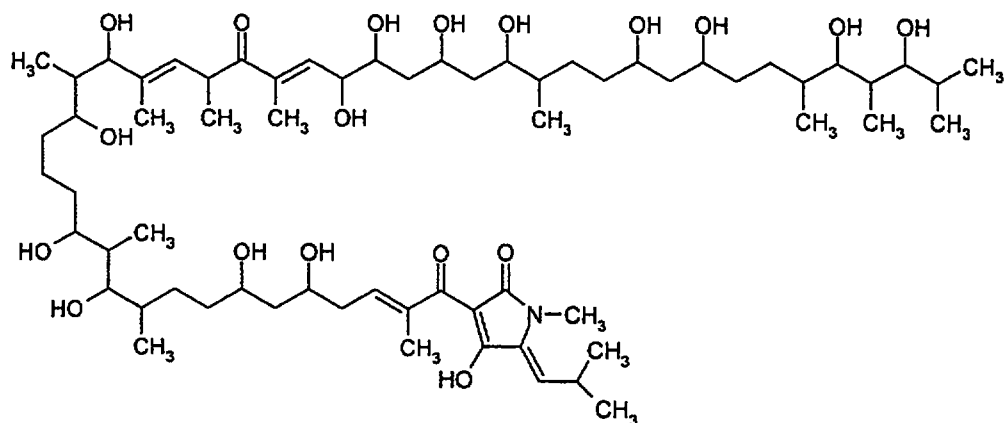


Amycomycin, a process for its production and its use as a pharmaceutical.

This invention relates to a compound named Amycomycin, which is obtainable
5 by cultivation of the microorganism Amycolatopsis sp., ST101170 (DSM 12216),
and to its pharmaceutically acceptable salts and derivatives. The present
invention further relates to a process for the production of Amycomycin, to the
use of Amycomycin and its pharmaceutically acceptable salts and derivatives as
pharmaceuticals, in particular to their use as antibiotics, and to pharmaceutical
10 compositions comprising Amycomycin or a pharmaceutically acceptable salt or
derivative thereof.

Methicillin resistant *Staphylococcus aureus* (MRSA) infections are known to be
predominant in several infectious conditions like wounds and burns. Vancomycin
15 and teicoplanin, belonging to the glycopeptide class, are the only two antibiotics
clinically used for the treatment of MRSA infections. However, due to the recent
emergence of vancomycin- and teicoplanin-resistant strains, these infections are
reported to have become menacing and fatal. An intensive search for a
structurally different class of compounds active against these vancomycin and
20 teicoplanin resistant strains has, therefore, been initiated. For instance,
methysulfomycin I, a cyclic thiopeptide, has been described earlier [EP-A-
0818539 filed July 11, 1996] as an antibiotic active against vancomycin- and
teicoplanin-resistant strains.

25 It has now been found that a novel compound named Amycomycin has
antibiotic activity. The present invention thus relates to a compound of the
formula:



and to the pharmaceutically acceptable salts and derivatives thereof, such as esters,
 5 ethers and other obvious chemical equivalents, including all stereoisomeric forms and
 all tautomeric forms.

Amycomycin has a characteristic tetramic acid moiety with a highly oxygenated C45-
 side chain. It has the molecular formula $C_{65}H_{115}NO_{18}$ and is obtainable by cultivation
 10 of the microorganism *Amycolatopsis* species ST101170 (DSM 12216) under aerobic
 conditions in a nutrient medium containing sources of carbon and nitrogen, followed by
 isolation and purification in a customary manner. The microorganism ST101170
 belongs to the order of Actinomycetales, genus *Amycolatopsis* and has been
 deposited on 4 June 1998 with the German Collection of Microorganisms and Cell
 15 Cultures (DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH),
 Braunschweig, Deutschland and has been given the accession number DSM No.
 12216.

The present invention further provides a process for the production of the compound
 20 named Amycomycin from *amycolatopsis* species ST101170, its mutants and variants,
 under aerobic conditions in a nutrient medium containing one or more sources of
 carbon and one or more sources of nitrogen and optionally nutrient inorganic salts
 and/or trace elements, followed by isolation of the said compound and purification in a
 customary manner.

Mutants and variants of the microorganism ST101170 may also be able to synthesize the compound according to the present invention. Such mutants may be produced in a known manner by physical means, for example irradiation such as with ultraviolet- or 5 X-rays, or chemical mutagens, such as ethylmethylnsulfonate (EMS), 2-hydroxy-4-methoxy-benzophenone (MOB) or N-methyl-N'-nitro-N-nitrosoguanidine (MNNG).

The screening for suitable mutants and variants which can produce the compound according to the invention can be confirmed by determination of the biological activity 10 of the active compounds accumulated in the culture broth, for example by testing the antibacterial action, in particular against Vancomycin resistant strains (see Table 2 below).

Preferred carbon sources suitable for aerobic fermentation are assimilable 15 carbohydrate and sugar alcohols such as glucose, lactose or D-Mannit as well as carbohydrate-containing natural products such as malt extract. Suitable sources of nitrogen are, for example, amino acids, peptides and proteins, including their degradation products such as peptones or tryptones, meat extract, ground seeds, for example of maize, white beans, soya or the cotton plants, distillation residues from 20 alcohol production, meat meal and yeast extracts, but also ammonium salts and nitrates. Suitable inorganic salts which the nutrient solution can contain are, for example, chlorides, carbonates, sulfates or phosphates of the alkaline metals or alkaline earth metals, iron, zinc, cobalt or manganese.

25 The formation of Amycomycin proceeds particularly well, for example, in a nutrient medium comprising about 0.5 to 5 % starch (soluble), preferably 1 to 2 %, about 0.5 to 5 % glucose, preferably 1 to 3 %, about 0.5 to 5 % glycerine, preferably 1 to 2 %, about 0.1 to 0.5 % corn steep liquor, preferably 0.2 to 0.3 %, about 0.2 to 1 % peptone, preferably 0.4 to 0.6 %, about 0.1 to 0.5 % yeast extract, preferably 0.2 to 0.4 %, about 30 0.05 to 0.2 % sodium chloride, preferably 0.1 to 0.2 % and about 0.1 to 0.5 % CaCO_3 , preferably 0.2 to 0.3 %. These amounts are based on the weight of the whole nutrient medium.

The cultivation of ST101170 is carried out aerobically, for example, submerged with shaking or stirring in shake flasks or laboratory fermenters, optionally with introduction of air or oxygen. Cultivation by fermentation can be carried out, for example, in sterile
5 wide-necked bottles or round-bottomed flasks of various volumes, in glass fermenters or V₂A-steel tanks.

The cultivation of ST101170 may be carried out at temperatures between about 20 and about 35°C, preferably between about 25 and about 30 °C and pH between 4 and 10,
10 preferably between 6 and 8. Under these conditions the microorganism is cultivated in general over a period of 20 to 200 hours, preferably 24 to 150 hours.

Cultivation is advantageously carried out in several stages. Firstly, one or more pre-cultures may be prepared in a liquid nutrient medium. A main culture, the actual
15 production medium is then inoculated with the pre-culture in, for example, a volume ratio of 1 : 10. The pre-culture is obtained, for example, by inoculating a nutrient medium with sporified mycelium and allowing to grow for about 20 to about 120 hours, preferably 24 to 90 hours. The sporified mycelium can be obtained by, for example, allowing the microorganism to grow for about 1 to about 40 days, preferably 5 to 12
20 days, on a solid or liquid nutrient medium such as yeast-malt agar or potato-dextrose agar.

The course of fermentation and the formation of Amycomycin can be monitored by methods known to the skilled person such as by measuring the biological activity of the
25 culture broth in bioassays or by chromatographic methods such as thin-layer chromatography (DC) or high-pressure liquid chromatography (HPLC).

The compound Amycomycin is present in the culture filtrate as well as in the mycelium. Usually, however, the main amount is present in the mycelium. The compound can be
30 isolated using known separation techniques. Thus, it can be recovered from the culture filtrate by, for example, filtration or centrifugation. The filtrate can be extracted with a

water immiscible solvent such as 1-butanol, ethyl acetate, chloroform, dichloromethane or the like, preferably butanol or ethyl acetate.

The active material can also be recovered from mycelium by extraction with a water miscible solvent such as methanol, acetone, acetonitrile, n-propanol or iso-propanol, 5 preferably methanol or acetone or a water immiscible solvent such as t-butanol, ethyl acetate, chloroform, dichloromethanol or the like, preferably butanol or ethyl acetate.

The extraction of the culture filtrate may be carried out at a wide pH range. It is preferable, however, for the extraction to be carried out in a neutral or weakly acidic 10 medium, preferably at a pH of between 4 and 9. The organic extract may be concentrated in vacuum and dried to give the active crude material.

The isolation or purification of the compound Amycomycin may be carried out in a known manner taking into consideration the chemical, physical and biological 15 characteristics of the natural compound.

One method of isolation of Amycomycin according to the invention is solution partition in a manner known per se.

20 Another method of purification of the Amycomycin is by chromatography on adsorption resins such as Diaion® HP-20 (Mitsubishi Casei Corp., Tokyo), on Amberlite® XAD 7 (Rohm and Haas, USA), on Amberchrom® CG (Toso Haas, Philadelphia, USA) or on similar resins. The separation can be carried out at a wide pH range. Preferably the pH range is 1 to 9, more preferably 2 to 8. Also suitable are numerous reverse phase 25 supports, example RP₈ and RP₁₈, such as have been generally publicized in the context of high-pressure liquid chromatography (HPLC). A further possibility of purification of the compound according to the invention consists in the use of so-called normal-phase chromatographic supports such as silica gel, or Al₂O₃ (alumina) or others in a manner known per se. Many eluents are suitable for this such as 30 dichloromethane, chloroform, methanol, ethyl acetate, acetone, petroleum ether or combinations thereof. The pH can be varied, for example, by addition of triethylamine.

An alternative isolation process of the compound Amycomycin is the use of molecular sieves such as Fractogel® TSK HW-40, Sephadex® LH-20 and others in a manner known per se. It is moreover also possible to recover the compound Amycomycin from the crude material by crystallization. Suitable herefor are, for example, organic
5 solvents and their mixtures, anhydrous or with the addition of water.

An additional process for the isolation and purification of the compound according to the invention consists in the use of anion-exchangers, preferably in the pH range of from 7 to 10 and cation-exchangers, preferably in the pH range of from 3 to 7.

10 Particularly suitable for this purpose is the use of buffer solutions to which amounts of the organic solvents have been added.

Additionally, counter-current chromatography using a biphasic eluent system made up of two or more solvents such as water, methanol, ethanol, butanol, isopropanol,
15 acetone, dichloromethane, ethyl acetate or petroleum ether, is a possible purification process.

The compound Amycomycin or chemical derivatives thereof can be converted to the corresponding pharmacologically acceptable salts by methods known to one skilled in
20 the art.

Pharmacologically acceptable salts of compounds according to the invention are inorganic or organic salts such as are described in Remington's Pharmaceutical Sciences (17. Edition, page 1418 (1985)). Possible salts are alkali metal salts,
25 ammonium salts, alkaline earth metal salts, salts with physiologically acceptable amines and salts with inorganic or organic acids such as HCL, HBr, H₂SO₄, maleic acid and fumaric acid.

Obvious chemical equivalents of compounds according to the present invention are
30 compounds which have a slight chemical difference but which have the same or similar activity or which can under mild conditions be converted to the compounds according to the present invention. Examples of obvious chemical equivalents are esters, ethers,

amino derivatives, complexes or adducts of the or with the compounds according to the invention.

Esters may be prepared, for example, by reacting Amycomycin with carboxylic acids in the presence of reagents such as dicyclohexylcarbodiimide (DCC), or by treating the compound with an acylating agent such as an acid chloride.

Ethers may be prepared, for example, from Amycomycin by reaction with alkylating agents under basic conditions.

10

Other methods of preparation of esters and ethers are given in the literature, for example, in Advanced Organic Synthesis, 4th Edition, J. March, John Wiley & Sons., 1992.

15 Chemical equivalents may be stable complexes with metal ions e.g. transition metals like La^{3+} , Sm^{3+} , Eu^{3+} , Gd^{3+} , which are typical for tetramic acid derivatives and may be prepared by the methods given in the literature (K. Tanaka et. al., Chem. Pharm. Bull. 1979, 27, 1901. K. Matsuo, Chem. Pharm. Bull. 1980, 28, 2494).

20 The double bonds of the alkyl side chain may be reduced by the methods given in the literature, for example in P. N. Rylander, "Hydrogenation Methods", Academic Press, New York (1985), Chpt. 2 or may be hydrohalogenated by methods described by H.O. House in "Modern Synthetic Reactions", W.A. Benjamin, Inc., New York (1972), pp 446-452. Hydroxylated derivatives may be produced by reaction of the double bonds
25 with reagents like OsO_4 as described in the literature e.g. in Chem. Rev. 1980, 80, 187.

Derivatives may also be formed by conversion of the double bonds into epoxides by oxidation e.g. with MCPBA like described in Advanced Organic Synthesis, 4th Edition, J. March, John Wiley & Sons., 1992.

30

The physical-chemical as well as spectroscopic characteristics of the compound Amycomycin according to the invention are as follows:

Appearance: colourless solid, soluble in methanol, DMSO, pyridine

Molecular formula: $C_{65}H_{115}NO_{18}$

HPLC (High Pressure

5 Liquid Chromatography: Column: Purospher Star RP.18e (Merck), 55 x 4 mm, 3 μ m

Eluent: CH_3CN / 0,01 % H_3PO_4 (85%)

Gradient: Time (min) % CH_3CN

0.00 5.0

3.00 95.0

10 5.00 95.0

6.00 5.0

10.00 5.0

Flow: 2 ml/min

Temp.: 40 °C

15 Detection: 210 nm, 254, 280, 320, 380

t_R : 2.67 min

Molecular weight: 1198.64 Da

HR-FAB-MS: 1220.801187 $[M+Na]^+$

20 1H -und ^{13}C -NMR: see Table 1

UV/VIS: MeOH, λ_{max} (log) = 229 nm (3.29), 281 (3.16)

Table 1:

Chemical shift of Amycomycin in MeOD at 300 K.

25

	1H	^{13}C
1	0.86	14.76
2	0.97	20.83
3	1.89	31.20
4	3.41	82.20
5	1.70	39.55

6	0.77	13.63
7	3.54	80.19
8	1.65	36.32
9	0.86	12.71
10	1.43	31.20
11	1.44	36.46
12	3.75	71.98
13	1.62/1.54	44.79
14	3.74	72.22
15	1.58/1.37	36.46
16	1.63/1.14	29.27
17	1.51	40.69
18	0.90	15.70
19	3.70	72.90
27	1.51/1.46	42.12
28	4.07	66.31
29	1.52	42.12
30	3.80	72.54
31	4.33	73.26
32	6.62	142.18
33	-	138.47
34	1.83	12.75
35	-	206.04
36	4.21	41.00
37	1.14	17.77
38	5.36	128.37
39	-	138.72
40	1.69	12.75
41	3.98	80.54
42	1.64	41.25
43	0.88	8.02

44	3.59	73.88
45	1.49	36.46
46	1.62/1.32	23.50
47	1.55/1.32	33.34
48	3.80	75.09
49	1.74	42.71
50	0.77	11.92
51	3.41	77.87
52	1.61	36.46
53	0.86	12.75
54	1.55/1.32	31.37
55	1.61/1.44	36.46
56	3.77	71.83
57	1.67	44.53
58	3.92	71.12
59	2.30	37.54
60	5.84 (b)	~131.7 (c)
61	-	(c)
62	1.82	13.81
63	-	(c)
64	-	(c)
65	3.24 (b)	27.91
66	-	(c)
67	-	(c)
68	-	(c)
69	5.50 (b)	~119.3 (c)
70	3.09	26.52
71	1.10	24.31
72	1.10	24.31

b) Broad signals

c) These signals are not visible. C60 und C69 could only be assigned with the HMQC-spectrum.

5 Amycomycin has extraordinary antibacterial activity, particularly against gram positive bacteria such as, for example, Staphylo- and Enterococccen. Minimum inhibitory concentrations of Amycomycin against a wide range of bacteria are given in Table 2 below. These strains in particular have lately increasingly proven to be problem strains, i.e., those microorganisms which have become resistant to existing antibiotics. The
10 superiority of the present compound in relation to other antibiotics is shown, for example, in the inhibition of vancomycin- and teicoplanin-resistant strains such as, for example, *E. faecalis*, *E. faecium* or *E. gallinarium*.

Table 2: Minimum Inhibition Concentration (mg/L) (micro-dilutions test)

15

Grampositive Strain	CODE		Amycomycin	Vancomycin
<i>S.aureus</i>	011HT3	oxa S ery S	0.08	0.3
<i>S.aureus</i>	011HT18	ATCC 13709 Smith	0.08	0.3
<i>S.epidermidis</i>	012GO20	oxa S ery S tet R	0.3	0.6
<i>S.aureus</i>	011HT1	nov R	<=0.04	0.08
<i>S.aureus</i>	011DU5	nov R tet R	0.08	0.15
<i>S.aureus</i>	011CB20	oxa R ery Rc tet R	0.08	0.15
<i>S.aureus</i>	011GO71	off S oxa R ery S tet R	0.15	0.6
<i>S.aureus</i>	011GO64	off R oxa R ery Rc tet R	0.3	1.2
<i>S.epidermidis</i>	012GO42	oxa R	0.3	1.2
<i>Staph.coag.negative</i>	012HT5	off R oxa R tet R	0.15	0.6
<i>S.aureus</i>	011GR91	pri R oxa R ery R nov R	1.2	1.2
<i>S.pyogenes</i>	O2A1SJ1	van S ery Rc	0.3	0.15
<i>S.pyogenes</i>	O2A1UC1	van S ery S	0.6	0.15
<i>S.pyogenes</i>	O2A1FI6	ery R	0.6	0.08
<i>Strepto gr.G</i>	O2G0CB2	tet R rif R nov R	0.6	0.15
<i>S.pneumoniae</i>	030BI2	ery R	0.15	0.15

S.milleri	O2milGR12	ery S van S	1.2	0.3
S.mitis	O2mitGR16	ery Ri van S	1.2	0.3
E.faecium	O2D3AP9	nov S van R ery S tei R	0.6	>40
E.faecium	O2D3HT12	tei R van R ery R tet R	0.6	>40
E.faecium	O2D3IP2	tei R van R ery R tet R	ND	>40
E.faecium	O2D3HM3	nov S van A ery R tei R	1.2	>40
E.gallinarium	O2D0HM8	van C tet R ery S	1.2	>40
E.faecalis	O2D2HM9	nov R van B ery R tei S	2.5	>40
E.faecalis	O2D2UC5	ATCC 29212 nov R	2.5	2.5
E.faecalis	O2D2DU18	tet R nov R	1.2	0.3
E.faecalis	O2D2HT10	nov R van S tet R	1.2	0.6
Gramnegative Strain CODE				
E.coli	DB10 250IP5	ery S fuc S nov S	ND	>40
P.aeruginosa	1771 391HT2		>40	>40
P.aeruginosa	1771m 391HT3	mutant perméable	>40	>40

Amycomycin and its pharmaceutically acceptable salts and derivatives can be administered to animals, preferable to mammals, and in particular to humans as

5 pharmaceuticals on their own, in mixtures with one another and in the form of pharmaceutical compositions which permit parenteral or other modes of administration. Accordingly the present invention also relates to Amycomycin and its pharmaceutically acceptable salts and derivatives for use as pharmaceuticals and to the use of Amycomycin and its pharmaceutically acceptable salts and derivatives for the

10 production of medicaments having antibacterial activity. The present invention further relates to pharmaceutical compositions which contain an effective amount of Amycomycin and/or one or more pharmaceutically acceptable salts and/or derivatives thereof, together with a pharmaceutically acceptable carrier.

15 Amycomycin can be administered enterally (oral route), parenterally (intravenously or intramuscularly) rectally or locally (topically). Pharmaceutical compositions which contain Amycomycin or a pharmaceutically acceptable salt or derivative thereof with other pharmaceutically active substances can be prepared by mixing the active

compounds with one or more pharmacologically tolerated auxiliaries and/or excipients, and converting the mixture into a suitable pharmaceutical form such as, solutions, powders (tablets, capsules including microcapsules), ointments (creams or gels), liposome preparations, lipid complexes, colloidal dispersions or suppositories suitable for administration.

Possible auxiliaries and/or excipients for formulations of this type are the pharmaceutically customary liquid or solid fillers and extenders, solvents, emulsifiers, lubricants, flavour corrigents, colourants and/or buffer substances.

10

As is customary, the galenic formulation and the method of administration as well as the dosage range which are suitable in a specific case depend on the species to be treated and on the state of the respective condition or disease, and can be optimized using methods known in the art. As an example, a dose of 0.001-10mg, preferably 0.1 – 5 mg, more preferably 1.0 mg for a body weight of approx. 75 kg may be suitable. The dose should at least be sufficient to produce the desired effect.

The following are illustrative examples of the present invention but not limitative of the scope thereof :

20

Example 1:

Preparation of seed material

25 100 ml of nutrient solution (4 g/l yeast extract, 15 g/l soluble starch, 1 g/l K_2HPO_4 , 0.5g/l $MgSO_4 \times 7 H_2O$ filled with water to 1000 ml, pH 7.0 before sterilization) in a sterile 300 ml Erlenmeyer flask is inoculated with the strain *Amycolatopsis* sp.(DSM 12216) and incubated for 5 days at 28°C and 180 rpm on a rotary shaker. 1.5 ml of this culture is subsequently diluted with 1.5 ml of 99 % glycerine and stored at 20°C.

Example 2:

Preparation of culture or pre-culture of *Amycolatopsis* sp., ST101170 (DSM 12216) in 5 Erlenmeyer flasks.

A sterile Erlenmeyer flask containing 100 ml of the following nutrient medium: 10 g/l starch solution, 10 g/l glucose, 10 g/l glycerine 99 %, 2.5 g/l corn steep fluid or liquor, 5 g/l peptone, 2 g/l yeast extract, 1 g/l NaCl and 3 g/l CaCO₃ is inoculated with a loop-ful 10 of grown culture (same nutrient solution, but with 2 % agar) or with 1 ml of a glycerine culture (see Example 1) and incubated on a shaker at 180 rpm and 28°C. Maximum production of the compound Amycomycin is reached after 72 hours.

A 72 hour old submersed culture (produced according to the described process for the 15 shake culture, Example 1, but with the following medium: 15 g/l glucose, 15 g/l soyameal, 3 g/l CaCO₃ and 5 g/l NaCl, pH 7.5) is sufficient for the inoculation of 10 and 200 L fermenters with an inoculation amount of 10 %.

Example 3:

20

Production of the compound Amycomycin

A 200 L fermenter was run with the following parameters:

25 Nutrient medium:	10 g/l starch
	10 g/l Glucose
	10 g/l glycerine 99 %
	2.5 g/l cornsteep liquor
	5 g/l peptone
30	2 g/l yeast extract
	7 g/l NaCl
	3 g/l CaCO ₃

	pH 7.2 (before sterilization)
Inoculum:	10 % fermenter volume
Incubation time:	60 to 80 hours
Incubation temperature:	28°C
5 Agitation:	50rpm
Aeration:	150 l/min

By addition of 1 to 2 ml of an ethanolic polyol solution it was possible to limit foam formation. The production maximum was reached after 69 hours.

10

Example 4: Isolation of the compound Amycomycin

200 l of the culture solution obtained from Example 3 was centrifuged and the mycelium was exhaustively extracted with methanol. The methanol extract was
15 concentrated to a ratio of approximately 1 : 10 to obtain a colourless precipitate which was filtered off. This procedure was repeated until the substance Amycomycin could no longer be detected in the filtrate (HPLC). The residue was freeze-dried and subsequently purified by HPLC:

20 1. Column: @Fractogel TSK-HW 40 (4L, 500 x 100 mm)

Eluent: MeOH

Flow Rate: 20 ml/min

Detection: 204 and 236 nm.

25 The fractions enriched with Amycomycin eluted after 125 minutes. Fractions were pooled based on HPLC (conditions mentioned above). The active pooled fractions with the desired compound were concentrated in vacuum and freeze-dried.

2. Column: Silica Gel 60 (Merck); Erimatech (300 x 20mm, 100ml)

Eluent: A) CH₂Cl₂

B) CH₂Cl₂: MeOH 9 : 1

C) MeOH.

5	Gradient:	min	%A	%B	%C
		0	100	0	0
		15	100	0	0
		35	0	100	0
		45	0	100	0
10		65	0	0	100

Flow Rate: 25 ml/min

Detection: 236 and 288 nm

15 The active compound Amycomycin eluted after 42 minutes. Fractions were pooled based on HPLC (conditions mentioned above). The active pooled fractions with the desired compound were concentrated in vacuum and freeze-dried.

3. Column: ® Fractogel TSK-HW 40 (1 L, 500 x 50 mm)

20 Eluent: MeOH

Flow Rate: 5 ml/min

Detection: 204 and 236 nm

The active component Amycomycin eluted after 112 minutes.

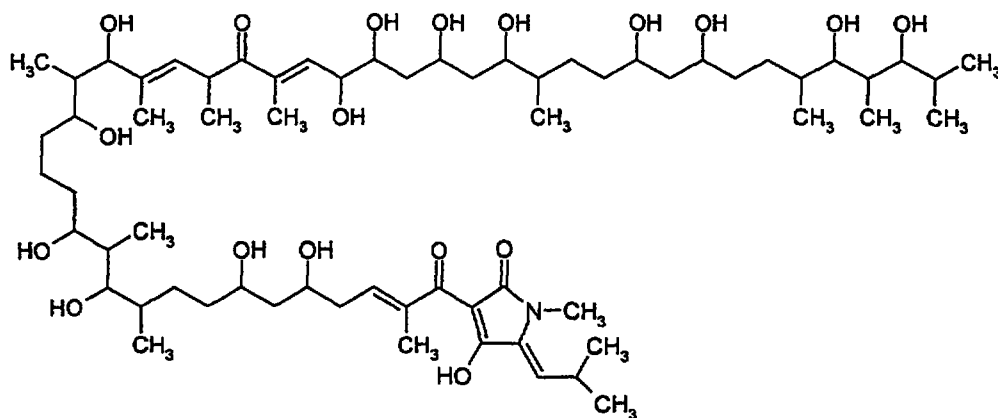
25

From 200 L fermentation broth 110 mg of Amycomycin could be recovered according to the above process.

Claims

1. A compound of the formula:

5



and its pharmaceutically acceptable salts, esters, ethers and other obvious chemical equivalents, in all their stereoisomeric and tautomeric forms.

10

2. A compound of the molecular formula $C_{65}H_{115}NO_{18}$, obtainable by cultivation of the microorganism *Amycolatopsis* species, ST101170 (DSM 12216) under aerobic conditions in a nutrient medium containing sources of carbon and nitrogen, followed by isolation and purification in a customary manner, and its pharmaceutically acceptable salts, and derivatives, in all their stereoisomeric and tautomeric forms.

15

3. A process for the production of the compound as claimed in claim 1 or claim 2, comprising cultivation of the microorganism *Amycolatopsis* species, ST101170 (DSM 12216) under aerobic conditions in a nutrient medium containing sources of carbon and nitrogen, followed by isolation and purification of the compound in a customary manner.

20

4. A process according to claim 3, further comprising conversion of the resultant compound into a pharmacologically tolerable salt, ester, ether or other obvious chemical equivalent.

25



5. A compound as claimed in claim 1 or claim 2 or a pharmaceutically acceptable salt, ester, ether or other obvious chemical equivalent thereof for use as a pharmaceutical.

5

6. A pharmaceutical composition, comprising an effective amount of a compound as claimed in claim 1 or claim 2 and/or a pharmaceutically acceptable salt, ester, ether or other obvious chemical equivalent thereof, and a pharmaceutically acceptable carrier.

10

7. A compound as claimed in claim 1 or claim 2, or a pharmaceutically acceptable salt, ester, ether or other obvious chemical equivalent thereof for use as an antibiotic.

