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(54) **Title:** NEW COMPOSITION AND METHOD FOR THE PREPARATION THEREOF

(57) **Abstract:** Described is a cannabidiol (CBD) composition comprising at least 50 w/w% cannabidiol and at most 0.2 w/w% tetrahydrocannabinol (THC)and a method for thepreparation thereoffrom cannabisplant material, comprising the steps of conversion of the cannabinoidsfrom the cannabis plant material into the respective salts and complexes thereof, alcoholic extraction of cannabis plant material, acidification of the cannabinoid salts and complexes into the respective cannabinoid acids, decarboxylation under conditions that result in preferential formation of THC as compared to formation of CBD, providing a decarboxylated mixture, incubating the said decarboxylated mixture with a salt and/or a base so as to convert the cannabinoid acids andthe cannabinoids into cannabinoid salt and/or complexes, respectively, adding alcohol to a water : alcohol ratioof 30 –70 : 70 –30 wherein the cannabinoid salts and complexes dissolve while THC does not dissolve, andcontactingthe said mixtureto an adsorbentor absorbent, allowing THC to bind, resulting in a THC depleted mixture, acidification of the THC depleted mixture resulting in conversion of the cannabinoid salts and complexesinto cannabinoid salts, decarboxylation of the cannabinoid acids into their respective cannabinoids, resulting in a decarboxylated THC depleted mixture and recovery of one or more of the cannabinoids from the said decarboxylated THC depleted mixture. Further described is the use of the cannabidiol compositionin the preparation of a medicament.

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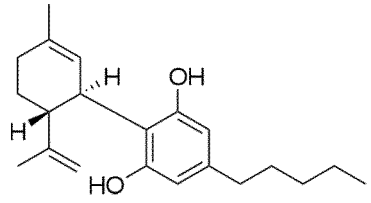
New composition and method for the preparation thereof

The invention relates to a composition comprising at least 50 w/w% cannabidiol (CBD) and at most 0.2 w/w% tetrahydrocannabinol (THC) and to a method for the preparation thereof from cannabis, as well as to the use of the composition in the preparation of a medicament, or their use in the preparation of food supplements or cosmetics.

In the pharmaceutical industry, cannabinoids find application in treatments of numerous conditions, such as for treatment of epilepsy in children, to reduce nausea and vomiting during chemotherapy, treatment of chronic pain and muscle spasms. Cannabinoids can be produced in a chemical manner, or be extracted from the cannabis plant, of which three species can be recognized, *C.sativa, C. indica and C. ruderalis*. Extraction is a very cost effective production method of cannabinoids. However, such extracts contain the psychoactive constituent tetrahydrocannabinol (THC) which is not desired in many applications of cannabinoids as a medicament, in particular when children are concerned. To this end, extracts are prepared from Cannabis varieties that produce minimal levels of THC. About 30 varieties are known that produce below 0.2 w/w% THC per 1 w/w% CBD. Such plants may also comprise the cannabinoids in their acid form. Herein, the term THCA stand for the acid of the cannabinoid THC, whereas CBDA stands for the acid of the cannabinoid CBD.

Attractive extracts comprise a low THC content but a high content of CBD and optionally other cannabinoids such as cannabigerol (CBG), The structural formula of CBD is given below.



Preparation methods of extracts with reduced THC content are known in the art and involve supercritical CO_2 extraction. However, the extracts obtained by such methods are not consistent in their contents, and therefore less suitable as raw material for processing industries, such as pharmaceutical industries that use cannibinoids as CBD for the preparation of medicaments.

Provided is a novel composition comprising at least 50 w/w% cannabidiol (CBD) and at most 0.2 w/w% tetrahydrocannabinol (THC) and a method for the preparation

thereof enabling the provision of the said composition of constant and reliable content consistency.

Preferably the composition is a full spectrum whole plant extract. The present invention demonstrates how to prepare a whole plant extract with 0,2 % of THC or less. Usually industrial hemp contains 0,02-0,08 % of THC and 2% of CBD. We concentrate the percentage of CBD up to 50% while the percentage of THC in whole plant extract starts from 0,5 %. Under current EU regulations, hemp products with a THC level higher than 0,2 % cannot be used as food supplements. Moreover, the use of pure CBD (isolate) cannot be used as a food supplement.

The percentage of THC can be decreased in the method according to the present invention due to the described method of extraction, because these extracts do not contain semisolid (insoluble) waxes. The presence of semisolid (insoluble) waxes makes removal of THC by methods of flash chromatography impossible. Flash chromatography is the only known method which allows to "cut" a fraction of THC and to collect all other fractions of whole plant extract that contain all other useful compounds like non psychoactive cannabinoids, polyphenols, chlorophyll, organic acids, pectins and so on. The present method therefore allows for a new alkali based extraction method providing a new full spectrum whole plant extract which contains non psychoactive cannabinoids, polyphenols, chlorophyll, organic acids, pectins and etc. and which do not contain waxes.

The inventors are not aware of the existence of previous publications describing compositions comprising 50% CBD which are whole plant extract, with a level of THC 0.2% or less.

Such composition can also contain about 5 – 10 w/w% pectins, in particular 6 – 8 w/w% pectins, more in particular about 7 w/w% pectins. The term ‘about’ allows a deviation of the indicated value by 10% (i.e. allowing a range of 6.3 to 7.7 w/w%), preferably of 5%, more preferably of 3% or even 1%. Such composition can further comprise non-psychoactive cannabinoids, polyphenols, chlorophyll, organic acids, among others. Such composition does not contain waxes.

Preferred compositions according to the invention therefore comprise at least one, preferably at least two, more preferably at least three, more preferably at least four, most preferably each of the components selected form the group consisting of non-psychoactive cannabinoids, polyphenols, chlorophyll, organic acids and pectins.

In a further preferred embodiment the composition does not contain waxes.

A method for the preparation of the above composition comprises the steps of

a) Providing cannabis plant material comprising cannabinoids and acids thereof,

b) Incubation of the plant material of step a) in an aqueous medium comprising salt and/or hydroxide, at 25 – 75 °C in a medium comprising between 30 to 100 v/v% alcohol, preferably 90 v/v% alcohol, for 0.5 to 1 hour, to allow conversion of cannabinoid acids and cannabinoids into the respective cannabinoid salts and/or complexes thereof,

c) Allowing the cannabinoid salts and/or complexes of step b) to separated from waxes contained in the plant material, resulting in aqueous cannabinoid salts or complexes on a surface of raw material,

d) Mixing the aqueous cannabinoid salts or complexes of step c) with an alcohol, resulting in an alcoholic cannabinoid extract,

e) Bringing the water to alcohol ratio of the alcoholic extract of step c) to 30 – 70 : 70 - 30 v/v%, preferably to 40 – 60 : 60 – 40 v/v%, providing an aqueous extract comprising the cannabinoid salts and complexes,

f) Acidification of the aqueous extract of step e) resulting in the cannabinoid salts and complexes to be converted into their acids, producing an aqueous acid extract,

g) Subjecting the cannabinoid acids of step f) to decarboxylation with basic Al_2O_3 at a temperature of at least 20 °C resulting in preferential formation of THC as compared to formation of CBD, providing a decarboxylated mixture,

h) Optionally, further incubating the decarboxylated mixture of step g) with basic Al_2O_3 at a temperature of at least 20 °C to convert the cannabinoid acids and the cannabinoids into cannabinoid salt and/or complexes, respectively,

i) Adding alcohol to the mixture of step h) to a water : alcohol ratio of 30 – 70 : 70 – 30, preferably of 40 – 60 : 60 – 40, wherein the THC dissolves while the cannabinoid salts and complexes do not dissolve,

j) Contacting the mixture of step i) to an adsorbent or absorbent, allowing the THC to eliminate from said adsorbent or absorbent, resulting in a THC depleted mixture,

k) Acidification of the THC depleted mixture of step j) resulting in conversion of the cannabinoid salts and complexes in the THC depleted mixture, into cannabinoid acids with removal of said mixture from the adsorbent or absorbent with a alcohol, preferably at least 50 v/v% more preferably at least 70 v/v% alcohol,

l) Decarboxylation of the cannabinoid acids into their respective cannabinoids at a temperature in the range of 50 to 150 ^{0}C, preferably between 60 and 70 °C, and vacuum in the range of 0 to 1000 mBar, preferably between 400 and 600 mBar, to achieve a desired decarboxylation degree between 1 to 10 hours, resulting in a decarboxylated THC depleted mixture,

m) Recovery of one or more of cannabinoids from the decarboxylated THC depleted mixture of step l).

In a first step, cannabis plant material is provided. Such plant material comprises different cannabinoids as well as acids thereof. The said plant material may e.g. be cut in smaller pieces or grinded in order to improve the processability thereof. It is advantageous for the plant material to be derived from cannabis varieties that have a low THC content. Such varieties are known in the art as described above. Preferred varieties comprise more than 1 w/w% CBD/CBDA content, at most 0.2 w/w% THC/THCA, preferably at most 0.1 w/w% THC/THCA, more preferably at most 0.05 w/w% THC/THCA, most preferably at most 0.035 w/w% THC/THCA. In particular, the female tops of cannabis plants are attractive starting material for the extraction. Such tops have a high CBD content. Therefore, the cannabis plants material is preferably derived from the upper 50 cm of the stems or branches of cannabis plants, where the seeds are growing.

In a subsequent step, the plant material is incubated in an aqueous medium comprising a salt and/or a hydroxide, resulting in salt and complex formation of the cannabinoid, which salts and complexes are soluble in water, and which increase solubility of cannabinoids in water-alcohol solutions, while decreasing the solubility of waxes and helping to easily to remove cannabinoids from waxes contained in the plant

material.. When reacting with the salt provided by the aqueous medium, cannabinoid acid is therewith converted into the corresponding cannabinoid salt. In order to allow the reaction to proceed towards the formation of the cannabinoid salt, a salt may be chosen of an acid that is weaker than CBDA, or a component is removed from the reaction mixture like CO_2 in case a carbonate salt is chosen, therewith driving the reaction towards cannabinoid salt formation. In case a carbonate is chosen, CO_2 may be formed by heating the reaction, also driving the reaction towards the envisaged cannabinoid salt formation.

A base, such as potassium hydroxide, reacts with the cannabinoid acid to form a potassium salt. Preferred hydroxides for use in the method according to the invention are NaOH or KOH.

In case a sodium or potassium carbonate salt is chosen cannabinoids tends to form ligand complexes which dissolve well in water – alcohol solutions. Preferred salts are Na_2CO_3 or K_2CO_3.When the complexes and/or salts of the cannabinoids are formed, these will dissolve in the aqueous medium.

By the addition of an alcohol, an alcoholic extract of the cannabinoid salts and complexes is obtained. By this extraction undesired components like waxes are removed. Alcoholic extraction of cannabis plants to bring cannabinoids into solution are known in the art. Any alcohol can be used, as long as the CBD dissolves therein in significant amounts. In particular alkanols, more in particular ethanol, but also isopropanol or butanol can be used. The extraction is preferably done in 70 – 100 v/v% ethanol, where the remainder is water or an aqueous solution, e.g. comprising some salt or a buffer, but is preferably water. In particular, mixtures of 85-95 v/v% ethanol and 5-15 v/v% water are used. However, mixtures of different alcohols, or alcohols with other solvents can be used, optionally in combination with water.

It is to be noted that when potassium carbonate is used as a salt, the above conversion and alcohol extraction can be performed simultaneously, as the aqueous potassium carbonate medium does not mix with the alcohol such as 90 v/v% ethanol. After extraction, a phase separation is obtained, where the cannabinoid salts and complexes reside in the ethanol phase.

Subsequently, the alcohol content is lowered by bringing the ratio of water to alcohol to 30 – 70 : 70 - 30 v/v%, preferably to 40 – 60 : 60 – 40 v/v%, providing an aqueous extract comprising the cannabinoid salts and complexes. This can be done

by the addition of water, or by evaporation of alcohol from the extract, or by a combination of both.

The resulting aqueous medium is acidified, e.g. by the addition of a suitable salt, such as e.g. and organic acid, in particular a food grade acid, such as citric acid. The acidification results in the conversion of the cannabinoid salts and complexes into the respective cannabinoid acids.

In a next step, decarboxylation is performed with basic Al_2O_3 at a temperature of at least 20 °C, resulting in preferential formation of THC from THCA. The skilled person will understand that other suitable options besides Al_2O_3 may be used. This step can be done by choosing the reaction parameters such, that (1) THCA is decarboxylated into THC, while significantly avoiding the formation of CBD from CBDA, i.e. selective decarboxylation of THCA, or (2) by decarboxylation of both THCA and CBDA, followed by a selective carboxylation of CBD into CBDA while significantly avoiding the formation of THCA from THC.

(1) Selective decarboxylation resulting in decarboxylation of THCA while leaving CBDA substantially untouched can be done by using sodium as catalyst at mild conditions, such as a reaction temperature of 65°C for one hour, or at 70°C or half an hour or 10 minutes at 90°C.

(2) At harsher conditions using sodium as katalyst, both THCA as well as CBDA are decarboxylated to form THC and CBD respectively. When using potassium in a subsequent carboxylation step, CBD is converted into CBDA, while THC remains substantially untouched.

As a result of the above, a decarboxylated mixture is obtained, rich in CBDA, poor in CBD, with a THC content but significantly void of THCA.

In an optional subsequent step, the decarboxylated mixture is further incubated with Al_2O_3 as described above in order to convert the cannabinoids and cannabinoid acids into salts and complexes. The skilled person will understand that other suitable options besides Al_2O_3 may be used. This step is preferably performed in an aqueous medium comprising 40 to 60 v/v% alcohol, in particular ethanol. CBD salts and complexes of CBD will be insoluble in the water phase, whereas THC will be solved therein.

The resulting mixture of solved THC and insoluble CBD salts and complexes thereof can be separated using an absorbent or adsorbent, thus eliminating the solved THC. Suitable adsorbents include Al_2O_3, diatomaceous earth, silicagel, MgO, activated

carbon or a combination of two or more thereof. Al_2O_3 is a particular attractive adsorbent for this purpose.

The adsorbed material will comprise the CBD salt and complexes, whereas the majority of the THC can be eliminated. The adsorbed material can easily be recovered from the adsorbent material, i.e. by a water or water-alcohol mixture, such as a 1:1 v:v alcohol to water ratio, where the alcohol preferably comprises or even is ethanol.

Subsequently, after removal of the THC by the above-described adsorption, the CBD salts and complexes are converted into CBD acid by acidification of the water-alcohol mixture to a pH of 3 to 6.8, preferably to a pH of 6.0 – 6.5. This can be done by the addition of a suitable acid as described above, in particular citric acid. A subsequent decarboxylation step as discussed above results in CBD.

Next, the cannabinoid acids are decarboxylated into their respective cannabinoids. Preferred this step is performed at a temperature in the range of 50 to 150 ^{0}C, preferably between 60 and 70 °C, and vacuum in the range of 0 to 1000 mBar, preferably between 400 and 600 mBar, to achieve a desired decarboxylation degree between 1 to 10 hours. The result is a THC depleted decarboxylated mixture.

This CBD enriched and THC depleted preparation can be recovered and further purified by evaporation or drying. Preferably, the enriched cannabidiol preparation thus obtained is recovered, which recovery in particular comprises drying and optionally also washing of the enriched cannabidiol preparation before or after drying with water in order to remove acid and other residues from the preparation to provide the envisaged composition, which appear to reproducibly comprise at least 50 w/w% cannabidiol (CBD) and less than 0.2 w/w% tetrahydrocannabinol (THC), rendering the said composition highly suitable as raw material for the preparation of a medicament.

Alternatively, a method for the preparation of the above composition comprises the steps of

a) Providing cannabis plant material comprising cannabinoids and acids thereof,

b) Incubation of the plant material of step a) in an aqueous medium comprising salt and/or hydroxide, under conditions to allow conversion of cannabinoid acids and cannabinoids into the respective cannabinoid salts and/or complexes thereof,

c) Removing of the aqueous medium comprising salt and/or hydroxide of step b) from plant material by filtering or centrifugation,

d) Adding to the plant material of step c) an aqueous alcohol solution of 30 – 100 v/v% alcohol, preferably 90 v/v% alcohol, resulting in an alcoholic cannabinoid extract after stirring at 0,5 hour or more,

e) Separation of the alcoholic cannabinoid extract from plant material step d) by filtering or centrifugation,

f) Evaporation of alcohol from extract step e), preferably at 500 Celsius with vacuum,

g) Subjecting the extract of step f) to decarboxylation at temperature from 50 to 1500 Celsius, preferably at 650 Celsius and vacuum from 0 to 1000 mBar, preferably 500 mBar, to achieve a desired decarboxylation degree at 1 to 10 hours,

h) Acidification of the extract of step g) resulting in the cannabinoid salts and complexes to be converted into their original form and removing excess salt / hydroxide of step b), producing an extract with water layer,

i) Separation of extract from water layer step h), washing extract with water and drying,

j) Purifying of extract step i) from THC by method of preparative HPLC/Flash chromatography with gradient flow of alcohol-water from 50:50 v/v% to 96 v/v% on reverse phase like C18, C6 etc. with elimination of THC fraction and collecting all other fractions together,

k) Evaporation of alcohol from collected fractions step j) and drying with obtaining a full spectrum whole plant extract composition comprising at least 50 w/w% cannabidiol (CBD) and at most 0.2 w/w% tetrahydrocannabinol (THC).

Steps b) and d) can be also combined in case of using of potassium/sodium hydroxides due to a good solubility of these in alcohol. A subsequent decarboxylation step as discussed above results in CBD.Separation of the extract from the water layer, washing with water and drying gives an extract ready for purifying from THC. The drying procedure can also be omitted because step j) starts with an alcohol-water mixture of 50:50 v/v%.

Purifying of the extract from THC by method of preparative HPLC/Flash chromatography, with evaporation of the solvent gives a composition which comprise

at least 50 w/w% cannabidiol (CBD) and less than 0.2 w/w% tetrahydrocannabinol (THC), rendering the said composition highly suitable as raw material for the preparation of a food grade supplement, medicament. or cosmetics.

Example 1

30 g of raw hemp flowers with a total 2,9% CBDA/CBD are mixed with 200 ml of saturated solution of potassium carbonate in a glass vessel and left for 0,5 hour (250 Celsius) with periodical stirring. The liquid phase is removed on a Shott filter and raw hemp is returned to a glass vessel. 90% ethanol is added and left for 0,5 hour with periodical stirring. The liquid phase is removed on a Shott filter and raw hemp is washed with 30 ml of 90% alcohol. The alcohol is evaporated from the liquid phase. 50 ml of diethyl ether is added and 5% water solution of citric acid to pH 6. Separate a water layer and wash two times by 20 ml of deionized water. Evaporate ether. A residue of 1,68 g is a whole plant extract which has 51% of CBDA/CBD total by HPLC.

CLAIMS

1. Composition, comprising at least 50 w/w% cannabidiol (CBD) and less than 0.2 w/w% tetrahydrocannabinol (THC), wherein the composition is a whole plant extract.

2. Composition according to claim1, further comprising at least one, preferably at least two, more preferably at least three, more preferably at least four, most preferably each of the components selected form the group consisting of non-psychoactive cannabinoids, polyphenols, chlorophyll, organic acids and pectins.

3. Composition according to claim 1 or 2, wherein the composition does not contain waxes.

4. Method for the preparation of a composition according to claim 1 or 2 from cannabis plant material, comprising the steps of:

a) Providing cannabis plant material comprising cannabinoids and acids thereof,

b) Incubation of the plant material of step a) in an aqueous medium comprising salt and/or hydroxide, at 25 – 75 °C in a medium comprising between 30 to 100 v/v% alcohol, preferably 90 v/v% alcohol, for 0.5 to 1 hour, to allow conversion of cannabinoid acids and cannabinoids into the respective cannabinoid salts and/or complexes thereof,

c) Allowing the cannabinoid salts and/or complexes of step b) to separated from waxes contained in the plant material, resulting in aqueous cannabinoid salts or complexes on a surface of raw material,

d) Mixing the aqueous cannabinoid salts or complexes of step c) with an alcohol, resulting in an alcoholic cannabinoid extract,

e) Bringing the water to alcohol ratio of the alcoholic extract of step c) to 30 – 70 : 70 - 30 v/v%, preferably to 40 – 60 : 60 – 40 v/v%, providing an aqueous extract comprising the cannabinoid salts and complexes,

f) Acidification of the aqueous extract of step e) resulting in the cannabinoid salts and complexes to be converted into their acids, producing an aqueous acid extract,

g) Subjecting the cannabinoid acids of step f) to decarboxylation with basic Al_2O_3 at a temperature of at least 20 °C resulting in preferential formation of THC as compared to formation of CBD, providing a decarboxylated mixture,

h) Optionally, further incubating the decarboxylated mixture of step g) with basic Al_2O_3 at a temperature of at least 20 °C to convert the cannabinoid acids and the cannabinoids into cannabinoid salt and/or complexes, respectively,

i) Adding alcohol to the mixture of step h) to a water : alcohol ratio of 30 – 70 : 70 – 30, preferably of 40 – 60 : 60 – 40, wherein the THC dissolves while the cannabinoid salts and complexes do not dissolve,

j) Contacting the mixture of step i) to an adsorbent or absorbent, allowing the THC to eliminate from said adsorbent or absorbent, resulting in a THC depleted mixture,

k) Acidification of the THC depleted mixture of step j) resulting in conversion of the cannabinoid salts and complexes in the THC depleted mixture, into cannabinoid acids, and removing of said mixture from the adsorbent or absorbent with a alcohol preferably at least 50 v/v% more preferably at least 70 v/v% alcohol,

l) Decarboxylation of the cannabinoid acids into their respective cannabinoids at a temperature in the range of 50 to 150 ^{0}C, preferably between 60 and 70 °C, and vacuum in the range of 0 to 1000 mBar, preferably between 400 and 600 mBar, to achieve a desired decarboxylation degree between 1 to 10 hours, resulting in a decarboxylated, THC depleted mixture,

m) Recovery of one or more of cannabinoids from the decarboxylated THC depleted mixture of step l).

5. Method for the preparation of a composition according to claim 3, wherein the cannabis plant material in step a) is derived from a

cannabis variety that comprises, at least 1 w/w% CBD content, and at most 0.2 w/w% THC, preferably at most 0.1 w/w% THC, more preferably at most 0.05 w/w% THC, most preferably at most 0.035 w/w% THC.

6. Method for the preparation of a composition according to claim 3 or 4, wherein the cannabis plant material is derived from the upper 50 cm of the stems and branches of cannabis plants.

7. Method for the preparation of a composition according to any of the claims 3 - 5, wherein in step d) is performed in 70 – 100 v/v% ethanol and 30 – 0 v/v% water, preferably in 85 – 95 v/v% ethanol and 5 - 15 v/v% water.

8. Method for the preparation of a composition according to any of the claims 3 - 6, wherein the salt in the aqueous medium of step b) comprises carbonate, wherein the carbonate is preferably chosen from sodium carbonate and potassium carbonate or a mixture thereof.

9. Method for the preparation of a composition according to any of the claims 3 - 7, wherein in step e) the alcohol is evaporated to the envisaged water to alcohol ratio.

10. Method for the preparation of a composition according to any of the claims 3 - 8, wherein the decarboxylation of step g) is between 20 and 65 ºC, preferably between 60 and 65 °C for 30 minutes to 3 hours, preferably between 30 minutes and 2 hours.

11. Method for the preparation of a composition according to any of the claims 3 - 9, wherein the adsorbent/absorbent in step j) comprises an alkali adsorbent/absorbent, the adsorbent/absorbent preferably comprising Al_2O_3, diatomaceous earth, silicagel, MgO, activated carbon or a combination of two or more thereof.

12. Method for the preparation of a composition according to any of the claims 3 -10, wherein the acidification in step f) and/or k) comprises addition of citric acid.

13. Method for the preparation of a composition according to any of the claims 3 - 11, wherein step m) comprises evaporation and/or drying the cannabinoid.

14. Method for the preparation of a composition according to any of the claims 3 - 12, further comprising a step n) of washing the recovered material of step m) with water, optionally followed by a drying step.

15. The composition according to claim 1 or 2 for use as a medicament.

16. Use of the composition according to claim 1 or 2 in the preparation of a food supplement or cosmetic.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/076010

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K31/05 A61K31/352 A61P25/08 A61P1/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 393 182 A (GW PHARMA LTD [GB]) 24 March 2004 (2004-03-24)	1-3,15
Y	page 13, line 18 - line 20	16
A	page 15, line 19 - line 30	4-14

X	WO 2016/127111 A1 (COLORADO CAN LLC [US]) 11 August 2016 (2016-08-11)	1,2,15
Y	page 2, paragraph 5; example 5	16
A	page 22; example 5	4-14

Y	CN 107 095 302 A (HE ZONGXUN) 29 August 2017 (2017-08-29) abstract	16

A	US 2015/190442 A1 (RADERMAN JOSHUA MICHAEL [US]) 9 July 2015 (2015-07-09) the whole document	4-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
7 December 2018	17/12/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Trifilieff-Riolo, S

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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