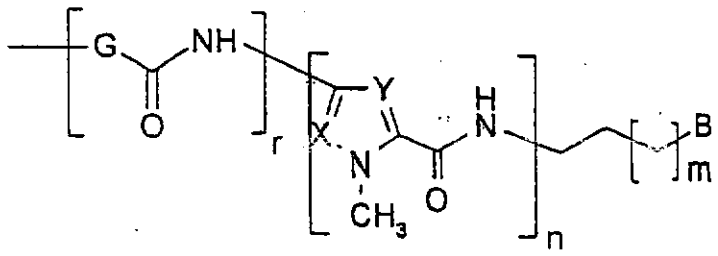


(I)

wherein:

R_1 is a bromine or chlorine atom;

R_2 is a group of formula (II)



(II)

wherein

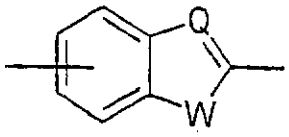
m is an integer from 0 to 2;

n is an integer from 2 to 5;

r is 0 or 1;

X and Y are, the same or different and independently for each heterocyclic ring, a nitrogen atom or a CH group;

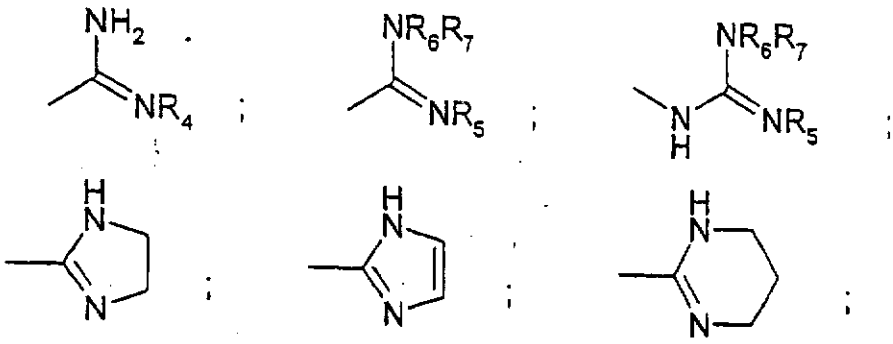
G is phenylene, a 5 or 6 membered saturated or unsaturated heterocyclic ring with from 1 to 3 heteroatoms selected among N, O or S, or it is a group of formula (III) below:



(III)

wherein Q is a nitrogen atom or a CH group and W is an oxygen or sulfur atom or it is a group NR_3 wherein R_3 is hydrogen or C_1-C_4 alkyl;

B is selected from the group consisting of



$-CN$; $-NR_5R_6$; $-CONR_5R_6$; $-NHCONR_5R_6$

wherein R_4 is cyano, amino, hydroxy or C_1-C_4 alkoxy; R_5, R_6 and R_7, the same or different, are hydrogen or C_1-C_4 alkyl.

12. Products according to claim 8 wherein the acryloyl distamycin derivative is selected from the group as defined in claim 7.

13. Use of an acryloyl distamycin derivative of formula (I), as defined in claim 1 or in any one of claims from 4 to 7 in the preparation of a medicament for use in combination therapy with an antimetabolite in the treatment of tumors.

14. Use according to claim 13 wherein the medicament further comprises the said antimetabolite.

15. Use according to claim 13 or 14 wherein the acryloyl distamycin derivative is selected from the group as defined in claim 7.

16. Use according to any one of claims 13 to 15 wherein the tumor is selected from breast, ovary, lung, colon, kidney, stomach, pancreas, liver, melanoma, leukemia and brain tumors.

17. Use of an acryloyl distamycin derivative of formula (I), as defined in claim 1 or in any one of claims from 4 to 7 in the preparation of a medicament for use in combination therapy with an antimetabolite in the prevention or treatment of metastasis or in the treatment of tumors by inhibition of angiogenesis.

18. Use according to claim 17 wherein the medicament further comprises the said antimetabolite.

19. Use of the acryloyl distamycin derivative of formula (I), as defined in claim 1 or any one of claims 4 to 7, for the preparation of a medicament for treating a mammal, including humans, suffering from a neoplastic disease state.

20. Use of an antimetabolite with an acryloyl distamysin derivative of formula (I), as defined in claim 1 or any one of claims 4 to 7, for the preparation of a medicament for lowering the side effects caused by antineoplastic therapy with an antineoplastic agent in a mammal in need thereof including humans.

21. A pharmaceutical composition according to claim 1 wherein the acryloyl distamycin derivative, optionally in the form of a pharmaceutically acceptable salt, is N-(5-{[(5-{[(5-{[(2-{[amino(imino)methyl]amino}ethyl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)amino]carbonyl}-1-methyl-1H-pyrrol-3-yl)-4-[(2-bromoacryloyl)amino]-1-methyl-1H-pyrrole-2-carboxamide, and the antimetabolite is gemcitabine.