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(54) Titre : HUILE DE CANNABIS POUR VAPOTAGE, METHODE D'UTILISATION ET DE FABRICATION ASSOCIEE
(54) Title: CANNABIS VAPE OIL, METHOD OF USE AND OF MAKING SAME

(57) Abrégé/Abstract:
The present disclosure relates to cannabis vaping oil for use in a vaping device. The cannabis oil includes a mixture of a cannabis concentrate and an additive in a proportion sufficient to bring the flash point of the mixture equal to or above a vaporization temperature at which one or more cannabinoids in the vaping oil vaporize, while maintaining a viscosity which is suitable for use in the vaping device.

ABSTRACT

The present disclosure relates to cannabis vaping oil for use in a vaping device. The cannabis oil includes a mixture of a cannabis concentrate and an additive in a proportion sufficient to bring the flash point of the mixture equal to or above a vaporization temperature at which one or more cannabinoids in the vaping oil vaporize, while maintaining a viscosity which is suitable for use in the vaping device.

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CANNABIS VAPE OIL, METHOD OF USE AND OF MAKING SAME

TECHNICAL FIELD

[01] This application generally relates to the field of cannabis oil for vaping.

BACKGROUND

[02] Conventionally, electronic vaping devices utilize a liquid supply reservoir that contains a liquid material. The liquid material is drawn toward a heater via a wick, where the heater vaporizes the liquid material, and the vaporized liquid is entrained in an air flow that is discharged into a vaper's mouth for consumption.

[03] In order for the liquid material to function properly in the vaping device, the liquid material must have properties, which are suitable for the liquid to vaporize, namely the liquid must have a proper viscosity such that it can be adequately metered to the heating element by the capillary action of the wick. For instance, a liquid that is too viscous will not function well because the wick will have difficulty transferring the liquid to the heating element. Also, the liquid should have a flash point that is in proper relation to the temperature at which the liquid is heated by the heating element. If the flash point of the liquid is below the temperature of the heating element, the liquid may explode in the vaping device, creating a hazard risk.

[04] A number of liquid material formulations have been proposed for use in vaping devices, in particular in connection with the nicotine market (e-cigarettes). However, such formulations are not easily transferrable into other markets, such as the cannabis vaping oil market. While some sort of thinner agent is required for cannabis concentrates, which typically have a viscosity which is too high for use in vaping devices, common thinner agents used in the nicotine market have been reported as negatively affecting the organoleptic properties of cannabis concentrates.

[05] Despite the widespread population of vaping, cannabis concentrate-containing liquid materials for use in a vaping device have remained elusive.

SUMMARY

[06] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key aspects or essential aspects of the claimed subject matter.

[07] As embodied and broadly described herein, the present disclosure relates to a cannabis oil for use in a vaping device configured for heating the cannabis oil at a vaporization temperature to vaporize a cannabinoid contained in the cannabis oil, the cannabis oil comprising a mixture of a cannabis concentrate and an additive, the additive having a flash point below the vaporization temperature, the cannabis concentrate and the additive cooperating to produce a mixture having a flash point above the vaporization temperature of the cannabinoid.

[08] As embodied and broadly described herein, the present disclosure relates to a cannabis oil for use in a vaping device, the cannabis oil comprising a mixture of a cannabis concentrate and an additive, the additive having a flash point below 200 °F, the cannabis concentrate and the additive cooperating to produce a mixture having a flash point above 200 °F.

[09] As embodied and broadly described herein, the present disclosure relates to a cannabis oil for vaping, the cannabis oil comprising a mixture of a cannabis concentrate and a carrier oil of plant origin, the cannabis concentrate being in a proportion sufficient to bring the flash point of the cannabis oil above 200 °F, the cannabis oil being free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG).

[10] As embodied and broadly described herein, the present disclosure relates to a cartridge component of an electronic vaping device, comprising a liquid reservoir containing the herein described cannabis oil.

[11] As embodied and broadly described herein, the present disclosure relates to a cannabis vaping oil comprising a cannabis concentrate and a carrier oil selected from the group consisting of a d-limonene, Citrus sinensis, b-myrcene, Pinus sylvestris, Abies siberica, Abies balsamea, Juniperus communis, lemon Lime Flavor, peppermint oil and any combination thereof.

[12] As embodied and broadly described herein, the present disclosure relates to a method of manufacturing cannabis vaping oil suitable for use in a vaping device, the vaping device being configured for using a vaping oil having a viscosity at room temperature below a threshold, and the vaping device further being configured to heat the vaping oil at a vaporization temperature at which one or more cannabinoids in the vaping oil vaporize. The method comprising providing a cannabis concentrate having a viscosity at room temperature which is above the threshold, the cannabis concentrate having a flash point above the vaporization temperature; providing an additive having a viscosity below the threshold at room temperature and a flash point below the vaporization temperature; and diluting the cannabis concentrate with an additive to obtain a

mixture, wherein the proportions of cannabis concentrate and additive are selected such that the mixture has a viscosity below the threshold and a flash point above the vaporization temperature.

[13] In one embodiment, the vaporization temperature is above 200 °F, or above about 240 °F, or above about 260 °F, or above about 280 °F, or above about 300 °F, or above about 320 °F, or above about 340 °F, or more.

[13a] In another embodiment, the present disclosure relates to a method of manufacturing vaping oil include a cannabinoid, the vaping oil having a target viscosity at room temperature for safe use in a vaping device the method comprising: selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the target viscosity and having a flash point above the vaporization temperature, selecting an additive having a viscosity below the target viscosity and having a flash point below the vaporization temperature, and selecting proportions of cannabis concentrate and additive such that the vaping oil has a viscosity below the target viscosity and a flash point above the vaporization temperature.

[13b] In another embodiment, the present disclosure relates to a method of manufacturing vaping oil includes a cannabinoid which is vaporized at a vaporization temperature, for use in a vaping device, the vaping oil having a target viscosity at room temperature which makes the vaping oil suitable for use in the vaping device, and a flashpoint that is above the vaporization temperature such that the vaping oil is safe to use in the vaping device, the method comprising: selecting a cannabis concentrate having a flash point above the vaporization temperature and a viscosity at room temperature that is above the target viscosity, selecting at least one additive having a viscosity below the target viscosity and a flash point below the vaporization temperature, the selected at least one additive when mixed with the cannabis concentrate operating to lower the viscosity of the cannabis concentrate, selecting the proportions of cannabis concentrate and of the least one additive to be mixed together, such that the at least one additive dilutes the cannabis concentrate to a sufficient degree to achieve the target viscosity, to achieve a flashpoint of the mixture of the cannabis concentrate and the at least one additive above the vaporization temperature, and mixing the selected proportions in forming the vaping oil.

[13c] In another embodiment, the present disclosure relates to a method of manufacturing vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device, the method comprising selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity and having a flash point above the vaporization temperature, selecting an additive having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG), and a concentration of additive that (i) will reduce the viscosity of the cannabis concentrate sufficiently low for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature, and mixing the cannabis concentrate and the additive previously mentioned on the basis of the determined concentration to obtain the cannabis vaping oil.

[13d] In another embodiment, the present disclosure relates to a method of manufacturing vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device and being free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG), the method comprising: selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity and having a flash point above the vaporization temperature, selecting a terpene having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the terpene operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and terpene, and determining a concentration of terpene that (i) will reduce the viscosity of the cannabis concentrate sufficiently low for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature and mixing the cannabis concentrate and the terpene previously mentioned on the basis of the determined concentration to obtain the vaping oil.

[13e] In another embodiment, the present disclosure relates to a method for manufacturing a vape cartridge for a vaping device, the method comprising providing a vape cartridge including

(i)an unfilled reservoir for receiving a vaping oil containing a cannabinoid characterized by a (ii)vaporization temperature; vaporization means that includes a ceramic core configured to achieve vaporization of the cannabinoid wherein the vaping oil supplied to the vaporization means has a viscosity at room temperature that does not exceed a predetermined viscosity threshold; and formulating the vaping oil according to the predetermined viscosity threshold such that the vaping oil is suitable for use in the vape cartridge, the formulating including (i) providing a cannabis concentrate including the cannabinoid, the cannabis concentrate having a viscosity at room temperature which is above the predetermined viscosity threshold; (ii) providing an additive having a viscosity below the predetermined viscosity threshold and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); and (iii)determining a concentration of the additive required to simultaneously achieve a mixture viscosity at room temperature at or below the predetermined viscosity threshold; and a mixture flashpoint above the vaporization temperature; (iv) mixing the cannabis concentrate of i) and the additive of ii) on the basis of the concentration determined in iii) to obtain the vaping oil; and filling the reservoir with the vaping oil of iv).

[13f] In another embodiment, the present disclosure relates to a method for manufacturing a vape cartridge for a vaping oil containing a cannabinoid, the method comprising a)selecting a cannabinoid to vape in a range of cannabinoids that can be vaped, the selected cannabinoid being characterized by a vaporization temperature, b) providing the vape cartridge including i) an unfilled liquid reservoir configured to be filled with the vaping oil containing the cannabinoid; ii)vaporization means that includes a ceramic core configured to achieve vaporization of the cannabinoid when the vaping oil supplied to the vaporization means has a viscosity at room temperature that does not exceed a predetermined viscosity threshold; c) formulating the vaping oil according to the viscosity threshold such that the vaping oil is suitable for use in the vape cartridge, the formulating including i) providing a cannabis concentrate including the selected cannabinoid, the cannabis concentrate having a viscosity at room temperature which is above the viscosity threshold; ii)providing an additive having a viscosity below the viscosity threshold and

having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); and iii) determining a concentration of the additive required to simultaneously achieve 1) a mixture viscosity at room temperature at or below the viscosity threshold; 2) a mixture flashpoint above the vaporization temperature; i) mixing the cannabis concentrate of i) and the additive of ii) on the basis of the concentration determined in iii) to obtain the vaping oil; and d) filling the reservoir with the vaping oil of iv).

[13g] In another embodiment, the present disclosure relates to a method of manufacturing cannabis vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device, the method comprising: a) selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity; and having a flash point above the vaporization temperature; b) selecting an additive having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); c) determining a range of concentrations of additive that (i) will reduce the viscosity of the cannabis concentrate sufficiently for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature; d) selecting a particular concentration of additive in the range of concentrations; and e) mixing the cannabis concentrate of a) and the additive of b) on the basis of the concentration in d) to obtain the cannabis vaping oil.

[13h] In another embodiment, the present disclosure relates to a method of manufacturing a batch of vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device, the method comprising a) selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity and having a flash point above

Date Reçue/Date Received 2020-10-29

the vaporization temperature; b) selecting an additive having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); and c) determining a concentration of additive that (i) will reduce the viscosity of the cannabis concentrate sufficiently low for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature; d) manufacturing the batch of vaping oil including the cannabis concentrate of a) and the additive of b) on the basis of the concentration determined in c).

[13i] In another embodiment, the present disclosure relates to a method of manufacturing a batch of vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device and being free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG), the method comprising: a) selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity and having a flash point above the vaporization temperature; b) selecting a terpene having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the terpene operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and terpene; and c) determining a concentration of terpene that (i) will reduce the viscosity of the cannabis concentrate sufficiently low for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature; d) manufacturing the batch of vaping oil including the cannabis concentrate of a) and the terpene of b) on the basis of the concentration determined in c).

[13j] In another embodiment, the present disclosure relates to a method for manufacturing a vape cartridge for a vaping device, the method comprising: a) providing a vape cartridge including: (i) an unfilled reservoir for receiving a vaping oil containing a cannabinoid characterized by a vaporization temperature; (ii) vaporization means that includes a ceramic core configured to achieve vaporization of the cannabinoid wherein the vaping oil supplied to the vaporization means has a viscosity at room temperature that does not exceed a predetermined viscosity threshold; b) formulating the vaping oil

Date Reçue/Date Received 2020-10-29

according to the predetermined viscosity threshold such that the vaping oil is suitable for use in the vape cartridge, the formulating including: (i) providing a cannabis concentrate including the cannabinoid, the cannabis concentrate having a viscosity at room temperature which is above the predetermined viscosity threshold; (ii) providing an additive having a viscosity below the predetermined viscosity threshold and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); and (iii) determining a concentration of the additive required to simultaneously achieve: (1) a mixture viscosity at room temperature at or below the predetermined viscosity threshold; (2) a mixture flashpoint above the vaporization temperature; (iv) manufacturing the batch of vaping oil including the cannabis concentrate of b) (i) and the additive of b) (ii) on the basis of the concentration determined in b) (iii); c) filling the reservoir with the vaping oil of b) (iv).

[14] All features of exemplary embodiments which are described in this disclosure and are not mutually exclusive can be combined with one another. Elements of one embodiment canutilized in the other embodiments without further mention. Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments in conjunction with the accompanying Figures.

Date Reçue/Date Received 2020-10-29

BRIEF DESCRIPTION OF THE DRAWINGS

[15] A detailed description of specific exemplary embodiments is provided herein below with reference to the accompanying drawings in which:

[16] Fig. 1A is a plan view of a cartridge component of an electronic vaping device in accordance with an embodiment of the present disclosure.

[17] Fig. 1B is an isometric view of a battery compartment component of an electronic vaping device in accordance with an embodiment of the present disclosure.

[18] In the drawings, exemplary embodiments are illustrated by way of example. It is to be expressly understood that the description and drawings are only for the purpose of illustrating certain embodiments and are an aid for understanding. They are not intended to be a definition of the limits of the invention.

DETAILED DESCRIPTION

[19] A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such embodiments, but the invention is not limited to any embodiment. The scope of the invention is limited only by the claims. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of non-limiting examples and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

[20] The present disclosure relates to a cannabis vaping oil, which has a viscosity and a flash point which are suitable for use in a vaping device where the vaping device is configured for using a vaping oil having a viscosity at room temperature below a viscosity threshold, and where the vaping device is further configured to heat the vaping oil at a vaporization temperature at which one or more cannabinoids in the vaping oil vaporize.

[21] Generally speaking, several options exist to obtain cannabis vaping oil having the herein described desired viscosity and flash point for use in a vaping device.

[22] A first option is to dilute a cannabis concentrate having a viscosity at room temperature which is above the viscosity threshold to the point of obtaining the desired viscosity with an additive having a flash point equal to or above the vaporization temperature. The dilution creates a mixture that has a sufficiently lower viscosity than the cannabis concentrate without the additive, while maintaining a flash point equal to or above the vaporization temperature for safely vaporizing one or more cannabinoids contained in the cannabis concentrate. Furthermore, when the mixture is loaded into a cartridge component of a vaping device with a pipette at room temperature, the mixture flows in and out of the pipette into the cartridge without much difficulty. In other words, the mixture behaves like a liquid.

[23] A second option is to dilute a cannabis concentrate having a viscosity at room temperature which is above the viscosity threshold to the point of obtaining the desired viscosity with an additive having a flash point below the vaporization temperature. In this option, the cannabis concentrate has a flash point equal to or above the vaporization temperature such that the dilution creates a mixture that has a flash point equal to or above the vaporization

[24] temperature for safely vaporizing one or more cannabinoids contained in the cannabis concentrate. In this option, the proportions of cannabis concentrate and additive are selected such that the mixture has a viscosity below the viscosity threshold while maintaining a flash point equal to or above the vaporization temperature.

Additive compound

[25] In a practical implementation, the additive includes a compound which operates to lower the viscosity of the cannabis concentrate. The additive can be a single material or a blend of different materials. Optionally, the rate of addition of the additive to the cannabis concentrate can be adjusted according to expected storage or the vaping device's operational parameters.

[26] In one embodiment, the additive used in the present disclosure does not significantly alter the organoleptic properties of the cannabis concentrate; in other words, the taste, smell and touch of the cannabis concentrate is not significantly altered by the addition of the additive.

[27] In an advantageous non-limiting embodiment, a single additive is added to the cannabis concentrate. This simplifies the manufacturing of the cannabis vaping oil and may increase regulatory approval likelihood by local regulatory bodies. However, it is also conceivable for two or more different additives to be added to the cannabis concentrate, especially when particular further advantageous properties are to be obtained. For example, a first additive having a flash point equal to or above the vaporization temperature may be used together with a second additive having a flash point below the vaporization temperature. In such situation, the overall proportion of cannabis concentrate required to obtain a suitable flash point for the whole mixture may not be as high compared to the situation where the additive(s) has (have) a flash point below the vaporization temperature. Accordingly, less cannabis concentrate may be required to have a cannabis oil with suitable flash point, although the person of skill may still wish to include higher proportion of cannabis concentrate in other to increase potency of the cannabis oil, i.e., increase the concentration of cannabinoid(s) in the cannabis vaping oil.

[27] In one non-limiting embodiment, the cannabis vaping oil of the present disclosure includes a mixture of the cannabis concentrate and the additive, where the cannabis concentrate is present in a proportion of $\geq$ 40 wt.% relative to the weight of the additive. Preferably, the proportion of cannabis concentrate is $\leq$ 70 wt.% relative to the weight of the additive, such that

the cannabis vaping oil retains sufficient free-flowing liquid properties to afford ease of use with the vaping device.

[28] Examples of additives that typically have a flash point above the vaporization temperature include Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG). Objectively, those compounds are less desirable than other examples provided in this disclosure because they are known to potentially produce toxic and carcinogenic impurities as a result of the thermal decomposition of VG, PEG and PG.

[29] In one non-limiting embodiment, the additive includes one or more carrier oil(s).

[30] In one non-limiting embodiment, the one or more carrier oil(s) is (are) of plant origin. For example, but without being limited to, terpenes, essential oils, and the like, such as for example, d-limonene, Orange sweet (Citrus sinensis), b-myrcene, Pine (Pinus sylvestris), Fir (Abies siberica or Abies balsamea), Juniper Berry (Juniperus communis), lemon Lime Flavor, peppermint oil, and the like.

[31] In one non-limiting embodiment, the additive includes a medium chain triglyceride (MCT) or a mixture of MCT and another additive. For example, the additive can include a mixture of peppermint oil and MCT in proportions such that the typical taste of peppermint oil is tamed down with the MCT.

Cannabis concentrate

[32] The cannabis concentrate of the present disclosure may be obtained with any known method in the art.

[33] For example, the cannabis concentrate may be obtained by a process including an extraction step from plant materials using heat decarboxylation to convert cannabinoids in their acid forms to neutral forms followed by or after CO_2 extraction (under sub-critical or super-critical conditions), and then, optionally, followed by ethanol winterization to remove waxes, as described for example in US 7,700,368 and US 2004/0049059. US 7,700,368 generally describes extraction/purification of cannabinoids or cannabinoid acids from any plant material known to contain such cannabinoids or cannabinoid acids, such as wild type Cannabis sativa and also variants thereof, including cannabis chemovars (varieties characterised by virtue of chemical composition) which naturally contain different amounts of the individual cannabinoids, also

Cannabis sativa subspecies indica including the variants var. indica and var. kafiristanica, Cannabis indica and also plants which are the result of genetic crosses, self-crosses or hybrids thereof. US 2004/0049059 generally describes a method for producing an extract from cannabis plant matter, containing tetrahydrocannabinol, cannabidiol and optionally the carboxylic acids thereof, from industrial hemp and from drug-producing hemp. Optionally, the method for obtaining the cannabis concentrate may further include purification steps such as a distillation step in order to further purify, isolate or crystallize one or more cannabinoids. A cannabis concentrate obtained by distillation may be further cut with one or more terpenes, i.e., chemicals made and stored in the trichomes of the cannabis plant, with the cannabinoids. Terpenes give cannabis its distinctive smell. Viscosity values for cannabis concentrates have been reported in the art, for example: WO2017180660 describes CBD 80%, 60°C: 1240mPas, CBD 80%, 70°C: 670mPas, THC 80%, 60°C: 5830mPas, THC 80%, 70°C: 2200mPas; Rheosense (Rheometer manufacturers) have an application note on analyzing 'cannabinoid oils' where they have measured viscosities at 25°C between 10000 to 80000 mPas using an unspecified shear rate between 60-200Hz; Monica Vialpando, Ph.D. – Pharmaceutical Development, Vialpando LLCy made a presentation entitled Pharmaceutical Formulation Technologies Applicable to Cannabis Product Development at the Emerald Conference 2018 (available on line), where the viscosity of THC was reported at 25°C to be 100000 mpas.

[34] The cannabis concentrate includes one or more cannabinoid(s). Examples of cannabinoids include, but are not limited to, cannabigerolic acid (CBGA), cannabigerol (CBG), cannabigerol monomethylether (CBGM), cannabigerovarin (CBGV), cannabichromene (CBC), cannabichromevarin (CBCV), cannabidiol (CBD), cannabidiol monomethylether (CBDM), cannabidiol-C4 (CBD-C4), cannabidivarin (CBDV), cannabidiorcol (CBD-C1), delta-9-tetrahydrocannabinol (Δ9-THC), delta-9-tetrahydrocannabinolic acid A (THCA-A), delta-9-tetrahydrocannabionolic acid B (THCA-B), delta-9-tetrahydrocannabinolic acid-C4 (THCA-C4), delta-9-tetrahydrocannabinol-C4, delta-9-tetrahydrocannabivarin (THCV), delta-9-tetrahydrocannabiorcol (THC-C1), delta-7-cis-iso tetrahydrocannabivarin, delta-8-tetrahydrocannabinol (Δ8-THC), cannabicyclol (CBL), cannabicyclovarin (CBLV), cannabielsoin (CBE), cannabinol (CBN), cannabinol methylether (CBNM), cannabinol-C4 (CBN-C4), cannabivarin (CBV), cannabinol-C2 (CBN-C2), cannabiorcol (CBN-C1), cannabinodiol (CBND), cannabinodivarin (CBVD), cannabitriol (CBT), 10-ethoxy-9hydroxy-delta-6a-tetrahydrocannabinol, 8,9-dihydroxy-delta-6a-tetrahydrocannabinol, cannabitriolvarin (CBTV),

[35] ethoxy-cannabitriolvarin (CBTVE), dehydrocannabifuran (DCBF), cannabifuran (CBF), cannabichromanon (CBCN), cannabicitran (CBT), 10-oxo-delta-6a-tetrahydrocannabionol (OTHC), delta-9-cis-tetrahydrocannabinol (cis-THC), 3,4,5,6-tetrahydro-7-hydroxy-alpha-alpha-2-trimethyl-9-n-propyl-2, 6-methano-2H-1-benzoxocin-5-methanol (OH-iso-HHCV), cannabiripsol (CBR), trihydroxy-delta-9-tetrahydrocannabinol (triOH-THC), cannabinol propyl variant (CBNV), and derivatives thereof.

[36] In some embodiments, the cannabinoid is tetrahydrocannabinol (THC). THC is only psychoactive in its decarboxylated state. The carboxylic acid form (THCA) is non-psychoactive. Delta-9-tetrahydrocannabinol (Δ9-THC) and delta-8-tetrahydrocannabinol (Δ8-THC) produce the effects associated with cannabis by binding to the CB1 cannabinoid receptors in the brain.

[37] In some embodiments, the cannabinoid is cannabidiol (CBD). The terms "cannabidiol" or "CBD" are generally understood to refer to one or more of the following compounds, and, unless a particular other stereoisomer or stereoisomers are specified, includes the compound "Δ2-cannabidiol." These compounds are: (1) Δ5-cannabidiol (2-(6-isopropenyl-3-methyl-5-cyclohexen-l-yl)-5-pentyl-l,3-benzenediol); (2) Δ4-cannabidiol (2-(6-isopropenyl-3-methyl-4-cyclohexen-l-yl)-5-pentyl-l,3-benzenediol); (3) Δ3-cannabidiol (2-(6-isopropenyl-3-

methyl-3-cyclohexen-l-yl)-5-pentyl-l,3-benzenediol); (4) Δ3,7-cannabidiol (2-(6-isopropenyl-3-methylenecyclohex-l-yl)-5-pentyl-l,3-benzenediol); (5) Δ2-cannabidiol (2-(6-isopropenyl-3-methyl-2-cyclohexen-l-yl)-5-pentyl-l,3-benzenediol); (6) Δ1-cannabidiol (2-(6-isopropenyl-3-methyl-l-cyclohexen-l-yl)-5-pentyl-l,3-benzenediol); and (7) Δ6-cannabidiol (2-(6-isopropenyl-3-methyl-6-cyclohexen-l-yl)-5-pentyl-l,3-benzenediol).

[37] In one embodiment, the cannabis oil of the present disclosure includes ≥ 300 mg/ml of CBD, for example, ≤ 650 mg/ml, ≤ 550 mg/ml, ≤ 550 mg/ml, ≤ 460 mg/ml, ≤ 450 mg/ml, ≤ 400 mg/ml, and the like.

[38] In one embodiment, the cannabis oil of the present disclosure additionally or alternatively includes ≤ 30 mg/ml THC, for example, 30 mg/ml, ≤ 25 mg/ml, ≤ 20 mg/ml, and the like.

Cartridge component of a vaping device

[39] The cannabis oil of the present disclosure can be used in any suitable cartridge component of a vaping device.

[40] For example, Fig. 1A is a plan view of a non-limiting example of a cartridge **100** component of an electronic vaping device. A vaping device can also be referred to as a vaporizer, a vaporizer pen, a vape pen or an electronic or "e-" cigarette, for example. The cartridge **100** includes a vapor outlet **50** at one end thereof, which includes a tip **40** and sidewalls **20** and **25**, which could be sides or parts of the same cylindrical sidewall in some embodiments.

[41] The cartridge **100** further includes a liquid reservoir **60** for containing the cannabis oil. The vapor outlet **50**, in addition to sealing an end of an interior space of the liquid reservoir **60**, also provides a mouth-piece portion through which a user can draw vapor from the electronic vaping device. The mouthpiece could be tapered, as shown, or otherwise shaped for a user's comfort. The present disclosure is not limited to any particular shape of the vapor outlet **50**.

[42] The vapor outlet **50** could be made from one or more materials including metal, ceramic, wood, or a combination thereof. However, other materials could also or instead be used.

[43] The liquid reservoir **60** holds the vaporization substance prior to vaporization. The liquid reservoir **60** includes outer walls **10** and **15**, which could be a single wall such as a

cylindrical sidewall. The outer walls **10** and **15** of the liquid reservoir **60** could be made from one or more transparent or translucent materials, such as medical grade glass, in order to enable a user to visibly determine the quantity of vaporization substance in the chamber.

[44] The liquid reservoir **60** engages the vapor outlet **50**, and could be coupled to the vapor outlet **50**, via an engagement or connection at **116**. A gasket or other sealing member could be provided between the liquid reservoir **60** and the vapor outlet **50** to seal the vaporization substance in the liquid reservoir **60**.

[45] Although some liquid reservoir are "non-recloseable" (or sealable) and cannot be opened after initial filling, others are recloseable chambers in which the engagement at **116**, between the vapor outlet **50** and the liquid reservoir **60**, is releasable. For example, the vapor outlet **50** could be a cover that releasably engages the liquid reservoir **60** and seals a vaporization substance in the liquid reservoir **60**, thereby preventing the vaporization substance from leaking out of the liquid reservoir **60**. A releasable engagement could include, for example, a threaded engagement or other type of connection, or an abutment between the liquid reservoir **60** and the vapor outlet **50**, without necessarily an actual connection between the chamber and the vapor outlet. Such a releasable engagement permits the vapor outlet **50** to be disengaged or removed from the liquid reservoir **60** so that the chamber can be cleaned, emptied, and/or filled with a vaporization substance, for example. The vapor outlet **50** could then re-engage with the liquid reservoir **60** to seal the vaporization substance inside the chamber.

[46] Fig. 1A also illustrates a stem **110** inside the liquid reservoir **60**. The stem **110** is a hollow tube or air channel through which vapor can be drawn into and through vapor outlet **50**. The stem **110** may also be referred to as a central column, a central post, a chimney, a hose or a pipe. Materials such as stainless steel, other metal alloys, plastics and ceramics could be used for stems such as the stem **110**. The stem **110** couples the vapor outlet **50** via an engagement or connection (not shown). The stem **110** may include at its base one or more intake holes (not shown) having a suitable opening size, such as for example 1.2 or 1.6 mm.

[47] In one embodiment, screwing the vapor outlet **50** onto the stem **110** could also engage the vapor outlet **50** with the liquid reservoir **60**, or similarly screwing the vapor outlet **50** onto the liquid reservoir **60** could also engage the vapor outlet **50** with the stem **110**.

[48] Fig. 1B shows a battery compartment **200** that includes supplies power to the cartridge **100**. The battery compartment **200** engages, and could also be coupled to the cartridge **100** via a

female engagement 130 which receives a male thread 30 present at an end of the cartridge 100. In this embodiment, the engagement 130 and thread 30 is a releasable engagement. However, in some embodiments, this could be a fixed connection. In some embodiments, the thread 30 may take the form of a 510 thread, which typically may include a connector having a length of 5 mm and having 10 threads. In the embodiment shown, the releasable engagement enables removal or disengagement of the battery compartment **200** from the cartridge **100** to permit recharging of the battery contained within the elongated body **210** of the battery compartment **200** or permuting the battery compartment **200** with another identical or different battery compartment **200'**.

[49] The battery compartment **200** generally includes circuitry to supply power to the cartridge **100**. For example, the battery compartment **200** could include electrical contacts that connect to corresponding electrical contacts with the battery. The battery compartment **200** could further include electrical contacts that connect to corresponding electrical contacts in the cartridge **100**. The battery compartment **200** could reduce, regulate or otherwise control the power/voltage/current output from the battery. However, this functionality could also or instead be provided by the battery itself. The battery compartment **200** could be made from one or more materials including metals, plastics, elastomers and ceramics, for example, to carry or otherwise support other base components such as contacts and/or circuitry. However, other materials could also or instead be used.

[50] The battery compartment **200** includes sidewalls **140** and **141**, a bottom **142** and a button **144**. The sidewalls **140** and **141**, could be a single wall such as a cylindrical sidewall. The battery compartment **200** could include single-use batteries or rechargeable batteries such as lithium-ion batteries. The battery compartment **200** powers the vaporization device and allows powered components of the vaporization device, including at least the cartridge **100**, to operate. Other powered components could include, for example, one or more light-emitting diodes (LEDs), speakers or other indicators of device power status (on / off), device usage status (on when a user is drawing vapor), etc. In some embodiments, speakers and/or other audible indicators could produce long, short or intermittent "beep" sounds as a form of indicator of different conditions.

[51] As noted above, in some embodiments, the vapor outlet **50**, the liquid reservoir **60**, the stem **110**, the battery compartment **200** are cylindrical in shape or otherwise shaped in a way such that sidewalls that are separately labeled in Fig. 1A and/or Fig. 1B could be formed by a single

sidewall. In these embodiments, the sidewalls **140** and **141** represent sides of the same sidewall. Similar comments apply to outer walls **10** and **15**, and sidewalls **20** and **25**, and other walls that are shown in the drawings and/or described herein. However, in general, vapor outlets, liquid reservoirs, stems, cartridges, battery compartments that are not cylindrical in shape are also contemplated. For example, these components could be rectangular, triangular, or otherwise shaped.

[52] It should be appreciated, that the example cartridge **100** and the example battery compartment **200** are solely for the purpose of illustration. Other embodiments are also contemplated. For example, the vaping device could be a multi-chamber device vape device or a pen-and-pod device as commercialized by PAX (e.g., the PAX Era™).

Definitions

[53] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by a person of ordinary skill in the art to which the present invention pertains. As used herein, and unless stated otherwise or required otherwise by context, each of the following terms shall have the definition set forth below.

[54] For the purpose of this specification, the expression "vaporization temperature" in the context of cannabis vaping oil means the temperature which allows formation of an aerosol (commonly called vapor) from the cannabis vaping oil, which contains one or more cannabinoid(s), and which a user of the vaping device can inhale. The vaporization temperature is not a fixed value. Cannabinoids will likely typically evaporate within a range of temperatures, especially when the vaporization is assisted by air flow or suction created by a user's mouth. For example, CBD doesn't have a clear set boiling point; it is more in the 160-180 °C range, and while THC has been reported as having a boiling point at 157 °C, the fact is that both will start to sublimate off at a lower temperature. At the lower end of the range, the evaporation will be slower and conversely at the high end of the range the evaporation will be quicker. Hence, "vaporization temperature", therefore, refers to any temperature in that range where a cannabinoid is evaporated for inhalation and subsequent desired effect on the human body. The vaporization temperature of pure cannabinoids can be found, for example, in McPartland and Russo (*J. of Cannabis Therapeutics*, Vol. 1, No. 3/4, 2011, p. 103-132).

[55] For the purpose of this specification, the expression "target viscosity" in

reference to a cannabis vaping oil means the highest viscosity value at room temperature which remains suitable for use in a particular vaping device and allow proper use of that vaping device, e.g., for loading cannabis oil into the cartridge, properly feeding the cannabis oil to the heating element of the vaping device in order to vaporize one or more cannabinoid(s) while minimizing clogging of cartridge internal components, the viscosity of the cannabis oil may also assist with the

performance of the vaping device such as by preventing or minimizing leakage of the cannabis oil from the vaping device when not in use, and optimizing the performance of the vaping device and its delivery of the cannabinoid(s), and the like.

[56] For the purpose of this specification, the expression "cannabis concentrates" means an extract of a cannabis plant that concentrates a cannabinoid concentration by processing a cannabis plant to purify / isolate the cannabinoids. Typically, cannabis concentrates have a viscosity, which is too high for use in a vaping device, but has a flash point, which is equal to or above the vaporization temperature of the cannabinoids.

[57] For the purpose of this specification, the expression "cannabis oil" refers to an oil that contains anything referred to in item 1 or 3 of Schedule 1 of the Canadian *Cannabis Act* S.C. 2018, c.16 and that is in liquid form at a temperature of 22 ± 2°C.

[58] The term "vegetable glycerin (VG)" is also known in the art as "monoglycerol" or "glycerol", generally obtained from plant and animal sources where it occurs as triglycerides.

[59] The term "polyethylene glycol (PEG)" is also known in the art as polyethylene oxide (PEO) or polyoxyethylene (POE), depending on its molecular weight and refers to a compound with the chemical formula $H-(O-CH_2-CH_2)_n-OH$.

[60] The term "propylene glycol" is also known in the art as propane-1,2-diol and refers to a synthetic organic compound with the chemical formula $C_3H_8O_2$.

[61] The term "of plant origin" is used interchangeably with "plant-based" or with "plant-derived" and refers to a compound that is extracted or prepared from plant raw material. In one embodiment, this compound can be synthetic.

[62] The term "essential oil" does not mean indispensable as with the terms essential amino acid or essential fatty acid which are so called since they are nutritionally required by a given living organism, rather, the essential oil is "essential" in the sense that it contains the "essence of" or "at least a portion of the essence of" the plant's fragrance - the characteristic fragrance of the plant from which it is derived. Essential oils are generally extracted by distillation, often by using steam. Other processes include expression, solvent extraction, sfumatura, absolute oil extraction, resin tapping, wax embedding, and cold pressing. As such, in the present disclosure,

essential oils are a concentrated hydrophobic liquid containing volatile aroma compounds from plants.

EXAMPLES

[63] The following examples describe some exemplary modes of making and practicing certain compositions that are described herein. It should be understood that these examples are for illustrative purposes only and are not meant to limit the scope of the disclosure.

Example 1 – Cartridge

[64] In accordance with a non-limiting example of the present disclosure, the inventors propose to use an A3-C full ceramic vape cartridge (Transpring Technology, USA) in order to test the cannabis oil of the present disclosure.

[65] The A3-C full ceramic vape cartridge has a full ceramic heating core, a 0.5 ml liquid reservoir, a resistance of 1.4/1.6Ω, and 1.2 mm/1.6 mm oil intake hole size. The liquid reservoir is made of medical grade glass and the rest of the cartridge is made of chrome-plated brass. The cartridge includes a 510 thread for coupling with the battery compartment.

Example 2 – Battery compartment

[66] In accordance with a non-limiting example of the present disclosure, the inventors propose to use an L0-A vape battery compartment (Transpring Technology, USA) in order to test with the A3-C cartridge of example 1.

[67] The L0-A vape battery has a capacity of 320 mAh, an output voltage of 2.6-4.0V with 3 adjustable voltages (green 2.6V, blue 3.3V, red 4.0V), a preheating output of 1.8V, a preheating time of 15 seconds, and 2 optional vaping ways: vape directly / vape with button-pressing.

Example 3 – Additive

[68] In accordance with a non-limiting example of the present disclosure, the inventors tested a number of additives.

[69] In order to be safe and, thus, suitable for vaping, the inventors sought to identify an additive having a proper flash point, i.e., at least 200 °F (at least 93.3 °C). This is because a number of cannabinoids require temperatures of at least 200 °F in order to vaporize, such that

having a cannabis vaping oil containing an additive with a flash point below 200 °F in proportions sufficient to reduce the flash point of the mixture to values below 200 °F would likely represent a fire / explosion hazard when heated in the vaping device.

[70] The inventors first set out to identify the flash point of a number of candidate additives. Several models were used and their results compared. The following table 1 sets out the flash point of these candidate additives:

TABLE 1

Candidate additive	**Flash point (°C)**	**WHIMS***
d-limonene	45	2
Orange sweet (*Citrus sinensis*)	45	3
b-myrcene	39	2
Pine (*Pinus sylvestris*)	43	2
Fir (*Abies siberica* or *Abies balsamea*)	45	3
Juniper Berry (*Juniperus communis*)	43	2
lemon Lime Flavor	25	3
peppermint	69	2
Vegetable Glycerin USP	160	1
Propylene Glycol	99	1

*Workplace Hazardous Materials Information System

[71] Except for vegetable glycerin (VG) and propylene glycol (PG), none of the candidate additives has a flash point equal to or above the vaporization temperature of at least 200 °F (at least 93.3 °C). Note that this vaporization temperature is in practice near the lower end of the vaporization range of certain cannabinoids. In other words, for a faster and stronger effect on the human body a higher vaporization temperature should be used, further amplifying the flash point differential and the attendant hazard.

Example 4 – Nicotine vaping carrier oils

[72] In accordance with a non-limiting example of the present disclosure, the inventors sought to better understand whether using additives typically used in nicotine-based vaping devices, was more suitable for using in the cannabis vaping oil of the present disclosure.

[73] The additives assessed are petroleum-based propylene glycol (PG) and polyethylene glycol 400 (PEG 400), and natural agents vegetable glycerin (VG) and medium chain triglycerides (MCT). Troutt and DiDonato (J Altern Complement Med. 2017 Nov;23(11):879-884) report that heating these oils at temperatures appropriate for cannabis oil vaporization (e.g., at 230 °C) resulted in formation of vapor containing harmful carbonyls, such as acetaldehyde, acrolein, and formaldehyde. To test the levels of the three carbonyl compounds screened for, each thinning agent was vaporized in 3 blocks of 25 'puffs', for a total of 75 puffs per agent. Puffs were vaporized every 30 seconds, each for a duration of 4 seconds and a volume of 55 mL. The vapor was then analyzed using high-performance liquid chromatography (HPLC) to individually measure amounts of acetaldehyde, acrolein, and formaldehyde.

[74] Analyses showed that PEG 400 produced significantly higher levels of acetaldehyde and formaldehyde than PG, MCT, and VG. Formaldehyde production was also significantly greater in PG compared with MCT and VG. Acrolein production did not differ significantly across the agents. PG and PEG 400 produced high levels of acetaldehyde and formaldehyde when heated to 230°C. Formaldehyde production from PEG 400 isolate was particularly high, with one inhalation accounting for 1.12% of the daily exposure limit, nearly the same exposure as smoking one cigarette.

[75] These results are in line with those disclosed by Grana et al., (Circulation, 2014; 129:1972-1986) where vapors produced from vaping device using liquid material containing nicotine and propylene glycol (PG) with or without vegetable glycerin (VG) produced 0.2 to 5.61 μg of formaldehyde per puff, which while may appear safer than the 1.6 to 52 μg of formaldehyde produced by one puff from a tobacco cigarette, nevertheless, has been perceived as not being ideal from a public health policy perspective.

[76] As such, the inventors have concluded that the PG, PEG and VG typically used in nicotine-based vaping devices are not without health risk when used in the cannabis vaping oil of the present disclosure.

Example 5 – Cannabis oil flash point

[77] The inventors discovered that even though an additive mixed with the cannabis concentrate has a flash point below the desired vaporization temperature, the cannabis concentrate, nevertheless, owing to its relatively high flash point operates to increase the flashpoint of the mixture such that it is equal to or above the desired vaporization temperature. Accordingly, it is therefore possible to provide a cannabis oil for vaping that is safe, in terms of reducing the likelihood of explosion in the vaping device resulting from a flash temperature of the cannabis oil that is too low, the viscosity of the cannabis oil is in the proper range and can be used in the vaping device and finally does not produce the harmful vapors produced by propylene glycol (PG), polyethylene glycol 400 (PEG 400) and vegetable glycerin (VG).

[78] The precis physical properties of cannabinoids are not known. The inventor had to use various mathematical models from the field of thermodynamics to calculate the flashpoint of cannabinoids. (Hristova and Tchaoushev, *J. of University of Chemical Technology and Metallurgy*, 41, 3, 2006, p. 291-296.) Several models were used to calculate the mixture's flash point and their results compared. The person of skill will realize that these calculations were made instead of proceeding with actually attempting to flash the mixture in a laminar hood because of obvious hazard risks (exploding on purpose a mixture). The following table 2 sets out the outcome of these results, for a number of cannabis oil formulation prepared by mixing cannabis concentrate (containing 2.14% THC and 84.6 % CBD) and peppermint oil (50 ml) at room temperature without heating.

TABLE 2

Cannabis Concentrate added (g)	**THC concentration (mg/ml)**	**CBD concentration (mg/ml)**	**Flash point equal to or above vaporization temperature?**
6	5.1	93.3	No
29	13.12	304	Yes
63	20.496	466	Yes
95	24.85	558	Yes
190	30.272	666	Yes

[79] To elaborate, adding 63 g of cannabis concentrate to 50 ml produced a 113 g sample. In this sample, the peppermint oil weight is 44.25% and the cannabis concentrate weight is 55.75%. The calculations were made using the following average flash points: CBD (149 °C), THC (137 °C), and peppermint oil (75 °C).

[80] The first calculation took into effect the contribution of CBD to peppermint oil, with the following equation: 1/(wt.% CBD x CBD average flash point) + (wt.% peppermint oil x peppermint oil average flash point). The first calculation gave a first calculated flash point of 93.69 °C – higher than the flash point of peppermint oil on its own. To this first calculation, the inventors made a second calculation using a similar formula by adding the contribution of THC, which resulted in a second calculated flash point of 98.48 °C.

[81] The inventors then made a third calculation by taking into account the remaining cannabinoids and wax content present in the cannabis concentrate in terms of their effect on the flash point; the inventors calculated that the contribution of the remaining cannabinoids was a factor of 1.68, which resulted in a third calculated flash point of 157.39 °C (314.6 °F).

[82] In performing these calculations, the inventors discovered that using at least about 40 wt.% cannabis concentrate relative to total weight of the additive was ideal in terms of having a flash point for the mixture which was suitable for using in a vape device at the vaporization temperatures. In other words, by increasing the relative amount of cannabis concentrate, the inventors were able to resolve the flash point issue observed with the additive on its own. This was surprising and unexpected. The same calculations were repeated with d-limonene and similar results were obtained. The inventors reasonably expect that cannabis vaping oils with such proportions of cannabis concentrate will be suitable for use in a vaping device.

Example 6 – Cannabis vaping oil saturation

[83] In accordance with a non-limiting example of the present disclosure, the inventors sought to test the viscosity obtained with mixing various amounts of the additive with the cannabis concentrate and assess whether the resulting viscosity was suitable for use in a vaping device. The following table 3 sets out a number of cannabis oil formulation prepared by mixing various amounts of cannabis concentrate (containing 2.14% THC and 84.6 % CBD) and peppermint oil (50 ml) at room temperature without heating.

TABLE 3

Cannabis Concentrate added (g)	Amounts of cannabinoids (g)	CBD concentration (mg/ml)	Concentrate to oil (%)
1	0.868	15.10	2.00
2	1.735	30.20	4.00
3	2.603	45.30	6.00
4	3.470	60.40	8.00
5	4.338	75.50	10.00
6.15	5.335	92.86	12.30
5.31	4.606	80.18	10.62
8	6.940	120.80	16.00
9	7.808	135.90	18.00
10	8.675	150.99	20.00
17.88	15.511	269.98	35.76
20	17.350	301.99	40.00
29.34	25.452	443.02	58.68
40	34.700	603.98	80.00
50	43.375	754.97	100.00
63.86	55.399	964.25	127.72
95.72	83.037	1445.32	191.44
133.1	115.464	2009.74	266.20
190.76	165.484	2880.38	381.52

[84] The following table 4 sets out a number of additional cannabis oil formulation prepared by mixing various amounts of cannabis concentrate (containing 2.14% THC and 84.6 % CBD) and peppermint oil (100 ml) at room temperature without heating.

TABLE 4

Cannabis Concentrate added (g)	Amounts of cannabinoids (g)	CBD concentration (mg/ml)	Concentrate to oil (%)
20	17.35000	150.99	20.00
40	34.70000	301.99	40.00
50	43.37500	377.49	50.00
80	69.40000	603.98	80.00

[85] The inventors discovered that using up to 190 g cannabis concentrate with 50 ml (i.e., 380 wt.%) of additive afforded cannabis vaping oil, which still flows at room temperature and can still be pipetted in a pipette, i.e., meeting the desired characteristic that the mixture remains liquid at room temperature.

[86] The inventors further optimized the relative proportions of cannabis concentrate to additive in order to obtain an optimum flash point for the mixture which is equal to or above the vaporization temperature of specific cannabinoids while maintaining an optimum viscosity below the threshold viscosity (at which is intended to function the vaping device), which affords optimal use in a vaping device. The optimized proportions discovered by the inventors are in the range of 40 to 70 wt.% of cannabis concentrate to additive.

[87] Other examples of implementations will become apparent to the reader in view of the teachings of the present description and as such, will not be further described here.

[88] Note that titles or subtitles may be used throughout the present disclosure for convenience of a reader, but in no way these should limit the scope of the invention. Moreover, certain theories may be proposed and disclosed herein; however, in no way they, whether they are right or wrong, should limit the scope of the invention so long as the invention is practiced according to the present disclosure without regard for any particular theory or scheme of action.

[89]

[90] It will be understood by those of skill in the art that throughout the present specification, the term "a" used before a term encompasses embodiments containing one or more to what the term refers. It will also be understood by those of skill in the art that

throughout the present specification, the term "comprising", which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, un-recited elements or method steps.

[91] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention pertains. In the case of conflict, the present document, including definitions will control.

[92] As used in the present disclosure, the terms "around", "about" or "approximately" shall generally mean within the error margin generally accepted in the art. Hence, numerical quantities given herein generally include such error margin such that the terms "around", "about" or "approximately" can be inferred if not expressly stated.

[93] Although various embodiments of the disclosure have been described and illustrated, it will be apparent to those skilled in the art in light of the present description that numerous modifications and variations can be made. The scope of the invention is defined more particularly in the appended claims.

CLAIMS

1. Method of manufacturing a batch of vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device, the method comprising:

    a) selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity and having a flash point above the vaporization temperature;

    b) selecting an additive having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); and

    c) determining a concentration of additive that (i) will reduce the viscosity of the cannabis concentrate sufficiently low for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature;

    d) manufacturing the batch of vaping oil including the cannabis concentrate of a) and the additive of b) on the basis of the concentration determined in c).

2. The method of claim 1, wherein the vaping oil includes cannabidiol (CBD).

3. The method of claim 2, wherein the vaping oil includes $\geq$ 400 mg/ml of CBD.

4. The method of claim 2, wherein the vaping oil includes $\geq$ 550 mg/ml of CBD.

5. The method of claim 2, wherein the vaping oil includes $\geq$ 650 mg/ml of CBD.

6. The method of any one of claims 1 to 5, wherein the vaping oil includes tetrahydrocannabinol (THC).

7. The method of claim 6, wherein the vaping oil includes $\leq$ 30 mg/ml THC.

Date Reçue/Date Received 2020-10-29

8. The method of any one of claims 1 to 7, the cannabis concentrate being in a proportion of ≥ 40 wt.% relative to a weight of the additive.

9. The method of claim 8, the cannabis concentrate being in a proportion of ≤ 70 wt.% relative to the weight of the additive.

10. The method of any one of claims 1 to 9, wherein the additive is an oil of plant origin.

11. The method of claim 10, wherein the oil of plant origin is selected from the group consisting of d-limonene, Citrus sinensis, b-myrcene, Pinus sylvestris, Abies siberica, Abies balsamea, Juniperus communis, lemon Lime Flavor, peppermint oil, and any combinations thereof.

12. The method of claim 10, wherein the oil of plant origin includes a terpene.

13. The method of claim 10, wherein the oil of plant origin includes d-limonene.

14. The method of any one of claims 1 to 13, wherein the vaporization temperature is above 200 °F.

15. The method of any one of claims 1 to 14, wherein the manufacturing is performed at room temperature without heating.

16. The method of any one of claims 1 to 15, wherein the cannabis concentrate includes more than one cannabinoid.

17. The method of any one of claims 1 to 16, wherein the vaping oil includes more than one terpene.

18. Method of manufacturing a batch of vaping oil including a cannabinoid, the vaping oil having a viscosity at room temperature suitable for use in a vaping device and being free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG), the method comprising:

    a) selecting a cannabis concentrate including the cannabinoid, the cannabinoid having a vaporization temperature, the cannabis concentrate having a viscosity at room temperature which is above the vaping oil viscosity and having a flash point above the vaporization temperature;

Date Reçue/Date Received 2020-10-29

b) selecting a terpene having a viscosity below the vaping oil viscosity and having a flash point below the vaporization temperature, the terpene operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and terpene; and

c) determining a concentration of terpene that (i) will reduce the viscosity of the cannabis concentrate sufficiently low for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature;

d) manufacturing the batch of vaping oil including the cannabis concentrate of a) and the terpene of b) on the basis of the concentration determined in c).

19. The method of claim 18, wherein the vaping oil includes cannabidiol (CBD).

20. The method of claim 19, wherein the vaping oil includes $\geq$ 400 mg/ml of CBD.

21. The method of claim 19, wherein the vaping oil includes $\geq$ 550 mg/ml of CBD.

22. The method of claim 19, wherein the vaping oil includes $\geq$ 650 mg/ml of CBD.

23. The method of any one of claims 18 to 22, wherein the vaping oil includes tetrahydrocannabinol (THC).

24. The method of claim 23, wherein the vaping oil includes $\leq$ 30 mg/ml THC.

25. The method of any one of claims 18 to 24, the cannabis concentrate being in a proportion of $\geq$ 40 wt.% relative to a weight of the terpene.

26. The method of claim 25, the cannabis concentrate being in a proportion of $\leq$ 70 wt.% relative to the weight of the terpene.

27. The method of any one of claims 18 to 26, wherein the terpene includes d-limonene.

Date Reçue/Date Received 2020-10-29

28. The method of any one of claims 18 to 26, wherein the terpene is selected from the group consisting of Citrus sinensis, b-myrcene, Pinus sylvestris, Abies siberica, Abies balsamea, Juniperus communis, lemon Lime Flavor, peppermint oil, and any combinations thereof.

29. The method of any one of claims 18 to 28 wherein the vaporization temperature is above 200 °F.

30. The method of any one of claims 18 to 29, wherein the manufacturing is performed at room temperature without heating.

31. The method of any one of claims 18 to 30, wherein the cannabis concentrate includes more than one cannabinoid.

32. The method of any one of claims 18 to 31, wherein the vaping oil includes more than one terpene.

33. A method for manufacturing a vape cartridge for a vaping device, the method comprising:
    a. providing a vape cartridge including:
        i. an unfilled reservoir for receiving a vaping oil containing a cannabinoid characterized by a vaporization temperature;
        ii. vaporization means that includes a ceramic core configured to achieve vaporization of the cannabinoid wherein the vaping oil supplied to the vaporization means has a viscosity at room temperature that does not exceed a predetermined viscosity threshold;
    b. formulating the vaping oil according to the predetermined viscosity threshold such that the vaping oil is suitable for use in the vape cartridge, the formulating including:
        i. providing a cannabis concentrate including the cannabinoid, the cannabis concentrate having a viscosity at room temperature which is above the predetermined viscosity threshold;
        ii. providing an additive having a viscosity below the predetermined viscosity threshold and having a flash point below the vaporization temperature, the additive operating to lower the viscosity of the cannabis concentrate and operating to lower a flash point of a mixture of the cannabis concentrate and

Date Reçue/Date Received 2020-10-29

additive, wherein the additive is free of Vegetable Glycerin (VG), Polyethylene Glycol (PEG), and Propylene Glycol (PG); and

iii. determining a concentration of the additive required to simultaneously achieve:

1. a mixture viscosity at room temperature at or below the predetermined viscosity threshold;
2. a mixture flashpoint above the vaporization temperature;

iv. manufacturing the batch of vaping oil including the cannabis concentrate of b) (i) and the additive of b) (ii) on the basis of the concentration determined in b) (iii);

c. filling the reservoir with the vaping oil of b) (iv).

34. The method of claim 33, wherein the vaping oil includes cannabidiol (CBD).

35. The method of claim 34, wherein the vaping oil includes $\geq$ 400 mg/ml of CBD.

36. The method of claim 34, wherein the vaping oil includes $\geq$ 550 mg/ml of CBD.

37. The method of claim 34, wherein the vaping oil includes $\geq$ 650 mg/ml of CBD.

38. The method of any one of claims 33 to 37, wherein the vaping oil includes tetrahydrocannabinol (THC).

39. The method of claim 38, wherein the vaping oil includes $\leq$ 30 mg/ml THC.

40. The method of any one of claims 33 to 39, the cannabis concentrate being in a proportion of $\geq$ 40 wt.% relative to a weight of the additive.

41. The method of claim 40, the cannabis concentrate being in a proportion of $\leq$ 70 wt.% relative to the weight of the additive.

42. The method of any one of claims 33 to 41, wherein the additive comprises a terpene.

43. The method of any one of claims 33 to 41, wherein the additive is selected from the group consisting of Citrus sinensis, b-myrcene, Pinus sylvestris, Abies siberica, Abies balsamea, Juniperus communis, lemon Lime Flavor, peppermint oil, and any combinations thereof.

Date Reçue/Date Received 2020-10-29

44. The method of any one of claims 33 to 43 wherein the vaporization temperature is above 200 °F.

45. The method of any one of claims 33 to 44, wherein the manufacturing is performed at room temperature without heating.

46. The method of any one of claims 33 to 45, wherein the vape cartridge includes a connector at one end thereof to engage with a battery compartment of the vaping device.

47. The method of claim 46, wherein the connector is a 510 thread.

48. The method of any one of claims 33 to 47, wherein the cannabis concentrate includes more than one cannabinoid.

49. The method of any one of claims 33 to 48, wherein the vaping oil includes more than one terpene.

50. The method of any one of claims 1 to 49, wherein the cannabis concentrate is a cannabis distillate.

51. The method of any one of claims 1 to 49, wherein the cannabis concentrate is a winterized cannabis concentrate.

52. The method of any one of claims 1 to 49, wherein the cannabis concentrate is a non-winterized cannabis concentrate.

53. Method of any one of claims 1 to 17 or 33 to 52, wherein determining the concentration of additive includes

> determining a range of concentrations of the additive that (i) will reduce the viscosity of the cannabis concentrate sufficiently for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature and selecting a particular concentration of the additive in the range of concentrations.

54. Method of any one of claims 18 to 32, wherein determining the concentration of additive includes

Date Reçue/Date Received 2020-10-29

determining a range of concentrations of the terpene that (i) will reduce the viscosity of the cannabis concentrate sufficiently for the mixture to be suitable for use in the vaping device and (ii) while avoiding reducing the flash point of the mixture below the vaporization temperature and selecting a particular concentration of the terpene in the range of concentrations.

Date Reçue/Date Received 2020-10-29

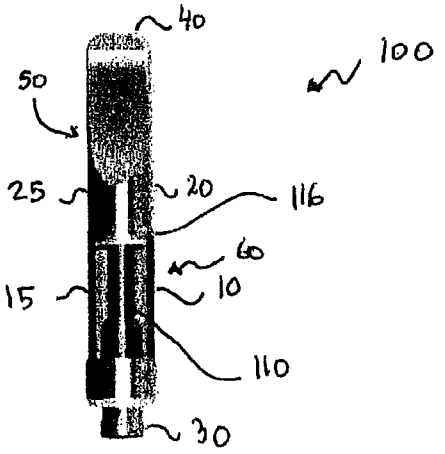

Fig. 1A

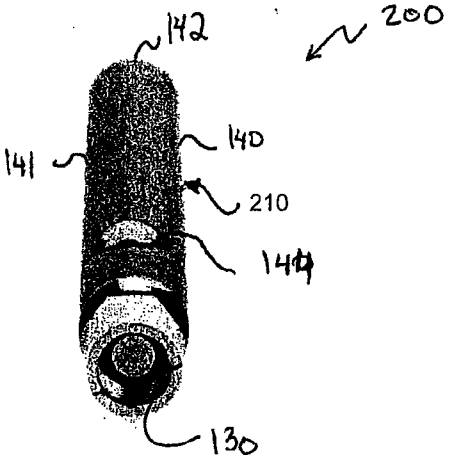

Fig. 1B

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