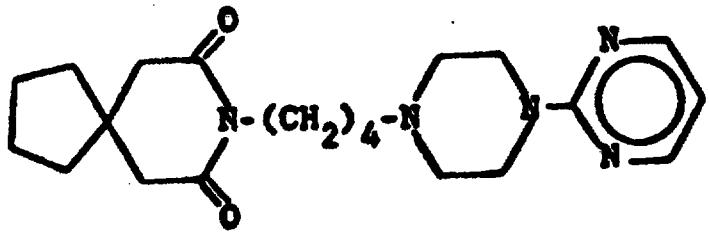
Description

This invention relates to a process for converting the lower melting polymorphic crystalline form of buspirone hydrochloride into the higher melting form thereof.

The psychotropic compound with which the present invention is concerned has the following structural formula:



and is known as buspirone. The hydrochloride salt has been referred to in the prior art as MJ 9022-1 end as buspirone hydrochloride. Other acid addition salts thereof are named by combining "buspirone" with the appropriate word to define the acid from which it is prepared as in "buspirone hydrochloride". The latter is the United States Adopted Name (USAN); refer to J. American Med. Assoc. 225, 520 (1973). Buspirone is currently approved for marketing as an effective clinical anti-anxiety agent.

The synthesis of the compound and the disclosure of its psychotropic properties are described in the following representative patents and publications.

1. Y. H. Wu. et al., J. Med. Chem., 15.477 (1972).
2. Y. H. Wu, et al., U. S. Pat. No. 3.717.634 which issued Feb. 20, 1973.
3. L. E. Allen et al., Arzneium. Forsch., 24. No. 6 917-922 (1974).
4. G. L. Sathananthan, et al., Current Therapeutic Research. 18/5, 701-705 (1975).
5. Y. H. Wu. et al., U. S. Pat. No. 3,976,776, issued Aug. 24, 1976.
6. J. C. Simms. U. S. Pat. No. 4,351,939, issued Sept. 28, 1982.

The melting point disclosed for buspirone hydrochloride in the above-listed references is 201.5 to 202.5 °C. No other melting point values outside a range of 201 to 205 ° for pure buspirone hydrochloride has been previously disclosed. As one aspect of the instant invention it has been discovered that solid buspirone hydrochloride can exist in two different crystalline phases. The capacity to occur in different crystal structures is known as polymorphism and is known to occur in many organic compounds including drugs. These different crystalline forms are known as "polymorphic modifications" or "polymorphs" and are realized only in the crystalline state. While polymorphic modifications have the same chemical composition, they differ in packing, geometrical arrangement, and other descriptive properties of the crystalline solid state. As such, these modifications may have different solid-state physical properties such as shape, color, density, hardness, deformability, stability, dissolution properties, and the like. Polymorphism of an organic drug molecule and its consequences would be appreciated by one skilled in the pharmaceutical arts.

In the manufacture of pharmaceutical supplies of buspirone hydrochloride, certain specified criteria, such as the melting point for example, defining physical characterization and purity of the pure drug substance must be met before it can be incorporated into pharmaceutical compositions for medicinal purposes. Satisfying these criteria is one requirement of the approvability process allowing continued distribution of drug product under good manufacturing procedure guidelines and regulations set forth by governmental agencies such as the Food and Drug Agency (FDA) in the U. S. Compliance with governmental regulations for drug manufacture requires meeting the requisite drug substance specifications as well as keeping related records and other quality assurance procedures for each batch of drug substance to be put into the pharmaceutical product manufacturing process. These requirements are required of every drug manufacturer for every drug falling under purview of the FDA or other appropriate governmental drug agency.

In the course of preparing larger batch lots of buspirone hydrochloride, a problem was experienced in meeting the specified melting point criterion. Closer examination led to the unexpected discovery of a second polymorphic modification of buspirone hydrochloride. This second polymorphic modification displays a melting point of about 188 ° as compared with the melting point of about 202 to 204 ° for the originally discovered polymorphic form. Since the extensive, expensive and time-consuming clinical studies required for drug approval were done with the original polymorph (designated P203), the specifications for

drug substance are for this polymorph in the approved New Drug Application (NDA) of buspirone. However, increasing difficulty was experienced in continued preparation of P203 and, to add further complication, some batches of P203 underwent partial conversion to P188 during storage.

It is therefore an object of this invention to be able to provide a reliable process whereby P203 can be conveniently and reproducibly prepared from P188 or a mixture of P188 and P203.

SUMMARY OF THE INVENTION

It has been found that buspirone hydrochloride can exist in two distinct polymorphic forms and when crystallized under equilibrium conditions at temperatures above about 95 °C, the higher melting polymorphic modification is obtained and when crystallization proceeds under equilibrium conditions at temperatures below about 95 °C, the lower melting polymorphic modification is obtained. It has also been found that the lower melting polymorph is the thermodynamically-favored form at pharmaceutically relevant temperatures. As a result of these discoveries, processes have been developed for the reliable production of either polymorphic modification of buspirone hydrochloride.

Research carried out to investigate solid state behavior of the useful anxiolytic drug, buspirone hydrochloride, has resulted in the discovery that it can exist in the solid state in the form of two polymorphic modifications. Further it was discovered that the two polymorphic modifications of solid buspirone hydrochloride could exist in equilibrium with each other at a transition temperature of about 95 °C and that the lower-melting polymorph, P188, was thermodynamically favored at temperatures below and the higher-melting polymorph, P203 was favored at temperatures above this transition temperature. These discoveries have led to the development of useful, reliable processes which enable one to produce whichever polymorph one desires.

Previous methods of crystallization of buspirone hydrochloride generally employed alcoholic solvents, usually ethanol or isopropanol, and temperatures below 95 °C. Under conditions of these methods, solid crystalline buspirone hydrochloride was forced from solution by chilling and the liberal use of P203 seed crystals. These conditions are understood to favor kinetic, or rate, control of product crystals and the high melting polymorph was usually produced with such methodology. It turned out that use of such kinetic-controlled methods, where rate of crystallization favored the P203 polymorph, became less and less reliable and the resultant crystalline product was usually contaminated with the P188 polymorph. The problem that this other polymorph contamination causes is that an entire batch or lot of drug substance now does not meet the required physical specifications for incorporation into pharmaceutical products and must be reworked. It is to be appreciated that considerable time and expense is involved in reworking large lots of buspirone hydrochloride in order to meet FDA specifications.

One aspect then of this invention is a process which reliably converts either one or a mixture of the two buspirone hydrochloride polymorphs into the other polymorph. In its most general form this process comprises the steps of:

a) disrupting the crystalline structure of solid buspirone hydrochloride containing the lower melting polymorphic form or a mixture of the two starting polymorphic forms of buspirone hydrochloride; and

b) allowing recrystallization to occur under equilibrium conditions at a temperature higher than about 95 °C.

Disruption of the crystalline structure encompasses processes ranging from crystal structure relaxation due to application of heat, to dissolution of the solid crystal by a suitable solvent, a combination of heat and dissolution, and even sublimation processes. Dissolution need only be partial, and in fact polymorph conversion can proceed under certain conditions of high humidity. In these humidity promoted polymorphic conversions, moisture-mediated dissolution crystallization equilibrium is established and sorption processes, in particular capillary condensation, come into play. The strong influence of humidity on some polymorphic transformations is discussed by Ramberger, et al., Ber. Bunsenges. Phys. Chem. 84, 1261-1264 (1980).

Similarly, polymorphic conversions can be accomplished in solvents in which buspirone hydrochloride has only low solubility even at elevated temperatures. In these instances, usually selected for obtaining P203, the solid is heated above the transition temperature until conversion is complete and then the mixture is allowed to cool and the desired polymorph is isolated with negligible contamination.

Preferred processes of this invention are carried out in a liquid medium with agitation. The process temperature is suitably selected and the liquid medium selected is generally one in which buspirone hydrochloride has some solubility. A preferred process involves the following steps:

a) disrupting the crystal structure of solid buspirone hydrochloride by dissolution by the liquid medium;

b) allowing recrystallization to occur in a selected temperature range above 95 °C;

c) agitating the solid buspirone hydrochloride: liquid medium mixture for a time sufficient to obtain solid/solution equilibrium in the mixture; and

d) separating the desired crystalline polymorph from the liquid component of the mixture.

Disruption of the crystalline structure of solid buspirone hydrochloride by dissolution of the liquid medium encompasses a range of dissolution processes from complete dissolution to only slight dissolution. Degree of dissolution can be modified by selection of the appropriate liquid media and/or by selection of process temperature within the specified allowable temperature range. Recrystallization temperatures are selected ranging above a temperature of about 95 °C. The agitation of the process mixture is carried out in the same temperature range as for the recrystallization and continues until solid/solution equilibrium has been established. The establishment of equilibrium conditions is required for these thermal processes so that thermodynamic selection of the favored polymorph dominates. The intended crystalline polymorph is then isolated, preferably by simple filtration. While filtration of the P203 polymorph is often carried out at temperatures above the 95° transition temperature, in those cases where buspirone hydrochloride's solubility in the selected liquid media is very low, cooling the mixture to room temperature prior to filtration results in negligible contamination by the P188 polymorph.

The preferred process comprises the steps of:

a) disrupting the crystal structure of solid buspirone hydrochloride by dissolution in a suitable liquid medium;

b) allowing recrystallization to occur while the temperature is kept above about 95 °C;

c) while maintaining the temperature above about 95 °C, the solid buspirone hydrochloride: liquid medium mixture is agitated for a period of time sufficient to obtain solid/solution equilibrium; and

d) separating the desired high-melting polymorph from the liquid component of the mixture.

In actual practice, a solvent or solvent mixture is selected in which buspirone hydrochloride has only slight solubility below about 100 °C. In these instances the solid product is composed of P203 with only negligible amounts of P188 present. This permits isolation of the solid product more conveniently at room temperature.

Certain preferred processes are those in which steps a), b), and c) are combined so that the solid buspirone hydrochloride is continuously undergoing liquid medium mediated dissolution-crystallization processes at the selected temperatures until the solid buspirone hydrochloride is constituted entirely of the desired polymorph. This crystalline product is then isolated according to step d). For these preferred processes most of the buspirone hydrochloride is suspended in the liquid medium as a solid with only minor amounts in solution. As would be expected, conversions to P203 are best carried out in liquid media comprised of higher boiling solvents or their mixtures such as xylene, butanol, xylene/cyclohexanone, nonane/cyclohexanone, and the like. The preferred range of temperatures for production of P203 is about 118 to 155 °C. Identification and semi-quantification of the polymorphs utilize micro-methods such as thermomicroscopy, infrared spectroscopy and thermal analysis, especially differential scanning calorimetry (DSC) which was particularly useful in investigating the polymorphic forms and their transformations according to the instant invention.

In essence, the polymorph production processes developed for buspirone hydrochloride are intended to encompass any and all thermal processes which rely on thermodynamic selection of the polymorph above the transition temperature. Choice of temperatures and conversion media will affect the rates of conversion. Disclosure of these processes will be extended by reference to the specific examples which can be found hereinbelow appearing before the claims.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS.

Polymorphic modifications and the processes for their preparation and interconversion which constitute this invention will appear more fully from a consideration of the following examples which are given for the purpose of illustration only and are not to be construed as limiting invention in sphere or scope. All temperatures are understood to be in degrees C when not specified. In addition to the elemental analysis data which are given spectra of the product polymorphs were consistent with the assigned buspirone hydrochloride structure.

A. Preparation of P203 Buspirone Hydrochloride

Example 1

8-[4-[4-(2-Pyrimidinyl)-1-piperazinyl]butyl]-8-azaspiro[4.5] decane-7,9-dione Hydrochloride, Buspirone HCl, Conversion of P188 polymorph to P203 polymorph in xylene.

To a 50 mL portion of xylene heated to reflux (138-139 • C) was added 10 g (0.024 mol) of buspirone HCl low melting polymorph P188. It should be understood that mixtures of P188 and P203 may also be employed in this and any of the following examples. The suspension was stirred at 138 • C for 17 hours, then cooled spontaneously to 25 • C (see Note 1). The crystalline solid was collected on a filter and dried under reduced pressure, weight 7.5 g, m.p. 199-200 • C (uncorr).

Anal. Calc'd. for $C_{12}H_{31}N_5O_2 \cdot HCl$			
C,59.77;	H,7.65;	N,16.60;	Cl,8.40
C,59.56;	H,7.39;	N,16.56;	Cl,8.09

The IR (KBr) and NMR ($CDCl_3$) spectra were consistent with structure.
DSC 10.68 mg sample, 10 deg/min, onset 202.89 • C.

Example 2

Buspirone HCl P188 to P203 Conversion in Xylene/cyclohexanone

A suspension of 5 g (0.0118 mol) of buspirone HCl P188 polymorph in 25 mL of xylene was heated to 138 • C under a nitrogen atmosphere. To this suspension was added 15 ml of cyclohexanone giving a clear solution. The heat was removed and the solution allowed to cool spontaneously. At 120 • C. the solution became cloudy and crystallization occurred at 115 • C After cooling to 24.5 • C, the solid was collected on a filter, washed with anhydrous ether, and dried under reduced pressure at 50 • C The high melting polymorph (P203) weighed 3.6 g. mp 201-202 • C

Anal. Calc'd. for $C_{21}H_{31}N_5O_2 \cdot HCl$			
C,59.77;	H,7.65;	N,16.60;	Cl,8.40
C,59.42;	H,7.39;	N,16.48;	Cl,8.34

IR (KBr) and NMR ($CDCl_3$) spectra were consistent with structure.
DSC, 1.45 mg sample, 10 deg/min, onset 201.3 • C.

Example 3

Buspirone HCl P188 to P203 Polymorph Conversion in Cyclohexanone/xylene.

In a 250 mL 3-necked round bottom flask fitted with a condenser, thermometer, magnetic stirrer, and nitrogen inlet tube were placed 50 mL of cyclohexanone. The solvent was heated to 155 • C and 5 g (0.0118 mol) of buspirone HCl low melting polymorph P188 was added which promptly dissolved. A stream of nitrogen gas was bubbled through the solution throughout the procedure. To this solution was added 125 mL of xylene, and the clear solution was stirred and allowed to cool slowly from 155 • C and crystallization occurred as the temperature dropped to 100 •. The suspension was allowed to cool to room temperature overnight and then the white solid was collected on a filter, washed with anhydrous ether, and dried in a vacuum oven at 50 • C, giving 4 g P203 polymorph, m.p. 202-204 • C.

Note 1: In this example and others, the very limited solubility of buspirone hydrochloride in the selected solvent system results in crystallization of essentially all the product isolable from the liquid media at temperatures above the 95° transition temperature. This allows isolation of the solid product to be done under the much more convenient conditions of room temperature with only negligible contamination by the P188 polymorph.

Anal. Calc'd. for $C_{21}H_{31}N_5O_2 \cdot HCl$			
C,59.77; C,59.85:	H,7.65; H,7.55;	N,16.60; N,16.63;	Cl,8.40 Cl,8.29

IR (KBr) and NMR ($CDCl_3$) spectra were consistent with structure.
DSC, 1.62 mg sample, 10 deg/min, onset 202.1 °C.

Example 4

Buspirone HCl P188 to P203 Conversion in Nonane/Cyclohexanone

A suspension of 5 g (0.0118 mol) of buspirone HCl P188 polymorph in 25 mL of nonane was heated to reflux under a nitrogen atmosphere. To this suspension was added 40 mL of cyclohexanone giving a clear solution. The heat was removed, and the contents of the flask allowed to cool to 24 °C. At 112-117 °C crystals formed, and the resulting suspension was allowed to stir and cool to room temperature The solid was collected on a filter, washed with several portions of anhydrous ether, and dried under reduced pressure at 50 °C giving 4.7 g of buspirone HCl P203 polymorph, m.p. 201-203 °C.

Anal. Calc'd. for $C_{21}H_{31}N_5O_2 \cdot HCl$			
C,59.77; C,59.44:	H,7.65; H,7.68;	N,16.60; N,16.48;	Cl,8.40. Cl,8.41

IR (KBr) and NMR ($CDCl_3$) spectra were consistent with structure.
DSC, 1.63 mg sample, 10 deg/min, onset, 201.4 °C

Example 5

Buspirone HCl P188 to P203 Conversion in 1-Butanol

A 5 g sample of buspirone HCl P188 polymorph was dissolved in 25 mL of hot 1-butanol (bp 118°) and heated at reflux under nitrogen for 1 hr. The heat was removed and the solution allowed to slowly cool and crystallize. The mixture was allowed to reach room temperature whereupon the white crystalline solid was collected on a filter, washed with several portions of dry ether, and dried under reduced pressure at 50 °C. giving 3.9 g buspirone HCl P203 polymorph, m.p. 201-203 °C.

Anal. Calc'd. for $C_{21}H_{31}N_5O_2 \cdot HCl$			
C,59.77; C,59.69;	H,7.65; H,7.74;	N,16.60; N,16.87,	Cl,8.40. Cl,8.52.

IR (KBr) and NMR ($CDCl_3$) spectra were consistent with structure.
DSC, 4.88 mg sample. 10 deg/min, onset, 203.3 °C.

Example 6

Larger-Scale Preparation of P203 Buspirone Hydrochloride

To a 12-L, 4-necked round flask fitted with reflux condenser, stainless steel stirring shaft and paddle, thermometer, and nitrogen inlet tube extending below the surface of the solvent, were added 2500 mL of xylene and 500 g (1.185 moles) of buspirone HCl (Note 1). The suspension was heated to reflux while nitrogen gas was bubbled through the solution. When the pot temperature reached 137 °C, 1500 mL of cyclohexanone was added in a thin stream (Note 2). The suspension was heated at reflux until a clear solution was obtained and no buspirone HCl remained on the walls or top of the flask. (Note 3). The heat was removed and the contents of the flask allowed to cool spontaneously. After 20 minutes, the contents of the flask cooled to 114° and crystals began to form. At 110 °C, crystallization was very rapid and the

mixture became thick (Note 4). The suspension was allowed to cool overnight under nitrogen atmosphere and the high melting polymorph collected on a filter, washed with 500 mL of xylene followed by 3 x 200 mL portions of ethyl ether. After drying in a vacuum oven to constant weight at 60 °C, the buspirone HCl P203 polymorph weighed 476.5 g (95.3% recovery) m.p. 201-202 °C. DSC 10 °/min.,onset 199.7 °C.

Anal. Calcd. for $C_{21}H_{31}N_5O_2 \cdot HCl$:				
Found:	C,59.77; C,59.63;	H,7.65; H,7.59;	N,16.60; N,16.45;	Cl,8.40 Cl,8.40

Infrared and NMR spectra were consistent with structure.

Notes:

1. Either P188 or a mixture of the polymorphs may be used as starting material.
2. The pot temperature dropped to 130 ° during this addition.
3. A clear solution was obtained in 20-30 minutes at 136-137 °C.
4. A sample was taken and dried for melting point determination. When the melting point capillary was dropped into a melting point bath heated to 190 °C, no melting occurred. This indicated complete conversion to high melting polymorph which was confirmed by differential scanning calorimetry.

Claims

1. A process for converting the lower melting polymorphic crystalline form of buspirone hydrochloride into the higher melting form thereof comprising
   a) disrupting the crystalline structure of solid buspirone hydrochloride containing the lower melting polymorphic crystalline form or a mixture of the lower and higher melting crystalline form of buspirone hydrochloride, and
   b) allowing recrystallization to occur at a temperature higher than about 95 °C.

2. The process of Claim 1 comprising
   a) disrupting the crystalline structure of said solid buspirone hydrochloride by dissolution in a liquid medium;
   b) allowing recrystallization to occur at a temperature higher than about 95 °C; and
   c) separating the higher melting polymorphic crystalline form from the liquid medium.

3. A process for preparing the higher melting polymorphic crystalline form of buspirone hydrochloride comprising
   a) agitating a mixture of solid buspirone hydrochloride containing the lower melting polymorphic crystalline form or a mixture of the lower and higher melting crystalline form of buspirone hydrochloride in a liquid medium at a temperature higher than about 95 °C;
   b) allowing solid/solution equilibrium to be established for the mixture at a temperature higher than about 95 °C while agitation is employed for a time sufficient to ensure that the solid buspirone hydrochloride is constituted entirely of the higher melting polymorph; and
   c) separating the higher melting polymorphic crystalline form of buspirone hydrochloride from the liquid medium of the mixture.

4. The process of Claim 2 or 3 wherein the tempeture is from about 115 to 160 °C.

5. The process of anyone of Claims 2 to 4 wherein the liquid medium is selected from the group consisting of butanol, cyclohexanone, nonane, xylene and mixtures thereof.

6. The process of claim 2 wherein the liquid medium is xylene and cyclohexanone and the temperature range is from about 110 to 140 °C.

mixture became thick (Note 4). The suspension was allowed to cool overnight under nitrogen atmosphere and the high melting polymorph collected on a filter, washed with 500 mL of xylene followed by 3 x 200 mL portions of ethyl ether. After drying in a vacuum oven to constant weight at 60 °C, the buspirone HCl P203 polymorph weighed 476.5 g (95.3% recovery) m.p. 201-202 °C. DSC 10 °/min.,onset 199.7 °C.

Anal. Calcd. for $C_{21}H_{31}N_5O_2 \cdot HCl$:				
Found:	C,59.77; C,59.63;	H,7.65; H,7.59;	N,16.60; N,16.45;	Cl,8.40 Cl,8.40

Infrared and NMR spectra were consistent with structure.

Notes:

1. Either P188 or a mixture of the polymorphs may be used as starting material.
2. The pot temperature dropped to 130 ° during this addition.
3. A clear solution was obtained in 20-30 minutes at 136-137 °C.
4. A sample was taken and dried for melting point determination. When the melting point capillary was dropped into a melting point bath heated to 190 °C, no melting occurred. This indicated complete conversion to high melting polymorph which was confirmed by differential scanning calorimetry.

Claims

1. A process for converting the lower melting polymorphic crystalline form of buspirone hydrochloride into the higher melting form thereof comprising
   a) disrupting the crystalline structure of solid buspirone hydrochloride containing the lower melting polymorphic crystalline form or a mixture of the lower and higher melting crystalline form of buspirone hydrochloride, and
   b) allowing recrystallization to occur at a temperature higher than about 95 °C.

2. The process of Claim 1 comprising
   a) disrupting the crystalline structure of said solid buspirone hydrochloride by dissolution in a liquid medium;
   b) allowing recrystallization to occur at a temperature higher than about 95 °C; and
   c) separating the higher melting polymorphic crystalline form from the liquid medium.

3. A process for preparing the higher melting polymorphic crystalline form of buspirone hydrochloride comprising
   a) agitating a mixture of solid buspirone hydrochloride containing the lower melting polymorphic crystalline form or a mixture of the lower and higher melting crystalline form of buspirone hydrochloride in a liquid medium at a temperature higher than about 95 °C;
   b) allowing solid/solution equilibrium to be established for the mixture at a temperature higher than about 95 °C while agitation is employed for a time sufficient to ensure that the solid buspirone hydrochloride is constituted entirely of the higher melting polymorph; and
   c) separating the higher melting polymorphic crystalline form of buspirone hydrochloride from the liquid medium of the mixture.

4. The process of Claim 2 or 3 wherein the tempeture is from about 115 to 160 °C.

5. The process of anyone of Claims 2 to 4 wherein the liquid medium is selected from the group consisting of butanol, cyclohexanone, nonane, xylene and mixtures thereof.

6. The process of claim 2 wherein the liquid medium is xylene and cyclohexanone and the temperature range is from about 110 to 140 °C.

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Patentansprüche

1. Verfahren zur Überführung der niedrigschmelzenden, polymorphen, kristallinen Form von Buspiron-Hydrochlorid in dessen höherschmelzende Form, wobei man
   a) die kristalline Struktur von festem Buspiron-Hydrochlorid, das die niedrigschmelzende, polymorphe, kristalline Form oder ein Gemisch der niedrig- und hochschmelzenden, kristallinen Form von Buspiron-Hydrochlorid enthält, zerstört, und
   b) die Rekristallisierung bei einer Temperatur, die höher als etwa 95 °C ist, erlaubt.

2. Verfahren gemäß Anspruch 1, wobei man
   a) die kristalline Struktur des Buspiron-Hydrochlorids durch Auflösen in einem flüssigen Medium zerstört;
   b) die Rekristallisierung bei einer Temperatur, die höher als 95 °C ist, erlaubt; und
   c) die höherschmelzende, polymorphe, kristalline Form von dem flüssigen Medium trennt.

3. Verfahren zur Herstellung der höherschmelzenden, polymorphen, kristallinen Form von Buspiron-Hydrochlorid, wobei man
   a) ein Gemisch von festem Buspiron-Hydrochlorid, das die niedrigschmelzende, polymorphe, kristalline Form oder ein Gemisch der niedrig- und höherschmelzenden kristallinen Form von Buspiron-Hydrochlorid enthält, in einem flüssigen Medium bei einer Temperatur, die höher als etwa 95 °C ist, rührt;
   b) das Fest-Flüssiggleichgewicht des Gemisches bei einer Temperatur, die höher als 95 °C ist, sich einstellen läßt, während ausreichend lange gerührt wird, um sicherzustellen, daß das feste Buspiron-Hydrochlorid vollständig aus dem höherschmelzenden Polymorph besteht; und
   c) die höherschmelzende, polymorphe, kristalline Form des Buspiron-Hydrochlorids von dem flüssigen Medium des Gemisches trennt.

4. Verfahren gemäß Anspruch 2 oder 3, wobei die Temperatur etwa 115 bis 160 °C beträgt.

5. Verfahren gemäß einem der Ansprüche 2 bis 4, wobei das flüssige Medium aus folgender Gruppe ausgewählt ist: Butanol, Cyclohexanon, Nonan, Xylol und Gemische davon.

6. Verfahren gemäß Anspruch 2, wobei das flüssige Medium Xylol und Cyclohexanon ist und der Temperaturbereich etwa 110 bis 140 °C beträgt.

Revendications

1. Procédé de conversion de la forme cristalline polymorphe du chlorhydrate de buspirone de point de fusion inférieur en sa forme de point de fusion supérieur comprenant:
   a) rompre la structure cristalline du chlorhydrate de buspirone solide contenant la forme cristalline polymorphe de point de fusion inférieur ou un mélange de la forme cristalline de points de fusion inférieur et supérieur du chlorhydrate de buspirone et
   b) laisser la recristallisation se produire à une température supérieure à environ 95 °C.

2. Procédé de la revendication 1, comprenant
   a) rompre la structure cristalline dudit chlorhydrate de buspirone solide par dissolution dans un milieu liquide ;
   b) laisser la recristallisation se produire à une température supérieure à environ 95 °C ; et
   c) séparer la forme cristalline polymorphe de point de fusion supérieur du milieu liquide.

3. Procédé de préparation de la forme cristalline polymorphe de chlorhydrate de buspirone de point de fusion supérieur, comprenant
   a) soumettre à agitation un mélange de chlorhydrate de buspirone solide contenant la forme cristalline polymorphe de points de fusion inférieur ou un mélange de la forme cristalline de points de fusion inférieur et supérieur du chlorhydrate de buspirone dans un milieu liquide à une température supérieure à environ 95 °C ;
   b) laisser l'équilibre solide/solution s'établir pour le mélange à une température supérieure à environ 95 °C tandis que l'on emploie l'agitation pendant un temps suffisant pour garantir que le chlorhydra-

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te de buspirone solide sera entièrement constitué du polymorphe de point de fusion supérieur ; et c) séparer la forme cristalline du polymorphe de point de fusion supérieur du chlorhydrate de buspirone du milieu liquide du mélange.

4. Procédé de la revendication 2 ou 3, où la température est comprise entre environ 115 et 160 °C.

5. Procédé selon l'une quelconque des revendications 2 à 4, où le milieu liquide est choisi dans le groupe consistant en butanol, cyclohexanone, nonane, xylène et leurs mélanges.

6. Procédé selon la revendication 2, où le milieu liquide est du xylène et de la cyclohexanone et la plage de températures est comprise entre environ 110 et 140 °C.

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