US011351212B2

(12) **United States Patent**
Young

(10) **Patent No.: US 11,351,212 B2**
(45) **Date of Patent: *Jun. 7, 2022**

(54) **METHOD OF DRYING BOTANICALS**

(71) Applicant: **Eric Young**, Bellingham, WA (US)

(72) Inventor: **Eric Young**, Bellingham, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/844,643**

(22) Filed: **Apr. 9, 2020**

(65) **Prior Publication Data**

US 2020/0230188 A1 Jul. 23, 2020

Related U.S. Application Data

(63) Continuation-in-part of application No. 16/796,031, filed on Feb. 20, 2020, now Pat. No. 11,191,797, which is a continuation of application No. 16/376,735, filed on Apr. 5, 2019, now Pat. No. 10,639,340.

(60) Provisional application No. 62/686,424, filed on Jun. 18, 2018.

(51) **Int. Cl.**

A61K 36/00	(2006.01)
A61K 36/185	(2006.01)
A61K 9/20	(2006.01)
A61K 9/48	(2006.01)

(52) **U.S. Cl.**
CPC ***A61K 36/185*** (2013.01); *A61K 9/20* (2013.01); *A61K 9/48* (2013.01); *A61K 2236/17* (2013.01); *A61K 2236/33* (2013.01); *A61K 2236/37* (2013.01); *A61K 2236/51* (2013.01)

(58) **Field of Classification Search**
CPC A61K 2236/17; A61K 2236/51
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2011/0021617 A1* 1/2011 Korthout A61K 31/192 514/454

FOREIGN PATENT DOCUMENTS

KR 2004099183 A * 11/2004

* cited by examiner

Primary Examiner — Qiuwen Mi
(74) *Attorney, Agent, or Firm* — KW Law, LLP

(57) **ABSTRACT**

A method for drying to increase the useful life of botanicals and shorten the time to market after harvest of the botanicals. The method may include flash freezing the botanicals, at a desired optimal temperature range, soon after harvest. The method may include storing the frozen botanicals indefinitely prior to drying. The method may include drying the frozen botanicals using a lyophilizer at a desired optimal temperature and pressure.

11 Claims, 4 Drawing Sheets

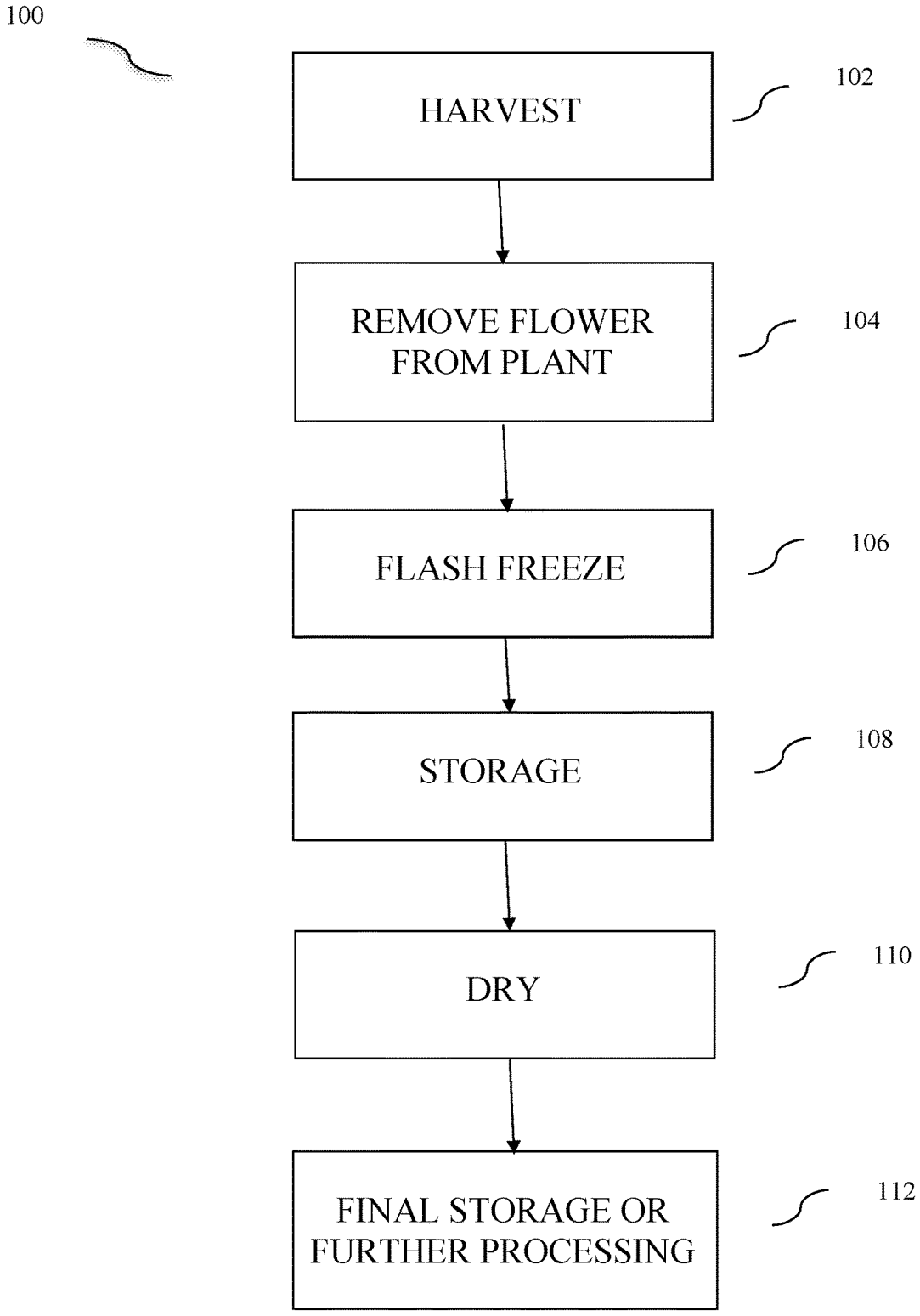

100
HARVEST
102
REMOVE FLOWER FROM PLANT
104
FLASH FREEZE
106
STORAGE
108
DRY
110
FINAL STORAGE OR FURTHER PROCESSING
112

Fig. 1

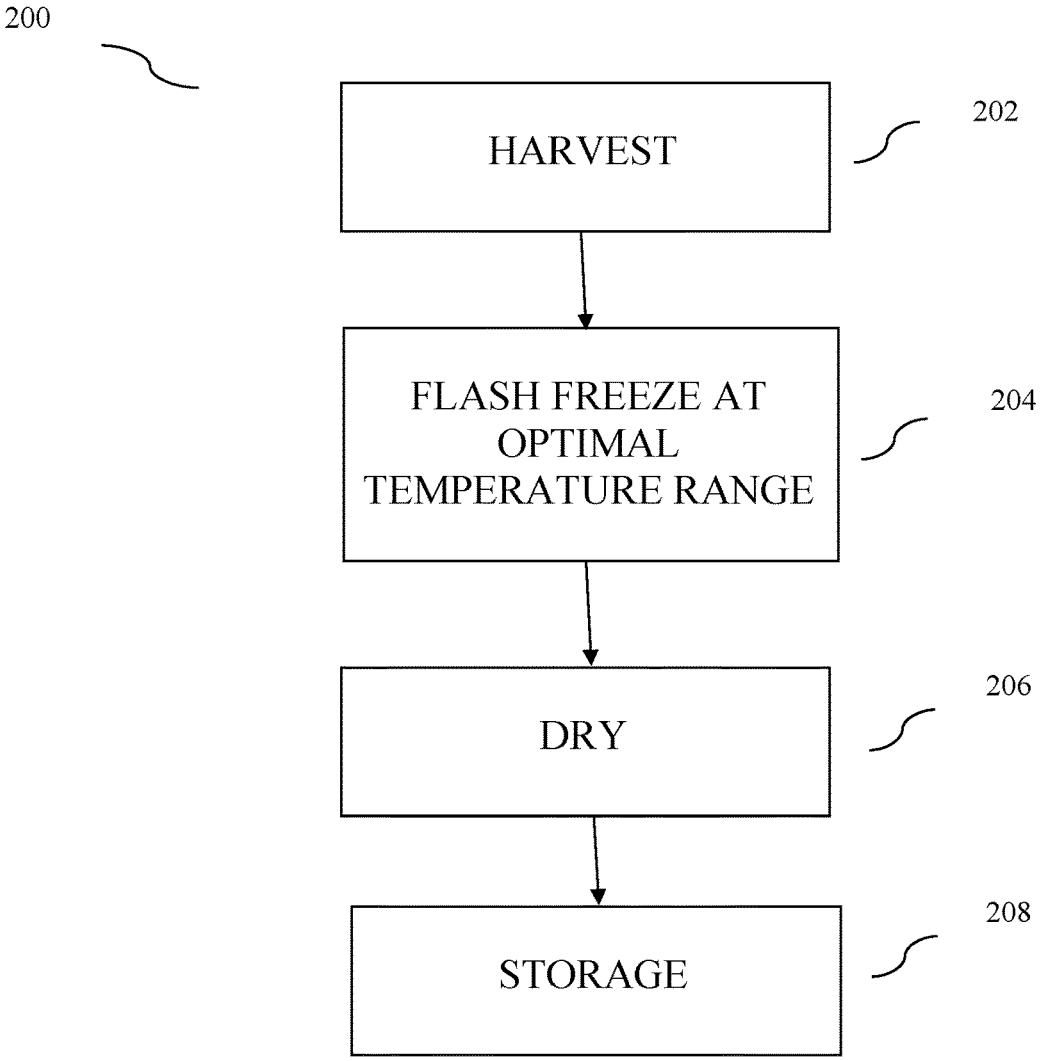

200
HARVEST
202
FLASH FREEZE AT OPTIMAL TEMPERATURE RANGE
204
DRY
206
STORAGE
208

Fig. 2

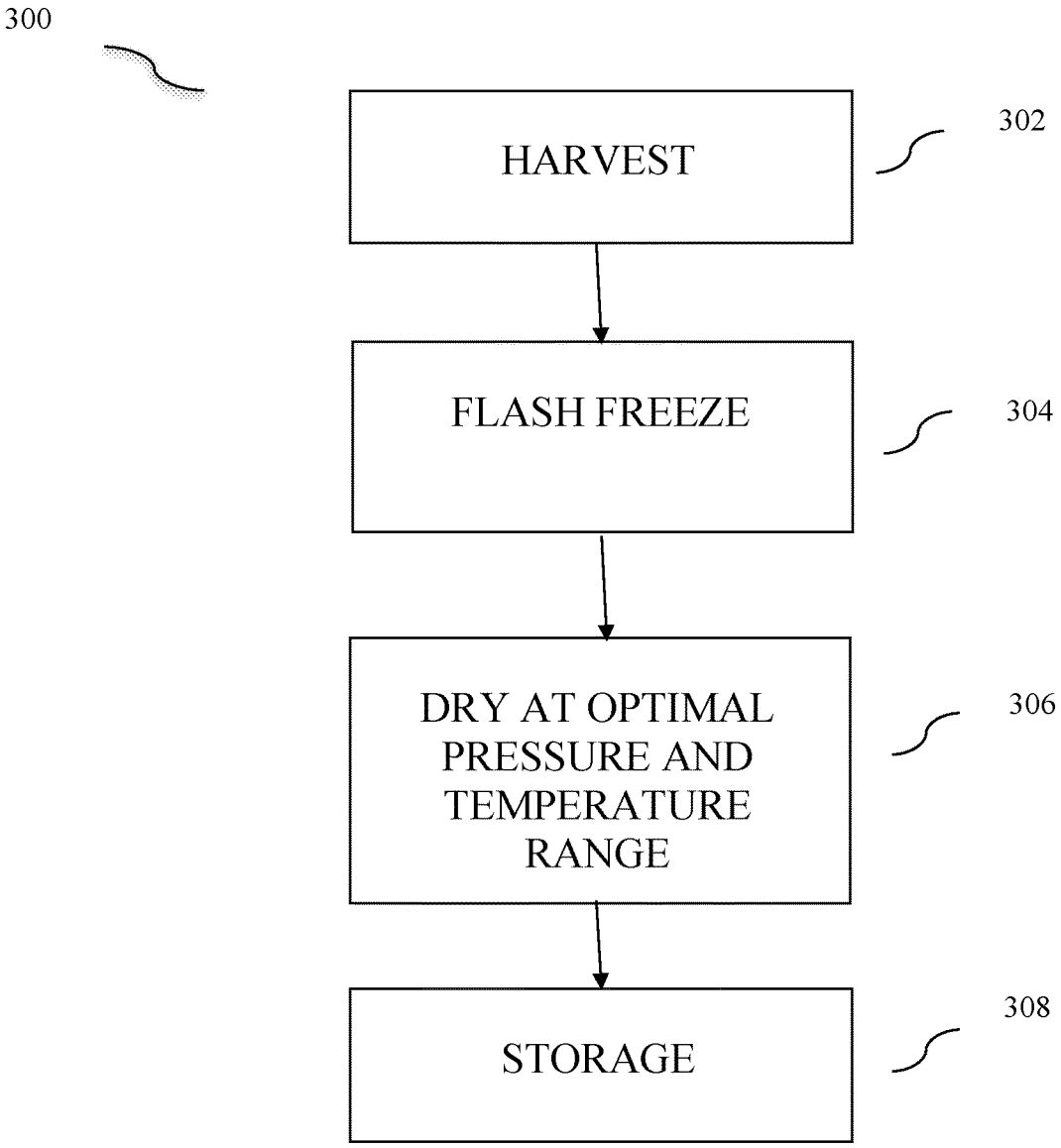

300
HARVEST
302
FLASH FREEZE
304
DRY AT OPTIMAL PRESSURE AND TEMPERATURE RANGE
306
STORAGE
308

Fig. 3

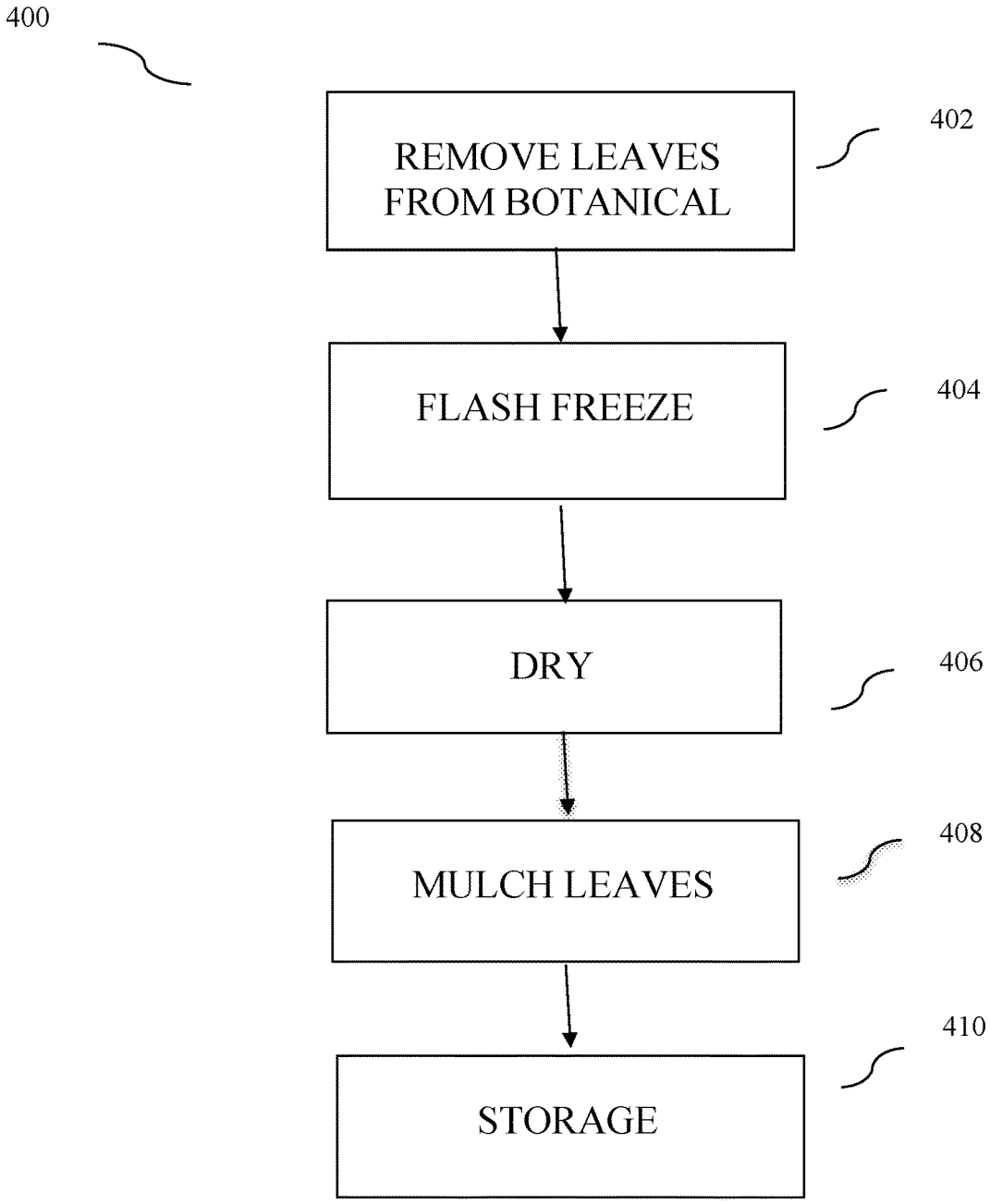

400
REMOVE LEAVES FROM BOTANICAL
402
FLASH FREEZE
404
DRY
406
MULCH LEAVES
408
STORAGE
410

Fig. 4

METHOD OF DRYING BOTANICALS

RELATED APPLICATIONS

This application is a continuation-in-part application of U.S. patent application Ser. No. 16/796,031 titled "Method of Drying Botanicals" filed on Feb. 20, 2020, which is a continuation application of U.S. patent application Ser. No. 16/376,735 titled "Method of Drying Botanicals" filed on Feb. 5, 2019, which claims priority to U.S. Provisional Application No. 62/686,424 titled "Method of Drying Botanicals" and filed on Jun. 18, 2018, the disclosures of which are incorporated by reference as if fully set forth herein for all purposes.

BACKGROUND

The present disclosure relates generally to processing botanical items. In particular, methods of drying the botanical items are described.

Conventional techniques for drying botanicals involve slowly drying the harvested botanicals by hanging them in a cool, dry room for several weeks. This process leads to quicker degradation of the appearance and compounds in the botanical. Once the botanical is dry, trimming it is difficult. Where the botanical is *cannabis*, the leaves are generally considered useless and are discarded.

Thus, there exists a need for drying that improves upon and advance the design of known method for processing botanicals, which also includes hemp and *cannabis*. Examples of new and useful drying methods relevant to the needs existing in the field are discussed below.

SUMMARY

The methods discussed below dramatically improve the overall appearance, quality, and shelf life of dried botanicals, while decreasing the drying time. According to one aspect of the invention, the improved dried botanical is produced by flash freezing a harvested botanical until the moisture content is solidified. The frozen botanical is dried by sublimating the solidified moisture content to a gas, while continuously removing the gas from the botanical. The resulting dried botanical generally maintains it original volumetric dimensions and maintains its usability for an extended period of time. The botanical can then be placed in a sealed container for future use. The removed gas can be converted to liquid form comprising of water and terpene oil, wherein the lighter terpene oil is separated from the heavier water and collected.

According to another aspect of the invention, the dried botanical may have its oil extracted therefrom. The extracted oil can be stored in capsules or converted into pill form.

According to a further aspect of the invention, the dried botanical may be trimmed to form particles, and the trimmed particles can be packed into cylindrical containers for future use. Additionally, the dried botanical can be converted into a powder and packed into cylindrical containers.

According to a still further aspect of the invention, leaves from a botanical are flash frozen and are dried by sublimating solidified moisture from the frozen leaves. The leaves are mulched either prior to being flash frozen or after being dried, and the resulting mulched leaves may be packed into cylindrical containers for future use.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flow chart summarizing a method of drying botanicals, according to an embodiment.

FIG. **2** is a flow chart summarizing a method of optimizing flash freezing process in drying botanicals, according to an embodiment.

FIG. **3** is a flow chart summarizing a method of optimizing sublimation processing in drying botanicals, according to an embodiment.

FIG. **4** is a flow chart summarizing a method of processing leaves of a botanical, according to an embodiment.

DETAILED DESCRIPTION

The disclosed methods will become better understood through review of the following detailed description in conjunction with the figures. The detailed description and figures provide merely examples of the various inventions described herein. Those skilled in the art will understand that the disclosed examples may be varied, modified, and altered without departing from the scope of the inventions described herein. Many variations are contemplated for different applications and design considerations; however, for the sake of brevity, each and every contemplated variation is not individually described in the following detailed description.

Throughout the following detailed description, a variety of methods are provided. Related features in the examples may be identical, similar, or dissimilar in different examples. For the sake of brevity, related features will not be redundantly explained in each example. Instead, the use of related feature names will cue the reader that the feature with a related feature name may be similar to the related feature in an example explained previously. Features specific to a given example will be described in that particular example. The reader should understand that a given feature need not be the same or similar to the specific portrayal of a related feature in any given figure or example.

With reference to FIG. **1** one method **100** of drying botanicals, will now be described. Within hours of harvesting **102** the botanical, it is placed in a freezer, ideally within one hour. For *cannabis* or hemp processing, it is desirable to remove the flower from the plant **104** and place only the flower in the freezer. In other embodiments, the whole plant may be directly placed in the freezer. Alternatively, the flowers can be removed from the whole plants at later steps of method **100**. For the step of flash freezing **106**, the freezer should be as cold as possible, with the current range being between −10 degrees Fahrenheit and at least −60 degrees Fahrenheit. The lower temperature insures the botanical freezes as quickly as possible for best preservation. The botanical can then be stored **108** in this frozen state indefinitely until the botanical is needed. After removal from frozen storage, the frozen botanical is dried **110**. This process includes placing the botanical in a drying machine, such as a lyophilizer which is generally composed of a vacuum chamber and a vacuum pump. Once the botanicals are placed in the vacuum chamber, the drying machine will lower the air pressure in the chamber and cycle the temperature. This process will allow the botanical to reach the triple point, where the frozen water molecules in the botanical will be sublimated or vaporized and turned into a gas. The machine removes the gas from the vacuum chamber using the vacuum pump, wherein the removed gas is converted to liquid form comprising of water and terpene oil which is lighter in weight, and the terpene oil is then collected using standard oil water separating procedures. The botanical is then removed, being dry and fully intact and placed in final storage **112**, ideally in an airtight container. For the dried flower of *cannabis* or hemp botanical, the final volumetric dimension of the botanical is substantially the

same as its initial volumetric dimension. Optionally, the resulting botanical may be further processed **112**, such as having its oil extracted therefrom or it is trimmed such that the trimmed particles may be packed into a cylindrical container for further use. This oil is extracted from the botanical by immersing the botanical in a solvent, such as food grade ethanol which is good to use for *cannabis* botanicals. The solvent is then distilled or boiled off, leaving behind the extracted oil. The extracted oil can be stored in capsule form or converted into pill form by adding a pill powder mix such as corn starch to the extracted oil and subjecting the resulting mixture to a standard pill pressing machine. Additionally, the dried botanical can be converted to small particles or powder form and packed into cylindrical containers for future use. Additionally, *cannabis* and hemp botanicals contain cannabinoids such as cannabidiol acid (i.e. CBD A) and tetrahydrocannabinol acid (i.e. THC A). The dried flower botanicals can have their cannabinoids activated by decarboxylating the dried flowers. Decarboxylation can occur by heating the dried flowers to about 200 degrees Fahrenheit for approximately 30 minutes in an oven, wherein the cannabinoids are converted to just CBD and THC with no acid content. The decarboxylated dried flower can be either trimmed to form trimmed particles or converted into a powder. The trimmed particles or powder can be placed in a blender to create a substantially uniform cannabinoid content therein. The cannabinoid content of the trimmed particles or powder can be measured to determine the quantity of CBD and THC contained therein. The measured trimmed particles or powder could be placed in capsules or other containers which may be sealed for further preservation. Alternatively, the dried flower can first be converted into trimmed particles or a powdered form which can then be decarboxylated. Additionally, the cannabinoid measured trimmed particles or powder can be directly placed in capsules or sealed containers without ever being decarboxylated.

Turning attention to FIG. **2**, a second example of drying botanicals will now be described. Method **200** includes many similar or identical features to method **100**. Within hours of harvesting **202** the botanical, it is placed in a freezer, ideally within one hour. For the step of flash freezing **204**, the freezer should be at within the optimal temperature range of −45f to −55f. The lower temperature insures the botanical freezes as quickly as possible for best preservation. After removal, the flash frozen botanical is dried **206**. This process includes placing the botanical in a drying machine, such as a lyophilizer which is generally composed of a vacuum chamber and a vacuum pump. Once the botanicals are placed in the vacuum chamber, the drying machine will lower the air pressure in the chamber and cycle the temperature. This process will allow the botanical to reach the triple point, where the frozen water molecules in the botanical will be sublimated or vaporized and turned into a gas. The machine removes the gas from the vacuum chamber using the vacuum pump. The botanical is then removed, being dry and fully intact and can be stored **208**, ideally in an airtight container.

FIG. **3** illustrates a third example of drying botanicals. Method **300** includes many similar or identical features to method **100**. Within hours of harvesting **302** the botanical, it is placed in a freezer, ideally within one hour. For the step of flash freezing **304**, the freezer should be as cold as possible, with the current range being between −10 degrees Fahrenheit and at least −60 degrees Fahrenheit. The lower temperature insures the botanical freezes as quickly as possible for best preservation. After flash freezing, the frozen botanical is dried **306**. This process includes placing the botanical in a drying machine, such as a lyophilizer which is generally composed of a vacuum chamber and a vacuum pump. Once the botanicals are placed in the vacuum chamber, the drying machine will lower the air pressure in the chamber to an optimal pressure, between 300 and 600 torr for example. Other pressures are also possible. Also during this step **306**, the machine will cycle the temperature, ideally between 40 and 60 degrees Fahrenheit. This process will allow the botanical to reach the triple point, where the frozen water molecules in the botanical will be sublimated or vaporized and turned into a gas. The machine removes the gas from the vacuum chamber using the vacuum pump. The botanical is then removed, being dry and fully intact and can be stored **308**, ideally in an airtight container.

FIG. **4** illustrates an example of processing the leaves of a botanical. Method **400** includes many similar or identical features to method **100**. Within hours of harvesting **402** the botanical, the leaves are separated from the botanical and then mulched. Alternatively, the leaves can be mulched at later steps in **400**. The mulch is placed in a freezer, ideally within one hour from harvesting. For the step of flash freezing **404**, the freezer should be as cold as possible, with the current range being between −10 degrees Fahrenheit and at least −60 degrees Fahrenheit. The lower temperature insures the botanical freezes as quickly as possible for best preservation. After flash freezing, the frozen mulch is dried **406**. This process includes placing the mulch in a drying machine, such as a lyophilizer which is generally composed of a vacuum chamber and a vacuum pump. Once the mulch is placed in the vacuum chamber, the drying machine will lower the air pressure in the chamber and cycle the temperature. This process will allow the mulch to reach the triple point, where the frozen water molecules in the mulch will be sublimated or vaporized and turned into a gas. The machine removes the gas from the vacuum chamber using the vacuum pump. The mulch is removed, being dry and fully intact. As indicated previously, the mulch can be first formed **408** after the leaves are flash frozen and dried (i.e. made substantially moisture free). The resulting dried mulched leaves can be stored **410**, by packing the dried mulched leaves into a container, which may be cylindrically shaped, for further use. Additionally, prior to storing the dried mulched leaves, they can be decarboxylated, as previously described in paragraph **15**, to activate the cannabinoids contained therein. The containers can also be capsules or sealed vessels.

The disclosure above encompasses multiple distinct inventions with independent utility. While each of these inventions has been disclosed in a particular form, the specific embodiments disclosed and illustrated above are not to be considered in a limiting sense as numerous variations are possible. The subject matter of the inventions includes all novel and non-obvious combinations and subcombinations of the various elements, features, functions and/or properties disclosed above and inherent to those skilled in the art pertaining to such inventions. Where the disclosure or subsequently filed claims recite "a" element, "a first" element, or any such equivalent term, the disclosure or claims should be understood to incorporate one or more such elements, neither requiring nor excluding two or more such elements.

Applicant(s) reserves the right to submit claims directed to combinations and subcombinations of the disclosed inventions that are believed to be novel and non-obvious. Inventions embodied in other combinations and subcombinations of features, functions, elements and/or properties

may be claimed through amendment of those claims or presentation of new claims in the present application or in a related application. Such amended or new claims, whether they are directed to the same invention or a different invention and whether they are different, broader, narrower or equal in scope to the original claims, are to be considered within the subject matter of the inventions described herein.

The invention claimed is:

1. A method comprising:

flash freezing a flower, having an initial volumetric dimension, to solidify moisture content within the flower;

sublimating the solidified moisture content from the flower until the flower is substantially dried, the dried flower containing cannabinoids; and

decarboxylating the dried flower to active the cannabinoids contained therein.

2. A method according to claim **1**, wherein the dried flower has a final volumetric dimension that is substantially the same as the initial volumetric dimension of the flower.

3. A method according to claim **1**, further comprising the step of:

trimming the dried decarboxylated flower to form a residue of particles.

4. A method according to claim **3**, further comprising the steps of:

creating a substantially uniform cannabinoid content from the trimmed particles;

measuring the substantially uniform cannabinoid content of the trimmed particles; and

packaging the measured trimmed particles.

5. A method according to claim **4**, wherein the packaged measured trimmed particles are encapsulated.

6. A method of claim **1**, further comprising the steps of:

converting the substantially dried decarboxylated flower to powdered form.

7. A method according to claim **6**, further comprising the steps of:

creating a substantially uniform cannabinoid content from the formed powder;

measuring the substantially uniform cannabinoid content of the powder; and

placing the measured formed powder into at least one capsule.

8. A method comprising:

flash freezing a flower, having an initial volumetric dimension, to solidify the moisture content with the flower;

sublimating the solidified moisture content from the flower until the flower is substantially dried while maintaining a volumetric dimension that is substantially the same as the initial volumetric dimension of the flower;

converting the dried flower to a powder containing cannabinoids; and

decarboxylating the powder to activate the cannabinoids therein.

9. A method according to claim **8**, further comprising the steps of:

creating a substantially uniform cannabinoid content within the decarboxylated powder;

measuring the substantially uniform cannabinoid content of the decarboxylated powder;

and

placing the measured decarboxylated powder into capsules.

10. A method comprising:

flash freezing a flower to solidify the moisture content within the flower;

sublimating the solidified moisture content from the flower until the flower is substantially dried;

trimming the dried flower to form a residue of particles containing cannabinoids; and

decarboxylating the residue of particles to active the cannabinoids contained therein.

11. A method according to claim **10**, further comprising the steps of:

creating a substantially uniform cannabinoid content within the decarboxylated residue of particles;

measuring the substantially uniform cannabinoid content of the decarboxylated residue of particles; and

placing the measured decarboxylated residue of particles into capsules.

* * * * *