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ORODISPERSIBLE PHARMACEUTICAL COMPOSITION OF IVABRADINE

The present invention relates to a solid orodispersible pharmaceutical form for the administration of ivabradine or a pharmaceutically acceptable salt thereof by the oral route, without the simultaneous drinking of a glass of water and without the problem of swallowing.

Ivabradine, or 3-(3-{[((7*S*)-3,4-dimethoxybicyclo[4,2,0]octa-1,3,5-trien-7-yl)methyl]-methylamino}propyl)-7,8-dimethoxy-1,3,4,5-tetrahydro-2*H*-3-benzazepin-2-one, is an exclusively bradycardic, sino-atrial regulator for use in the treatment of stable angina, heart failure and acute ischaemia.

The doses of ivabradine enabling the desired therapeutic effect to be obtained are generally of the order of from 1 mg to 20 mg, administered in the form of an immediate-release tablet.

Many people have difficulty in swallowing conventional tablets, the size of which is often not negligible. The problems associated with the ingestion of medicines (choking; suffocation as a result of obstruction of the throat) are often the cause of poor compliance with dosage regimens or, indeed, of discontinuation of treatment.

The pharmaceutical compositions of the present invention make it possible not only to solve the known problems of a tablet form that has to be swallowed but also to offer a superior medical service which especially allows the quality of life of patients to be improved.

The orodispersible pharmaceutical composition of ivabradine has the advantage that elevated plasma levels of active ingredient are obtained rapidly.

The orodispersible pharmaceutical composition according to the invention has the particular characteristic of requiring neither water nor chewing in the course of its

administration. It disintegrates very rapidly in the mouth, preferably in less than three minutes and even more preferably in less than one minute.

Many rapid-dissolution forms are described in the prior art. In general, it is common to the previously described technologies that they use a disintegrating agent such as Kollidon® CL (crosslinked polyvinylpyrrolidone), EXPLOTAB® (carboxymethyl starch) and AC DISOL® (crosslinked sodium carboxymethylcellulose).

That disintegrating agent is indispensable to the formulation of the orodispersible tablets and has to be used in conjunction with a direct-compression excipient. The difficulties encountered in the manufacture of such tablets reside in the fact that it is very difficult to obtain tablets having physical characteristics that are constant and reproducible and compatible with the customary handling requirements of tablets.

However, the customarily used mixtures result in tablets of very considerable hardness which is completely unsuitable for rapid disintegration in the oral cavity.

Other orodispersible forms can be produced by using lyophilisation, resulting in very porous solid forms called "oral lyophilisates". Those forms require the use of a highly specific and complicated industrial process which is lengthy to carry out, yielding a medicament form which has a high cost price.

The present invention enables those problems to be solved. It relates to a solid orodispersible form of ivabradine comprising a single excipient of natural origin which allows rapid disintegration and which has a neutral flavour and agreeable texture. The said excipient acts both as binder and as disintegrant. It allows a simple ivabradine formulation to be obtained, having excellent suitability for direct compression, resulting in tablets of low friability and of a hardness that is compatible with customary handling methods.

More specifically, the invention relates to a solid orodispersible pharmaceutical composition of ivabradine or a pharmaceutically acceptable salt thereof, characterised in that it comprises :

- ivabradine or a pharmaceutically acceptable salt thereof,
- and granules consisting of co-dried lactose and starch.

The composition according to the invention may also comprise, for reasons of tablet manufacture, one or more lubricants and a flow agent, as well as flavourings, colourings and sweetening agents as conventionally used.

In the pharmaceutical compositions according to the invention, the ivabradine is preferably in its hydrochloride form.

The invention relates also to the use of granules consisting of co-dried lactose and starch in the manufacture of solid orodispersible pharmaceutical compositions of ivabradine.

The term "orodispersible" is understood to refer to solid pharmaceutical compositions which disintegrate in the oral cavity in less than 3 minutes, preferably less than one minute.

The said granules present in the solid pharmaceutical compositions according to the invention correspond to the compositions described in Patent Application EP 00/402159.8. Those granules are characterised by a spherical structure and an advantageous compressibility and are marketed under the name STARLAC®.

The disintegrating properties of the said granules are known for tablets placed in large volumes of stirred liquids. It is especially surprising that, when used in the manufacture of orodispersible forms, the said granules should give especially satisfactory results in terms of disintegration in the mouth, for two reasons.

The first reason is based on the finding that the least water-soluble excipients are the most suitable for the formulation of orodispersible tablets (dissolution, in bringing about an increase in the viscosity of water, slows down its penetration into the tablets) and yet the said granules contain a large amount of highly water-soluble lactose. Moreover, the starch contained in the said granules is not a "super-disintegrant" agent as used and described in the orodispersible forms of the prior art.

The second is based on the finding that the disintegrant properties of an excipient (used in a tablet), when determined in water using conventional methods, cannot be extrapolated to the behaviour of the same tablet *in vivo*, in saliva. Disintegration rates in water are measured (in accordance with the European Pharmacopoeia) in an amount of water that is sufficiently large not to reach saturation level in terms of dissolution, whereas *in vivo*, by virtue of the small volume of saliva, the excipients are at saturation level. Furthermore, the stirring to which the tablets are subjected in the customary test does not reflect disintegration in the mouth. The Applicant accordingly found, during comparative tests, that certain excipients which are known as good disintegrants are not suitable for the preparation of orodispersible forms. Conversely, certain excipients that exhibit average disintegration in water may exhibit advantageous properties *in vivo*.

The Applicant then found, surprisingly, that the said granules rendered the tablets highly suitable for disintegration in the mouth, that being the case over a wide tablet hardness range, whilst maintaining a low level of friability, which is especially remarkable. Most orodispersible forms of the prior art which disintegrate rapidly in the mouth are highly friable, which is reflected by the need to use a specific packaging and the risk of the tablet disintegrating as soon as it is handled and taken out of its pack.

It is especially remarkable that the above-mentioned criteria of orodispersibility and low friability are maintained over a wide tablet hardness range, that is to say for tablets having a hardness of from 15 to 30 Newtons.

The pharmaceutical compositions according to the invention are preferably characterised in that they comprise, in relation to the total weight of the tablet:

- from 5 % to 20 % by weight of ivabradine or a pharmaceutically acceptable salt thereof, even more preferably from 7.5 % to 10 %,
- from 75 % to 94 % by weight of STARLAC®.

They may optionally comprise from 0.1 % to 3 % by weight of lubricating agents such as magnesium stearate or sodium stearyl fumarate, preferably from 0.5 % to 1.5 %, and from 0.1 % to 3 % by weight of a flow agent such as colloidal silica, preferably from 0.5 % to 1.5 %.

The following Examples illustrate the invention without limiting it in any way:

Orodispersible ivabradine tablets

EXAMPLE 1 :

Formulation : Finished tablet of 100 mg

Constituents	*Amount (mg)*
Ivabradine hydrochloride	7.5
Starlac®	91.5
Magnesium stearate	0.5
Anhydrous colloidal silica	0.5

EXAMPLE 2 :

Formulation : Finished tablet of 100 mg

Constituents	*Amount (mg)*
Ivabradine hydrochloride	10
Starlac®	88.5
Sodium stearyl fumarate	1
Anhydrous colloidal silica	0.5

The tablets are prepared by mixing the constituents, followed by direct compression. The hardness of the tablets of Examples 1 and 2 is about 20 Newtons.

In order to determine the disintegration time in the mouth, the orodispersible ivabradine tablets described in Examples 1 and 2 were placed in the mouth. In these

tests it was found that, for each of the formulations tested, the disintegration time in the mouth was less than 1 minute.

CLAIMS

1- Solid orodispersible pharmaceutical composition of ivabradine, or pharmaceutically acceptable salts thereof, characterised in that it comprises:
- ivabradine or a pharmaceutically acceptable salt thereof,
- granules consisting of co-dried lactose and starch.

2- Pharmaceutical composition according to claim 1, characterised in that it comprises, in relation to the total weight of the composition :
- from 5 % to 20 % by weight of ivabradine or a pharmaceutically acceptable salt thereof,
- from 75 % to 94 % by weight of granules consisting of co-dried lactose and starch.

3- Pharmaceutical composition according to claim 2, characterised in that it comprises from 7.5 % to 10 % by weight of ivabradine or a pharmaceutically acceptable salt thereof.

4- Pharmaceutical composition according to claim 1, characterised in that it also comprises one or more lubricants and a flow agent.

5- Pharmaceutical composition according to claim 1, characterised in that it is in the form of a tablet.

6- Tablet according to claim 5, characterised in that it is obtained by direct compression.

7- Tablet according to claim 6, characterised in that its hardness is from 15 to 50 Newtons.

8- Tablet according to claim 7, characterised in that its hardness is about 20 Newtons.

9- Use of granules consisting of co-dried lactose and starch in the manufacture of solid orodispersible compositions of ivabradine, or pharmaceutically acceptable salts thereof, which disintegrate in the mouth in less than three minutes, preferably less than one minute.

10- Solid orodispersible pharmaceutical composition of ivabradine or a pharmaceutically acceptable salt thereof, according to claim 1, for use in the treatment of stable angina, heart failure and acute ischaemia.