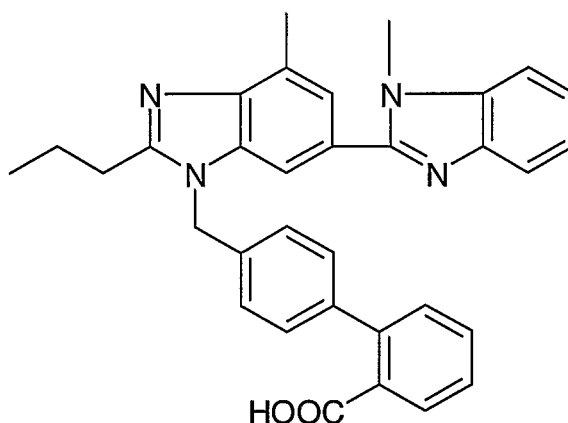


BILAYER TABLET COMPRISING TELMISARTAN AND AMLODIPINE

The present invention relates to a pharmaceutical tablet comprising a first layer of the
5 angiotensin II receptor antagonist telmisartan in a dissolving tablet matrix and a
second layer of the calcium channel blocker amlodipine in a disintegrating or eroding
tablet matrix.

Background of the invention

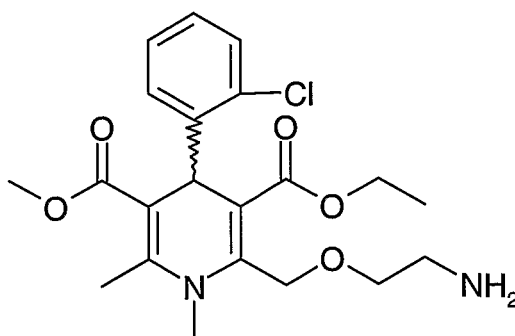
10 Telmisartan is an angiotensin II receptor antagonist developed for the treatment of
hypertension and other medical indications as disclosed in EP-A-502314. Its
chemical name is 4'-[2-n-propyl-4-methyl-6-(1-methylbenzimidazol-2-yl)-
benzimidazol-1-ylmethyl]-biphenyl-2-carboxylic acid having the following structure:



15 Telmisartan is manufactured and supplied in the free acid form. It is characterized by
its very poor solubility in aqueous systems at the physiological pH range of the
gastro-intestinal tract between pH 1 to 7. As disclosed in WO 00/43370, crystalline
telmisartan exists in two polymorphic forms having different melting points. Under the
20 influence of heat and humidity, the lower melting polymorph B transforms irreversibly
into the higher melting polymorph A.

Amlodipine was first disclosed in EP-A-89167. It belongs to the group of calcium
channel blockers and its chemical name is 3-ethyl-5-methyl-2-(2-
25 aminoethoxymethyl)-4-(2-chlorophenyl)-1,4-dihydro-6-methyl-3,5-
pyridinedicarboxylate, $C_{20}H_{25}ClN_2O_5$, M_R 408,88, having the following structure:

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Pharmaceutically amlodipine is used as maleate ($C_{24}H_{29}ClN_2O_9$; M_R 524,96), benzenesulfonate or besylate ($C_{26}H_{31}ClN_2O_8S$; M_R 567,10; EP-A-244944) and
 5 mesylate salt ($C_{21}H_{26}ClN_2O_8S$; M_R 502,01).

“Calcium channel blockers” are also called “calcium antagonists” or “calcium blockers”. They are medications that decrease the heart's pumping strength and relax blood vessels. They are used to treat high blood pressure, angina (chest pain
 10 or discomfort caused by reduced blood supply to the heart muscle) and some arrhythmias.

Object of the invention

The mechanisms of action of telmisartan and amlodipine are considered to cooperate favourably in the treatment of hypertension particularly in patients where the target blood pressure cannot be achieved with one of the medications only. There is an increasing desire for a fixed dose combination product comprising the active ingredients telmisartan and amlodipine. However, both telmisartan and amlodipine are
 20 chemical compounds difficult to handle. Therefore, an oral fixed dose combination dosage form which combines the features of pharmacologic efficacy, adequate drug stability and a reliable and robust method of manufacture has to overcome a number of technical problems. It is an object of the present invention to provide such a fixed dose combination dosage form.

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There are various types of fixed dose combination dosage forms conceivable but it cannot be predicted which of these dosage forms combines product stability, pharmacological efficacy and reliable manufacture best. Generally, combinations of two active pharmaceutical ingredients could be formulated as oral solid or oral liquid dosage forms such as tablets, capsules, coated or sugar-coated tablets, granules, oral solutions, emulsions or suspensions, syrups and lozenges. In view of experiences with liquid dosage forms of telmisartan oral liquid dosage forms are not considered a preferred embodiment according to the present invention. An instant release oral solid dosage form containing two drugs could be prepared by either making a powder mixture or a co-granulate of the two active ingredients with the necessary excipients. However, for a combination of telmisartan and amlodipine, this approach turns out not to result in a dosage form with sufficient product stability. A telmisartan formulation with acceptable in vivo performance has to comprise basic components like for example sodium hydroxide or meglumine whereas amlodipine is surprisingly not stable enough when it gets in direct contact with excipients to be used in a telmisartan formulation. The ester bonds in the amlodipine molecule appear to be subject to hydrolysis when exposed to an alkaline milieu. Therefore, the standard approach of directly mixing the active components with the necessary excipients cannot be applied to a fixed dose combination of telmisartan and amlodipine and more sophisticated techniques are needed to separate the basic telmisartan formulation from the amlodipine drug substance. Under these circumstances perlonget, coating or bilayer tablet technology could be used.

The perlonget approach is to produce separate film-coated tablets for telmisartan and amlodipine in such a size and shape that these can be filled into capsules. It turns out that large capsule sizes like 0 or bigger would be required for the high dose combinations, which is not preferable with regard to patients' compliance.

Another approach is to apply a film coat to the pure amlodipine drug substance or to granules/pellets containing amlodipine. Surprisingly the so coated particles are not stable in the alkaline and hygroscopic milieu of the telmisartan formulation.

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The present invention is based on the recognition, that the dosage form, which combines adequate drug stability, optimum drug release of both active ingredients, pharmacological efficacy and reliable manufacture for a combination of telmisartan and amlodipine best, is a bilayer tablet.

5

Summary of the invention

In accordance with the present invention problems associated with the preparation of a fixed dose combination drug comprising telmisartan and amlodipine can best be
10 handled by means of a bilayer pharmaceutical tablet comprising a first layer of telmisartan, preferably in substantially amorphous form, in a dissolving tablet matrix and a second layer of amlodipine in a disintegrating or eroding tablet matrix.

The tablet according to the present invention provides a largely pH-independent
15 dissolution of the poorly water-soluble telmisartan, thereby facilitating dissolution of the drug at a physiological pH level, and adequate stability and drug release of amlodipine. The tablet structure also overcomes the stability problem caused by the incompatibility of amlodipine with basic constituents of the telmisartan formulation.

20

Definitions

As used herein, the term "substantially amorphous" refers to a product comprising amorphous constituents in a proportion of at least 90%, preferably at least 95%, as determined by X-ray powder diffraction measurement.

25 The term "dissolving tablet matrix" refers to a pharmaceutical tablet base formulation having instant release (fast dissolution) characteristics that readily dissolves in a physiological aqueous medium.

The term "disintegrating or eroding tablet matrix" refers to a pharmaceutical tablet base formulation having instant release characteristics that readily disintegrates or
30 erodes in a physiological aqueous medium.

Description of the invention

A fixed dose combination according to the present invention represents a pharmaceutical bilayer tablet comprising a first layer of telmisartan in substantially amorphous form and a second layer of amlodipine in a disintegrating or eroding
5 tablet matrix.

The active ingredient telmisartan is generally supplied in its free acid form, although pharmaceutically acceptable salts such as the sodium salt may also be used. Since during subsequent processing telmisartan is normally dissolved and transformed into
10 a substantially amorphous form, its initial crystal morphology and particle size are of little importance for the physical and biopharmaceutical properties of the bilayer tablet formulation obtained. It is, however, preferred to remove agglomerates from the starting material, e.g. by sieving, in order to facilitate wetting and dissolution during further processing.

Substantially amorphous telmisartan may be produced by any suitable method known to those skilled in the art, for instance, by freeze drying of aqueous solutions, coating of carrier particles in a fluidized bed, and solvent deposition on sugar pellets or other carriers. Preferably, however, the substantially amorphous telmisartan is prepared by the specific spray-drying method described in WO 03/059327.
20

A bilayer tablet according to the present invention generally contains 10 to 160 mg, preferably 20 to 80 mg or 40 to 80 mg, of telmisartan; and 1 to 20 mg, preferably 2.5 to 10 mg, of amlodipine.

Preferred dose strengths of telmisartan are 20 mg, 40 mg and 80 mg; preferred dose
25 strengths of amlodipine are 2.5 mg, 5 mg and 10 mg.

Presently preferred forms are bilayer tablets comprising 20/10 mg, 40/10 mg, 80/10 mg, 20/5 mg, 40/5 mg, 80/5 mg, 20/2.5 mg, 40/2.5 mg and 80/2.5 mg of telmisartan and amlodipine, respectively.

The first tablet layer contains telmisartan in substantially amorphous form dispersed in a dissolving tablet matrix having instant release (fast dissolution) characteristics.
30

The dissolving tablet matrix may have neutral or basic properties, although a basic tablet matrix is preferred.

In such a preferred embodiment, the dissolving matrix of the telmisartan layer

5 comprises a basic agent, a water-soluble diluent and, optionally, other excipients and adjuvants.

Specific examples of suitable basic agents are alkali metal hydroxides such as NaOH and KOH; basic amino acids such as arginine and lysine; and meglumine (N-methyl-D-glucamine), NaOH and meglumine being preferred.

10 Specific examples of suitable water-soluble diluents are carbohydrates such as monosaccharides like glucose; oligosaccharides like sucrose, anhydrous lactose and lactose monohydrate; and sugar alcohols like sorbitol, mannitol, erythrol and xylitol. Sorbitol is a preferred diluent.

The other excipients and/or adjuvants are, for instance, selected from binders, 15 carriers, fillers, lubricants, flow control agents, crystallization retarders, solubilizers, coloring agents, pH control agents, surfactants and emulsifiers, specific examples of which are given below in connection with the second tablet layer composition. The excipients and/or adjuvants for the first tablet layer composition are preferably chosen such that a non-acidic, fast dissolving tablet matrix is obtained.

20

The first tablet layer composition generally comprises 3 to 50 wt.%, preferably 5 to 35 wt.%, of active ingredient; 0.25 to 20 wt.%, preferably 0.40 to 15 wt.%, of basic agent; and 30 to 95 wt.%, preferably 60 to 80 wt.% of water-soluble diluent (filler).

Other (optional) constituents may, for instance, be chosen from one or more of the 25 following excipients and/or adjuvants in the amounts indicated:

10 to 30 wt.%, preferably 15 to 25 wt.%, of binders, carriers and fillers, thereby replacing the water-soluble diluent;

0.1 to 5 wt.%, preferably 0.5 to 3 wt.%, of lubricants;

30 0.1 to 5 wt.%, preferably 0.3 to 2 wt.%, of flow control agents;

1 to 10 wt.%, preferably 2 to 8 wt.%, of crystallization retarders;

1 to 10 wt.%, preferably 2 to 8 wt.%, of solubilizers;

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0.05 to 1.5 wt.%, preferably 0.1 to 0.8 wt.%, of coloring agents;
0.5 to 10 wt.%, preferably 2 to 8 wt.%, of pH control agents;
0.01 to 5 wt.%, preferably 0.05 to 1 wt.%, of surfactants and emulsifiers.

- 5 The second tablet layer composition comprises amlodipine dispersed in a disintegrating or eroding tablet matrix having instant release (fast dissolution) characteristics. The disintegrating or eroding tablet matrix may have weakly acidic, neutral or weakly basic properties, a neutral tablet matrix being preferred.
- 10 In a preferred embodiment, the disintegrating or eroding matrix comprises one or more fillers, a disintegrant, a lubricant and, optionally flow control agents, binders or polymers, other excipients and adjuvants.

Preferred fillers for the second layer are selected from the group consisting of
15 pregelatinized starch, microcrystalline cellulose, cellulose, mannitol, erythritol, lactose monohydrate, dibasic calcium phosphate anhydrous, sorbitol, and xylitol. Particularly preferred are pregelatinized starch, microcrystalline cellulose, dibasic calcium phosphate anhydrous and lactose monohydrate.

- 20 Preferred lubricants are sodium stearyl fumarate and magnesium stearate. Particularly preferred is magnesium stearate.

Preferred disintegrants are selected from the group consisting of croscarmellose sodium (crosslinked carboxymethylcellulose sodium), sodium starch glycolate, crospovidone
25 (crosslinked polyvinylpyrrolidone), corn starch, pregelatinized starch, low-substituted hydroxypropylcellulose and microcrystalline cellulose. Particularly preferred are sodium starch glycolate and crospovidone.

- Preferred binders are selected from the group consisting of polyvinylpyrrolidone
30 (Povidone), copolymers of vinylpyrrolidone with other vinyl derivatives (Copovidone), microcrystalline cellulose, hydroxypropylmethylcellulose, methylcellulose,

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hydroxypropylcellulose and pregelatinized starch. Particularly preferred are hydroxypropylmethylcellulose and povidone.

Particularly preferred fillers of the second tablet layer composition are pregelatinized starch and/or microcrystalline cellulose as these fillers can additionally serve the purpose of a binder or disintegrant.

Preferred flow control agents are colloidal silicon dioxide and talc. Particularly preferred is colloidal silicon dioxide.

10

The other excipients and adjuvants, if used, are for example coloring agents including dyes and pigments such as iron oxides.

15

The second tablet layer composition generally comprises 0.5 to 20 wt.%, preferably 1 to 10 wt.% of amlodipine and 50 to 99.5 wt.%, preferably 80 to 99 wt.% of fillers.

20

The other excipients and/or adjuvants are, for instance, selected from binders (0 to 7 wt. %, preferably 1 to 5 wt. %), disintegrants (0 to 10 wt. %, preferably 1 to 5 wt. %), lubricants (0.25 to 3 wt. %, preferably 0.5 to 2 wt. %), flow control agents (0.25 to 3 wt. %, preferably 0.5 to 2 wt. %) and coloring agents (0.05 to 3 wt. %, preferably 0.1 to 1 wt. %), specific examples of which are also given below. The excipients and/or adjuvants for the second tablet layer composition are preferably chosen such that a neutral, disintegrating or eroding tablet matrix is obtained.

25

As solvent for the granulation liquid, which, as a volatile component, does not remain in the final product, methanol, ethanol, isopropyl alcohol or purified water can be used; preferred solvents are ethanol and purified water.

The layers can be differentiated by using different colors.

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For preparing a bilayer tablet according to the present invention, the first and second tablet layer compositions may be compressed in the usual manner in a bilayer tablet press, e.g. a high-speed rotary press in a bilayer tableting mode. However, care

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should be taken not to employ an excessive compression force for the first tablet layer. Preferably, the ratio of the compression force applied during compression of the first tablet layer to the compression force applied during compression of both the first and second tablet layers is in the range of from 1:10 to 1:2. For instance, the first
5 tablet layer may be compressed at moderate force of 4 to 8 kN, whereas the main compression of first plus second layer is performed at a force of 10 to 20 kN. During bilayer tablet compression adequate bond formation between the two layers is achieved by virtue of distance attraction forces (intermolecular forces) and mechanical interlocking between the particles.

10 The bilayer tablets obtained release the active ingredients rapidly and in a largely pH-independent fashion, with complete release occurring within less than 60 min and release of the major fraction occurring within less than 15 min.

15 In accordance with the present invention, a substantially increased dissolution rate of the active ingredients and, in particular, of telmisartan is achieved. Normally, at least 70% and typically at least 90% of the drug load are dissolved after 30 min.

20 The bilayer tablets of the present invention tend to be slightly hygroscopic and are therefore preferably packaged using a moisture-proof packaging material such as aluminium foil blister packs, or polypropylene tubes and HDPE bottles which preferably contain a desiccant.

25 A preferred method of producing the bilayer tablet according to the present invention comprises

- (i) providing a first tablet layer composition by
 - a) preparing an aqueous solution of telmisartan, at least one basic agent and, optionally, a solubilizer and/or a crystallization retarder;
 - b) spray-drying said aqueous solution to obtain a spray-dried granulate;
 - 30 c) mixing said spray-dried granulate with a water-soluble diluent to obtain a premix;
 - d) mixing said premix with a lubricant to obtain a final blend for the first layer;

- 10 -

e) optionally, adding other excipients and/or adjuvants in any of steps a) to d);

(ii) providing a second tablet layer composition by

a) a direct compression process comprising the steps of

- 5 - blending the active ingredient amlodipine or a pharmaceutically acceptable salt thereof, one or more fillers, flow control agents and disintegrants and/or other excipients in a mixer;
- optionally dry screening the mixture through a screen in order to segregate cohesive particles and to improve content uniformity;
- 10 - blending the mixture with remaining excipients such as a lubricant in a mixer in order to obtain the final composition;

b) a wet granulation process comprising the steps of

- blending the active ingredient amlodipine or a pharmaceutically acceptable salt thereof, one or more fillers, binders, disintegrants and optionally other excipients in a mixer;
- 15 - granulating the mixture by adding granulation liquid, preferably water;
- wet screening of the granules through a screen in order to segregate bigger agglomerates;
- drying of the granules in a fluidized bed dryer or a vacuum tray dryer;
- 20 - optionally dry screening of the granules through a screen in order to segregate cohesive particles and to improve content uniformity;
- blending the granules with remaining excipients such as lubricant(s) in a mixer in order to obtain the final composition.

c) a dry granulation process comprising the steps of

- 25 - blending the active ingredient amlodipine or a pharmaceutically acceptable salt thereof with either a portion of the filler(s), disintegrant(s), binder(s), flow control agent(s) and lubricant(s) or all the excipients in a mixer;
- compaction of the mixture on a suitable roller compactor;
- 30 - reducing the ribbons obtained in the previous step to small granules by suitable milling or sieving steps;

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- optionally blending the granules with remaining excipients in a mixer in order to obtain the final composition.
- (iii) compressing the first and second tablet layer composition from step (i) and (ii) on a suitable tablet press to form a bilayer tablet.

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To provide a first tablet layer composition an aqueous alkaline solution of telmisartan is prepared by dissolving the active ingredient in purified water with the help of one or more basic agents like sodium hydroxide and meglumine. Optionally, a solubilizer and/or a recrystallization retarder may be added. The dry matter content of the

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starting aqueous solution is generally 10 to 40 wt.%, preferably 20 to 30 wt.%. The aqueous solution is then spray-dried at room temperature or preferably at increased temperatures of, for instance, between 50 and 100°C in a co-current or countercurrent spray-drier at a spray pressure of, for instance, 1 to 4 bar. Generally speaking, the spray-drying conditions are preferably chosen in such a manner that a

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spray-dried granulate having a residual humidity of ≤ 5 wt.%, preferably ≤ 3.5 wt.%, is obtained in the separation cyclone. To that end, the outlet air temperature of the spray-drier is preferably kept at a value between about 80 and 90°C while the other process parameters such as spray pressure, spraying rate, inlet air temperature, etc. are adjusted accordingly.

20

The spray-dried granulate obtained is preferably a fine powder having the following particle size distribution:

d_{10} : $\leq 20 \mu\text{m}$, preferably $\leq 10 \mu\text{m}$

d_{50} : $\leq 80 \mu\text{m}$, preferably 20 to 55 μm

25

d_{90} : $\leq 350 \mu\text{m}$, preferably 50 to 150 μm

After spray-drying, the active ingredient telmisartan as well as the excipients contained in the spray-dried granulate are in a substantially amorphous state with no crystallinity being detectable. From a physical point of view, the spray-dried granulate

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is a solidified solution or glass having a glass transition temperature T_g of preferably $> 50^\circ\text{C}$, more preferably $> 80^\circ\text{C}$.

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Based on 100 parts by weight of active ingredient telmisartan, the spray-dried granulate preferably contains 5 to 200 parts by weight of basic agent and, optionally, solubilizer and/or crystallization retarder.

The water-soluble diluent is generally employed in an amount of 30 to 95 wt.%,

5 preferably 60 to 80 wt.%, based on the weight of the first tablet layer composition.

The lubricant is generally added to the premix in an amount of 0.1 to 5 wt.%, preferably 0.3 to 2 wt.%, based on the weight of the first tablet layer composition.

Mixing is carried out in two stages, i.e. in a first mixing step the spray-dried granulate and the diluent are admixed using, e.g., a high shear mixer or a free fall blender, and

10 in a second mixing step the lubricant is blended with the premix, preferably also under conditions of high shear. The method of the invention is however not limited to these mixing procedures and, generally, alternative mixing procedures may be employed in steps c), d), and also in the subsequent steps f) and g), such as, e.g., container mixing with intermediate screening.

15

To provide a second tablet layer composition comprising amlodipine, several different manufacturing methods can be used, for example the direct compression, wet granulation or roller compaction process.

20 The present invention is preferably directed to a method of manufacturing the second tablet layer composition of amlodipine by a direct compression process comprising the steps of

(1) producing a composition consisting of the active ingredient amlodipine or a
25 pharmaceutically acceptable salt thereof, one or more fillers like e.g. microcrystalline cellulose, dibasic calcium phosphate anhydrous or pregelatinized starch, a disintegrant like sodium starch glycolate or croscopovidone, a flow control agent like colloidal silicon dioxide and/or other excipients by mixing the components in a mixer;

30 (2) optionally dry screening the composition of step (1) through a screen in order to segregate cohesive particles and to improve content uniformity; and

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(3) mixing the composition of step (2) and remaining excipients such as the lubricant magnesium stearate in a mixer.

In case of wet granulation amlodipine or a pharmaceutically acceptable salt thereof is
5 premixed in a high shear granulator with suitable fillers such as microcrystalline
cellulose, lactose monohydrate or dibasic calcium phosphate anhydrous, and wet
binding agents such as hydroxypropylmethylcellulose or povidone, disintegrants such
as crospovidone and optionally other suitable excipients. Agglomeration of the
powder is promoted through the addition of the granulation liquid (for example
10 purified water or ethanol). After high shear granulation the granulate is wet screened
through an appropriate sieve and subsequently dried using a fluid bed dryer or a
vacuum tray dryer. The dried granules are optionally dry screened through an
appropriate sieve. After addition of the lubricant (for example magnesium stearate)
and/ or other excipients, the mixture is blended in a free fall blender or a high shear
15 mixer.

Alternative methods for wet granulation of active ingredient and excipients with the
granulation liquid are fluid bed granulation or one pot granulation.

20 In case of roller compaction, or in other words dry granulation, either a mixture of
amlodipine or a pharmaceutically acceptable salt thereof with a part of the excipients
used in the direct compression process, or the complete mixture containing all
excipients, is processed through a conventional roller compactor to form ribbons,
which are thereafter screened down to granules which are optionally mixed with other
25 excipients, like glidants, lubricants and antiadherents.

First and second tablet layer compositions as described above can be compressed
into bilayer tablets of the target tablet weight with appropriate size and crushing
strength, using an appropriate tablet press. Optional an appropriate external lubricant
30 spray system for the dies and punches can be used during manufacturing of tablets
in order to improve lubrication.

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For the production of bilayer tablets according to the present invention, the separate tablet layer compositions can be compressed in a bilayer tablet press, e.g. a rotary press in the bilayer tableting mode, in the manner described above. In order to avoid any cross-contamination between the tablet layers (which could lead to decomposition of amlodipine), any granulate residues have to be carefully removed during
5 tableting by intense suction of the die table within the tableting chamber.

A method described above can be used for the manufacture of a tablet according to the present invention to treat hypertension either alone or in combination with the
10 treatment or prevention of a condition selected from the group consisting of chronic stable angina, vasospastic angina, stroke, myocardial infarction, transient ischemic attack, congestive heart failure, cardiovascular disease, diabetes, insulin resistance, impaired glucose tolerance, pre-diabetes, type 2 diabetes mellitus, diabetic
15 nephropathy, metabolic syndrome (syndrome X), obesity, dyslipidemia, hypertriglyceridemia, elevated serum concentrations of C-reactive protein, elevated serum concentrations of lipoprotein(a), elevated serum concentration of homocysteine, elevated serum concentration of low-density lipoprotein (LDL)-
20 cholesterol, elevated serum concentration of lipoprotein-associated phospholipase (A2), reduced serum concentration of high density lipoprotein (HDL)-cholesterol, reduced serum concentration of HDL(2b)-cholesterol, reduced serum concentration of adiponectin, cognitive decline and dementia.

Particularly preferred is the additional treatment or prevention of chronic stable angina, vasospastic angina, stroke, myocardial infarction, congestive heart failure,
25 diabetes, dyslipidemia or dementia.

In order to further illustrate the present invention, the following non-limiting examples are given:

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Formulation Examples

Example 1: Telmisartan 80 mg / Amlodipine 10 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	80.000	16.667	
Sodium hydroxide	6.720	1.400	
Povidone	24.000	5.000	
Meglumine	24.000	5.000	
Sorbitol	337.280	70.267	
Magnesium stearate	8.000	1.667	
Purified water *	*	*	
Total Telmisartan-layer	480.000	100.000	
Amlodipine mesylate	12.800		6.400
Microcrystalline cellulose	100.000		50.000
Dibasic calcium phosphate	79.700		39.850
Sodium starch glycolate	6.000		3.000
Magnesium stearate	1.500		0.750
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	680.000		

* Volatile component, does not remain in final product

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Example 2: Telmisartan 80 mg / Amlodipine 5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	80.000	16.667	
Sodium hydroxide	6.720	1.400	
Povidone	24.000	5.000	
Meglumine	24.000	5.000	
Sorbitol	337.280	70.267	
Magnesium stearate	8.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	480.000	100.000	
Amlodipine besylate	6.944		3.472
Microcrystalline cellulose	100.000		50.000
Dibasic calcium phosphate	85.556		42.778
Sodium starch glycolate	6.000		3.000
Magnesium stearate	1.500		0.750
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	680.000		

* Volatile component, does not remain in final product

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Example 3: Telmisartan 80 mg / Amlodipine 2.5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	80.000	16.667	
Sodium hydroxide	6.720	1.400	
Povidone	24.000	5.000	
Meglumine	24.000	5.000	
Sorbitol	337.280	70.267	
Magnesium stearate	8.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	480.000	100.000	
Amlodipine mesylate	3.200		1.600
Microcrystalline cellulose	100.000		50.000
Dibasic calcium phosphate	89.300		44.650
Sodium starch glycolate	6.000		3.000
Magnesium stearate	1.500		0.750
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	680.000		

* Volatile component, does not remain in final product

Example 4: Telmisartan 40 mg / Amlodipine 10 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	16.667	
Sodium hydroxide	3.360	1.400	
Povidone	12.000	5.000	
Meglumine	12.000	5.000	
Sorbitol	168.640	70.267	
Magnesium stearate	4.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	240.000	100.000	
Amlodipine maleate	12.840		3.210
Microcrystalline cellulose	200.000		50.000
Pregelatinized starch	171.160		42.790
Sodium starch glycolate	12.000		3.000
Colloidal silicon dioxide	2.000		0.500
Magnesium stearate	2.000		0.500
Total Amlodipine-layer	400.000		100.000
Total 2-layer tablet	640.000		

* Volatile component, does not remain in final product

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Example 5: Telmisartan 40 mg / Amlodipine 5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	16.667	
Sodium hydroxide	3.360	1.400	
Povidone	12.000	5.000	
Meglumine	12.000	5.000	
Sorbitol	168.640	70.267	
Magnesium stearate	4.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	240.000	100.000	
Amlodipine maleate	6.420		3.210
Microcrystalline cellulose	100.000		50.000
Pregelatinized starch	85.580		42.790
Sodium starch glycolate	6.000		3.000
Colloidal silicon dioxide	1.000		0.500
Magnesium stearate	1.000		0.500
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	440.000		

* Volatile component, does not remain in final product

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Example 6: Telmisartan 40 mg / Amlodipine 2.5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	16.667	
Sodium hydroxide	3.360	1.400	
Povidone	12.000	5.000	
Meglumine	12.000	5.000	
Sorbitol	168.640	70.267	
Magnesium stearate	4.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	240.000	100.000	
Amlodipine maleate	3.210		3.210
Microcrystalline cellulose	50.000		50.000
Pregelatinized starch	42.790		42.790
Sodium starch glycolate	3.000		3.000
Colloidal silicon dioxide	0.500		0.500
Magnesium stearate	0.500		0.500
Total Amlodipine-layer	100.000		100.000
Total 2-layer tablet	340.000		

* Volatile component, does not remain in final product

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Example 7: Telmisartan 20 mg / Amlodipine 10 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	20.000	16.667	
Sodium hydroxide	1.680	1.400	
Povidone	6.000	5.000	
Meglumine	6.000	5.000	
Sorbitol	84.320	70.267	
Magnesium stearate	2.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	120.000	100.000	
Amlodipine maleate	12.840		6.420
Lactose monohydrate	100.000		50.000
Microcrystalline cellulose	74.160		37.080
Povidone	6.000		3.000
Crospovidone	5.000		2.500
Sodium stearyl fumarate	2.000		1.000
Purified water *	*		*
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	320.000		

* Volatile component, does not remain in final product

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Example 8: Telmisartan 20 mg / Amlodipine 5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	20.000	16.667	
Sodium hydroxide	1.680	1.400	
Povidone	6.000	5.000	
Meglumine	6.000	5.000	
Sorbitol	84.320	70.267	
Magnesium stearate	2.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	120.000	100.000	
Amlodipine maleate	6.420		3.210
Lactose monohydrate	100.000		50.000
Microcrystalline cellulose	80.580		40.290
Povidone	6.000		3.000
Crospovidone	5.000		2.500
Sodium stearyl fumarate	2.000		1.000
Purified water *	*		*
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	320.000		

* Volatile component, does not remain in final product

Example 9: Telmisartan 20 mg / Amlodipine 2.5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	20.000	16.667	
Sodium hydroxide	1.680	1.400	
Povidone	6.000	5.000	
Meglumine	6.000	5.000	
Sorbitol	84.320	70.267	
Magnesium stearate	2.000	1.667	
Purified water *	*	*	
Total Telmisartan -layer	120.000	100.000	
Amlodipine maleate	3.210		1.605
Lactose monohydrate	100.000		50.000
Microcrystalline cellulose	83.790		41.895
Povidone	6.000		3.000
Crospovidone	5.000		2.500
Sodium stearyl fumarate	2.000		1.000
Purified water *	*		*
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	320.000		

* Volatile component, does not remain in final product

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Example 10: Telmisartan 40 mg / Amlodipine 10 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	16.667	
Sodium hydroxide	3.360	1.400	
Povidone	12.000	5.000	
Meglumine	12.000	5.000	
Sorbitol	168.640	70.267	
Magnesium stearate	4.000	1.667	
Purified water *	*	*	
Total Telmisartan-layer	240.000	100.000	
Amlodipine maleate	12.840		3.210
Microcrystalline cellulose	212.000		53.000
Pregelatinized starch	169.160		42.290
Iron oxide yellow	2.000		0.500
Colloidal silicon dioxide	2.000		0.500
Magnesium stearate	2.000		0.500
Total Amlodipine-layer	400.000		100.000
Total 2-layer tablet	640.000		

* Volatile component, does not remain in final product

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Example 11: Telmisartan 40 mg / Amlodipine 5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	16.667	
Sodium hydroxide	3.360	1.400	
Povidone	12.000	5.000	
Meglumine	12.000	5.000	
Sorbitol	168.640	70.267	
Magnesium stearate	4.000	1.667	
Purified water *	*	*	
Total Telmisartan-layer	240.000	100.000	
Amlodipine besylate	6.944		3.472
Microcrystalline cellulose	120.000		60.000
Pregelatinized starch	70.056		35.028
Iron oxide red	1.000		0.500
Colloidal silicon dioxide	1.000		0.500
Magnesium stearate	1.000		0.500
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	440.000		

* Volatile component, does not remain in final product

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Example 12: Telmisartan 40 mg / Amlodipine 2.5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	16.667	
Sodium hydroxide	3.360	1.400	
Povidone	12.000	5.000	
Meglumine	12.000	5.000	
Sorbitol	168.640	70.267	
Magnesium stearate	4.000	1.667	
Purified water *	*	*	
Total Telmisartan-layer	240.000	100.000	
Amlodipine mesylate	3.200		1.600
Microcrystalline cellulose	120.000		60.000
Pregelatinized starch	73.300		36.650
Iron oxide red	0.500		0.250
Colloidal silicon dioxide	1.000		0.500
Magnesium stearate	2.000		1.000
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	440.000		

* Volatile component, does not remain in final product

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Example 13: Telmisartan 40 mg / Amlodipine 5 mg 2-layer tablets

Constituents	mg per tablet	% of Telmisartan- layer	% of Amlodipine- layer
Telmisartan	40.000	23.529	
Poloxamer	8.000	4.706	
Meglumine	40.000	23.529	
Mannitol	80.500	47.353	
Magnesium stearate	1.500	0.883	
Purified water *	*	*	
Total Telmisartan-layer	170.000	100.000	
Amlodipine maleate	6.420		3.210
Microcrystalline cellulose	100.000		50.000
Pregelatinized starch	91.580		45.790
Colloidal silicon dioxide	1.000		0.500
Magnesium stearate	1.000		0.500
Total Amlodipine-layer	200.000		100.000
Total 2-layer tablet	370.000		

* Volatile component, does not remain in final product

Claims

1. A pharmaceutical tablet comprising a first layer of telmisartan in a dissolving
5 tablet matrix and a second layer of amlodipine in a disintegrating or eroding
tablet matrix.
2. The tablet of claim 1, wherein telmisartan is in a substantially amorphous form.
3. The tablet of claim 1, wherein the dissolving tablet matrix has instant release
10 characteristics.
4. The tablet of claim 1, wherein the dissolving tablet matrix comprises a basic
agent, a water-soluble diluent and, optionally, other excipients and adjuvants.
- 15 5. The tablet of claim 4, wherein the basic agent is selected from alkali metal
hydroxides, basic amino acids and meglumine.
6. The tablet of claim 4, wherein the water-soluble diluent is selected from mono-
saccharides like glucose; oligosaccharides like sucrose and lactose; and sugar
20 alcohols like sorbitol, mannitol, and xylitol.
7. The tablet of claim 4, wherein the other excipients and adjuvants are selected
from binders, carriers, fillers, lubricants, flow control agents, crystallization
retarders, solubilizers, coloring agents, pH control agents, surfactants and
25 emulsifiers.
8. The tablet of claim 1, wherein the first tablet layer composition of telmisartan is
produced by spray-drying an aqueous solution comprising telmisartan and a
basic agent to obtain a spray-dried granulate, mixing said spray-dried granulate
30 with a water-soluble diluent to obtain a premix and mixing said premix with a
lubricant to obtain a final blend.

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9. The tablet of claim 1, wherein the disintegrating or eroding tablet matrix of the second layer comprises one or more fillers, a disintegrant, a lubricant and, optionally, a binder, a flow control agent or other excipients and adjuvants.
- 5 10. The tablet of claim 9, wherein the second tablet layer composition of amlodipine is manufactured by direct compression, wet granulation or a roller compaction process.
- 10 11. The tablet of claim 1, wherein the first layer contains 10-160 mg, preferably 20-80 mg or 40-80 mg telmisartan.
12. The tablet of claim 1, wherein the second layer contains 1-20 mg, preferably 2.5-10 mg amlodipine.
- 15 13. The tablet of claim 1 packaged in a moisture proof packaging material such as aluminium foil blister packs, or polypropylene tubes and HDPE bottles.
- 20 14. A method for the manufacture of a tablet of claim 1 to treat hypertension either alone or in combination with the treatment or prevention of a condition selected from the group consisting of chronic stable angina, vasospastic angina, stroke, myocardial infarction, transient ischemic attack, congestive heart failure, cardiovascular disease, diabetes, insulin resistance, impaired glucose tolerance, pre-diabetes, type 2 diabetes mellitus, diabetic nephropathy, metabolic syndrome (syndrome X), obesity, dyslipidemia, hypertriglyceridemia, elevated serum
- 25 concentrations of C-reactive protein, elevated serum concentrations of lipoprotein(a), elevated serum concentration of homocysteine, elevated serum concentration of low-density lipoprotein (LDL)-cholesterol, elevated serum concentration of lipoprotein-associated phospholipase (A2), reduced serum concentration of high density lipoprotein (HDL)-cholesterol, reduced serum
- 30 concentration of HDL(2b)-cholesterol, reduced serum concentration of adiponectin, cognitive decline and dementia.

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15. The method of claim 14 wherein the condition treated or prevented is chronic stable angina, vasospastic angina, stroke, myocardial infarction, congestive heart failure, diabetes, dyslipidemia or dementia.