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(54) Title: SOLID STATE FORMS OF VILAZODONE AND VILAZODONE HYDROCHLORIDE

(57) Abstract: The present invention provides solid state forms of Vilazodone and Vilazodone hydrochloride, processes for prepar-

SOLID STATE FORMS OF VILAZODONE AND VILAZODONE HYDROCHLORIDE

CROSS REFERENCE TO RELATED APPLICATIONS

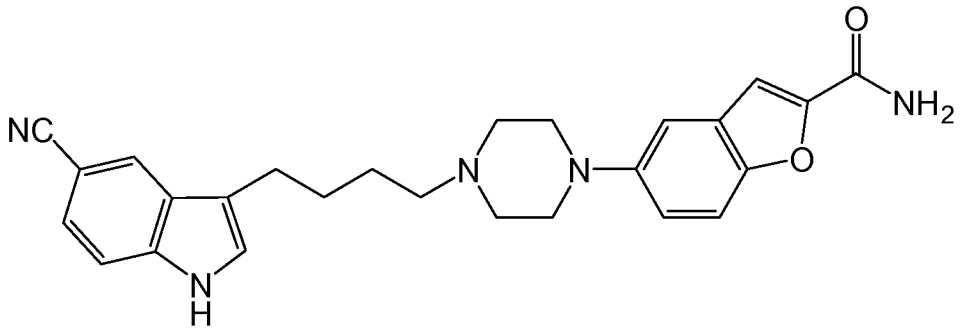
[0001] The present invention claims the benefit of the following United States Provisional Patent Application Nos.: 61/563,150, filed November 23, 2011; 61/583,368, filed January 5, 2012; 61/584,499, filed January 9, 2012; 61/590,412, filed January 25, 2012; 61/637,416, filed April 24, 2012; 61/651,221, filed May 24, 2012; 61/653,778, filed May 31, 2012; 61/670,895, filed July 12, 2012; and 61/717,351, filed October 23, 2012. The contents of these applications are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The invention relates to solid state forms of Vilazodone and Vilazodone hydrochloride, processes for preparing these solid state forms, and pharmaceutical compositions comprising one or more of these solid state forms.

BACKGROUND OF THE INVENTION

[0003] Vilazodone, 5-(4-[4-(5-cyano-1*H*-indol-3-yl)butyl]piperazin-1-yl)benzofuran-2-carboxamide, has the following chemical structure:



[0004] Vilazodone (HCl salt marketed as VIIBRYD) is an SSRI antidepressant (selective serotonin reuptake inhibitor and a $5HT_{1A}$ receptor partial antagonist) developed for the treatment of major depressive disorder. The compound was originally developed by Merck KGaA, Germany, and is now owned by Forest Laboratories Inc, USA.

[0005] A synthesis of Vilazodone is described in US Patent No. US 5,532,241.

[0006] Certain crystalline forms of Vilazodone hydrochloride, and of Vilazodone dihydrochloride are described in the PCT Publication No. WO2002102794.

[0007] Polymorphism, the occurrence of different crystal forms, is a property of some molecules and molecular complexes. A single compound may give rise to a variety of polymorphs having distinct crystal structures and physical properties like melting point, thermal behaviors (e.g., measured by thermogravimetric analysis – "TGA", or differential scanning calorimetry – "DSC"), powder X-ray diffraction (XRD) pattern, infrared absorption fingerprint, and solid state NMR spectrum. One or more of these techniques may be used to characterize a particular polymorph and to distinguish different polymorphic forms of a compound.

[0008] Discovering new polymorphic forms (including new solvates) of a pharmaceutical product can provide materials having, *inter alia*, desirable processing properties, such as ease of handling, ease of processing, chemical and polymorphic stability upon storage and processing, and ease of purification, or are useful as intermediate crystal forms that facilitate conversion to other polymorphic forms or salts of a pharmaceutical compound. New polymorphic forms and solvates of a pharmaceutically useful compound or salts thereof can also provide opportunities to improve the performance characteristics of a pharmaceutical product. They can also enlarge the repertoire of materials available to a formulation scientist for formulation optimization, for example by providing a product with different properties, e.g., better processing or handling characteristics, improved dissolution profile, or improved shelf-life. Lastly, new polymorphic forms may be prepared with improved reliability and reproducibility compared to other forms, for example in terms of crystallinity or polymorphic purity. For at least these reasons, there is a need for additional polymorphs of Vilazodone and its hydrochloride salt.

SUMMARY OF THE INVENTION

[0009] The present invention provides new solid state forms of Vilazodone. These solid state forms can *inter alia* be used to prepare salts, particularly Vilazodone hydrochloride, solid state forms of those salts and pharmaceutical compositions and formulations thereof.

[0010] The present invention also provides new solid state forms of Vilazodone hydrochloride. These solid state forms can be used to prepare pharmaceutical compositions

and formulations thereof, or they can be used to prepare Vilazodone free base and/or other salts of Vilazodone and/or formulations thereof.

[0011] The invention further provides the solid state forms of Vilazodone and of Vilazodone hydrochloride as described herein for use in the manufacture of a medicament, preferably for the treatment of major depressive disorders; and provides a method of treating major depressive disorders, said method comprising administering a therapeutically effective dose of one or more of the solid state forms described herein.

BRIEF DESCRIPTION OF THE FIGURES

[0012] Figure 1 provides a powder XRD pattern of crystalline Form A of Vilazodone.

[0013] Figure 2 provides a DSC thermogram of crystalline Form A of Vilazodone.

[0014] Figure 3 provides a powder XRD pattern of crystalline Form B of Vilazodone.

[0015] Figure 4 provides a DSC thermogram of crystalline Form B of Vilazodone.

[0016] Figure 5 provides a powder XRD pattern of crystalline Form C of Vilazodone.

[0017] Figure 6 provides a DSC thermogram of crystalline Form C of Vilazodone.

[0018] Figure 7 provides a powder XRD pattern of crystalline Form D of Vilazodone.

[0019] Figure 8 provides a DSC thermogram of crystalline Form D of Vilazodone.

[0020] Figure 9 provides a powder XRD pattern of crystalline Form E of Vilazodone.

[0021] Figure 10 provides a DSC thermogram of crystalline Form E of Vilazodone.

[0022] Figure 11 provides a powder XRD pattern of crystalline Form F of Vilazodone.

[0023] Figure 12 provides a DSC thermogram of crystalline Form F of Vilazodone.

[0024] Figure 13 provides a powder XRD pattern of crystalline Form G of Vilazodone.

[0025] Figure 14 provides a powder XRD pattern of crystalline Form H of Vilazodone.

[0026] Figure 15 provides a powder XRD pattern of crystalline Form I of Vilazodone.

[0027] Figure 16 provides a powder XRD pattern of amorphous Vilazodone.

[0028] Figure 17 provides a DSC thermogram of amorphous Vilazodone.

[0029] Figure 18 provides a powder XRD pattern of amorphous Vilazodone.

[0030] Figure 19 provides a DSC thermogram of amorphous Vilazodone.

[0031] Figure 20 provides a powder XRD pattern of crystalline Form E1 of Vilazodone.

[0032] Figure 21 provides a DSC thermogram of crystalline Form E1 of Vilazodone.

[0033] Figure 22 provides a powder XRD pattern of crystalline Form A1 of Vilazodone.

[0034] Figure 23 provides a DSC thermogram of crystalline Form A1 of Vilazodone.

[0035] Figure 24 provides a powder XRD pattern of crystalline Form Alpha of Vilazodone hydrochloride.

[0036] Figure 25 provides a DSC thermogram of crystalline Form Alpha of Vilazodone hydrochloride.

[0037] Figure 26 provides a powder XRD pattern of crystalline Form Beta of Vilazodone hydrochloride.

[0038] Figure 27 provides a DSC thermogram of crystalline Form Beta of Vilazodone hydrochloride.

[0039] Figure 28 provides a powder XRD pattern of crystalline Form Gamma of Vilazodone hydrochloride.

[0040] Figure 29 provides a DSC thermogram of crystalline Form Gamma of Vilazodone Hydrochloride.

[0041] Figure 30 provides a powder XRD pattern of crystalline Form Delta of Vilazodone hydrochloride.

[0042] Figure 31 provides a DSC thermogram of crystalline Form Delta of Vilazodone hydrochloride.

[0043] Figure 32 provides a powder XRD pattern of crystalline Form Epsilon of Vilazodone hydrochloride.

[0044] Figure 33 provides a DSC thermogram of crystalline Form Epsilon of Vilazodone hydrochloride.

[0045] Figure 34 provides a powder XRD pattern of crystalline Form Eta of Vilazodone hydrochloride.

[0046] Figure 35 provides a DSC thermogram of crystalline Form Eta of Vilazodone hydrochloride.

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