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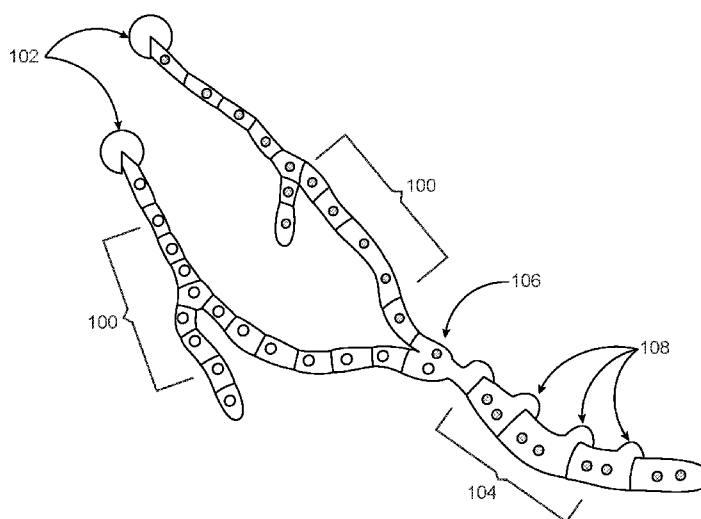


FIG. 2

(57) Abstract: A monokaryotic mycelium sheet producing system for creating a sheet of monokaryotic mycelial material. The mycelium sheet producing system includes a culture unit, a spore stock unit, a plating unit, a section unit, a sub-plating unit, an expanding unit and a colonization unit. The culture unit prepares a monokaryon culture. The spore stock unit grows a plurality of fruit bodies in sterile laboratory conditions to create a spore stock. The plating unit performs a peroxide-based spore rescue and a plating process. The section unit is adaptable to section robust hyphae. The sub-plating unit sub-plates and expands the robust hyphae onto a spawn grain master. The expanding unit subsequently expands the spawn grain master into appropriate production of spawn volume. The colonization unit is adaptable to perform a subsequent colonization of mycelium substrate thereby creating a substantially defect free sheet of mycelium.



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MONOKARYON MYCELIAL MATERIAL AND RELATED METHOD OF PRODUCTION

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RELATED APPLICATIONS

[0001] This application claims the benefit of US provisional patent application 62/749717, filed October 24, 2018, the disclosure of which is incorporated herein in its entirety.

10

BACKGROUND OF THE DISCLOSURE

TECHNICAL FIELD OF THE DISCLOSURE

15 **[0002]** The present embodiment relates generally to monokaryon strain development, and more particularly, to sheets of mycelium utilizing monokaryotic mycelial matter and methods of producing the same.

DESCRIPTION OF THE RELATED ART

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[0003] In the fungus life cycle, a fungal spore germinates into a homokaryotic mycelium. Although the term “homokaryotic” in general refers to multinucleate cells where the nuclei are generally identical, in practice with respect to fungal spore germinates, these multinucleate cells are not strictly similar with each other. As is well understood, homokaryotic mycelia may join and reproduce sexually, yielding increases in genetic variability in the mycelial mass.

25 **[0004]** A single basidiospore germinates to give rise to a mass of monokaryotic hyphal filaments wherein each cell of which contains a single haploid nucleus. The complex interwoven mat of branching hyphae arising from a single spore is called the mycelium. Part of the mycelium grows submerged within the medium on which the fungus is growing, but aerial hyphae exist and produce abundant uninucleate haploid spores (oidia) which can germinate to complete an asexual cycle. The mycelium continues

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to grow as a monokaryon until it encounters a hypha from another fungus. At this point, hyphae from the two separate fungi fuse and determination of whether the mates are sexually compatible occurs intracellularly. If the two fungi are compatible, reciprocal nuclear migration occurs after cell fusion.

5 **[0005]** The morphology of the dikaryon differs from that of the monokaryon in several respects, but most distinctively, cells of the dikaryon undergo a complex form of cell division involving the formation of clamp connections to preserve one copy of each haploid nucleus within every dikaryotic cell. In contrast, the monokaryotic cell does not go through the normal reproductive process and thus does not generate fruiting bodies at
10 any stage.

[0006] It is now understood that fungal tissue growth may be directed and controlled such that the resultant mycelial tissue has utility in various industries. In some cases, a sheet of mycelium biotextile is a result of these industrial processes, which upon harvest, can be cured and finished to take on qualities that are similar in texture, look and
15 performance to plastics, foams and animal skins. A common use for these materials includes industries in which leather would conventionally be used. In these industries, the uniformity of the leather-like material is often of value. Fungi are very sensitive to stimuli in their environment and have the ability to alter the direction and vigor of growth of expanding hyphae in response to gravitropic, thermotropic, thigmotropic, phototropic,
20 (chemotropic) and hydrotropic stimuli. It is understood that these growth factors may be manipulated in order to reduce the variability in the finished product.

[0007] Therefore, there is a need for an efficient and reliable system and method for creating large volumes of monokaryotic materials utilizing fewer resources and with a low environmental impact. Such a monokaryotic mycelial material producing system
25 would refine a mycelial tissue product without amounts of post processing and would reduce genetic variability, blemishes and fruiting bodies. Such a system would produce the mycelial material with a high degree of uniformity in thickness and appearance and with a high degree of consistency from batch to batch. Moreover, such a system would produce the mycelium material utilizing minimum time, cost and complexity associated
30 with minimizing variability and blemishes. The present embodiment accomplishes these objectives.

SUMMARY OF THE INVENTION

[0008] To minimize the limitations found in the prior art, and to minimize other limitations that will be apparent upon the reading of the specification, the present disclosure provides a monokaryotic mycelium sheet which is free or substantially free of defects. Preferably, the monokaryon cultures lack half their genetic material and also lack sex cell signal pathways that drive developmental behaviors of fruit formation. Therefore, the defects present in the resultant mycelial material are substantially reduced. In the preferred embodiment, a monokaryon strain of *G. lingzhi* and other fungi are used in the production of mycelium leather that does not express tissues associated with fruit body formation. However, any suitable fungi capable of monokaryotic growth may be utilized. In still other embodiments hybrid monokaryon strains may be created.

[0009] The disclosure also provides a mycelium sheet producing system comprising a culture unit for preparing a monokaryon culture utilizing a live culture sample of a fungal material. The system further includes a spore stock unit, a plating unit, a section unit, a sub-plating unit, an expanding unit and a colonization unit. In the preferred embodiment, the spore stock unit is designed to grow a plurality of fruit bodies in sterile laboratory conditions to create a spore stock. The plating unit performs a peroxide-based spore rescue and plating process. The section unit is adaptable to section robust hyphae. Preferably, the sub-plating unit sub-plates and expands the robust hyphae onto a spawn grain master. The expanding unit subsequently expands the spawn grain master into appropriate production of spawn volume. The colonization unit is adaptable to perform a subsequent colonization of substrate thereby creating the sheets of mycelium.

[00010] The preferred embodiment further provides a method for producing the monokaryotic mycelium sheet. The method is initiated by providing the mycelium sheet producing system. Next, the monokaryon culture is prepared at the culture unit utilizing the live culture sample of fungus. Then, the plurality of fruit bodies is grown in sterile conditions to create the spore stock at the spore stock unit. Thereafter, the peroxide-based spore rescue and plating process are performed at the plating unit. Upon successful germination of the peroxide-based spore, the robust hyphae are sectioned at the section unit. Next, the robust hyphae are sub-plated and expanded onto a spawn grain master at the sub-plating unit. Then, the spawn grain master is subsequently expanded into the appropriate production of spawn volume at the expanding unit. Finally, the subsequent

colonization of substrate is performed thereby creating the sheet of mycelium at the colonization unit.

5 [00011] A first objective of the present invention is to provide a monokaryotic mycelial sheet producing system and method for creating large volumes of substantially or completely pure monokaryotic materials.

[00012] A second objective of the present invention is to provide a monokaryotic mycelial sheet producing system that refines a mycelial tissue product without heavy post processing and which produces a sheet with reduced genetic variability, blemishes and fruiting bodies as compared to any sheet found in nature.

10 [00013] A third objective of the present invention is to provide a monokaryotic mycelial sheet producing system for harvesting the mycelial material with a high degree of uniformity in thickness and appearance and also with a high degree of consistency from batch to batch.

15 [00014] A fourth objective of the present invention is to provide a monokaryotic mycelial sheet producing system that produces the mycelium material utilizing minimum time, cost and complexity associated with minimizing variabilities and blemishes.

[00015] These and other advantages and features of the present invention are described with specificity so as to make the present invention understandable to one of ordinary skill in the art.

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BRIEF DESCRIPTION OF THE DRAWINGS

[00016] Elements in the figures have not necessarily been drawn to scale in order to enhance their clarity and improve understanding of these various elements and embodiments of the invention. Furthermore, elements that are known to be common and well understood to those in the industry are not depicted in order to provide a clear view of the various embodiments of the invention, thus the drawings are generalized in form in the interest of clarity and conciseness.

[00017] FIG. 1 is a schematic representation of a monokaryotic mycelium sheet producing system in accordance with the preferred embodiment of the present invention;

30 [00018] FIG. 2 is a diagrammatic image illustrating two monokaryons growing from two germinating spores in accordance with the preferred embodiment of the present invention;

[00019] FIG. 3 is a perspective view of a monokaryotic hyphae growing in a mycelium growth bed in accordance with the preferred embodiment of the present invention;

[00020] FIG. 4 is a perspective view of the monokaryotic hyphae flattened after
5 grown in the mycelium growth bed in accordance with the preferred embodiment of the present invention; and

[00021] FIG. 5 is a flowchart of a method for producing the monokaryotic mycelium sheet in accordance with the preferred embodiment of the present invention.

10 DETAILED DESCRIPTION OF THE DRAWINGS

[00022] In the following discussion that addresses a number of embodiments and applications of the present invention, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments
15 may be utilized, and changes may be made without departing from the scope of the present invention.

[00023] Various inventive features are described below that can each be used independently of one another or in combination with other features. However, any single inventive feature may not address any of the problems discussed above or only address
20 one of the problems discussed above. Further, one or more of the problems discussed above may not be fully addressed by any of the features described below.

[00024] As used herein, the singular forms "a", "an" and "the" include plural referents unless the context clearly dictates otherwise. "And" as used herein is interchangeably used with "or" unless expressly stated otherwise. As used herein, the term
25 'about' means +/- 5% of the recited parameter. All embodiments of any aspect of the invention can be used in combination, unless the context clearly dictates otherwise.

[00025] Unless the context clearly requires otherwise, throughout the description and the claims, the words 'comprise', 'comprising', and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense
30 of "including, but not limited to". Words using the singular or plural number also include the plural and singular number, respectively. Additionally, the words "herein," "wherein", "whereas", "above," and "below" and words of similar import, when used in this

application, shall refer to this application as a whole and not to any particular portions of the application.

[00026] The description of embodiments of the disclosure is not intended to be exhaustive or to limit the disclosure to the precise form disclosed. While the specific
5 embodiments of, and examples for, the disclosure are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the disclosure, as those skilled in the relevant art will recognize.

[00027] Referring to **FIG. 1**, a monokaryotic mycelium sheet producing system **10** for creating a sheet of monokaryotic mycelial material is illustrated. The mycelium sheet
10 producing system **10** includes a culture unit **20** for preparing a monokaryon culture utilizing a live culture sample of a fungal material. The monokaryon culture is adaptable to prepare substantially defect free sheet or mass of mycelium. In the preferred embodiment, a monokaryon strain of *G. lingzhi* and other fungi are used in the production of mycelium leather that does not express tissues associated with fruit body formation.
15 However, any suitable fungi capable of monokaryotic growth may be utilized. In still other embodiments, hybrid monokaryon strains may be created.

[00028] The mycelium sheet producing system **10** further includes a spore stock unit **30**, a plating unit **40**, a section unit **50**, a sub-plating unit **60**, an expanding unit **70** and a colonization unit **80**. The spore stock unit **30** is designed to grow a plurality of fruit
20 bodies in sterile laboratory conditions to create a spore stock. The plating unit **40** performs a peroxide-based spore rescue and plating process. The section unit **50** is adaptable to section robust hyphae. The sub-plating unit **60** sub-plates and expands the robust hyphae onto a spawn grain master. The expanding unit **70** subsequently expands the spawn grain master into an appropriate production of spawn volume. In one embodiment, the spawn
25 volume is about 20 liters, however in other embodiment the volume may be greater or less than 20 liters. The colonization unit **80** is adaptable to perform a subsequent colonization of mycelium substrate thereby creating the sheet or mass of mycelium that is substantially or completely free of defects.

[00029] **FIG. 2** is a diagrammatic image illustrating two monokaryons **100**
30 growing from two germinating spores **102**. The mycelium sheet producing system **10** does not allow a dikaryon stage **104** and a plasmogamy stage **106** having the clamp connections **108**. In the preferred embodiment, the fungal monokaryon cultures lack clamp

connections **108** associated with Ganoderma tissue which might confer particular material qualities and mechanical properties to finished mycelium-based materials. Additionally, the expression of the cells and their constituent biochemistry is varied from that found in nature, which can alter the curing and finishing processes. Further, the monokaryon
5 cultures lack half their genetic material and also lack sex cell signal pathways that drive developmental behaviors of fruit formation. Due to this, the defects present in the resultant mycelial material are substantially reduced. In the preferred embodiment, less than 10% of the surface of the mycelium material exhibits the formation of fruiting bodies and the cells of the mycelium material are monokaryotic. In other embodiments, less than 5% of
10 the surface exhibits the formation of fruiting bodies, and in still other embodiments less than 1% of the surface exhibits the formation of fruiting bodies. Of note, the organism is not being genetically modified during this process.

[00030] In one embodiment the monokaryotic mycelium sheet producing system provides a growing space comprising a tray having a conveying platform and a permeable
15 membrane with a plurality of pores positioned on the conveying platform; a substrate inoculated with a fungal strain positioned on the permeable membrane; a porous material positioned on top of the substrate; and a mass of mycelium grown within said growing space, the mass having a surface of which less than 10% of said surface exhibits the formation of fruiting bodies. In this or other embodiments, the system may be optimized
20 such that the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below
25 20% in steady state conditions to promote mycelium growth without the fruiting body.

[00031] Since mycelium-based leather-like materials are now of great interest in many markets, improved methods of harvesting such materials with a high degree of uniformity in thickness and appearance and a high degree of consistency from batch to batch have been required. Hence, it is highly recommended to grow and harvest the
30 monokaryotic hyphae **120** in a mycelium growth bed **124** as shown in **FIGS. 3** and **4**. **FIG. 3** shows the monokaryotic hyphae **120** grown from a mycelium substrate **122** in the mycelium growth bed **124**. The mycelium growth bed **124** uniformly separates the hyphae

120 from the mycelium substrate 122 thereby providing a uniform expression of the mycelium material. The sheet of mycelium, upon harvest in the mycelium growth bed 124, can be cured and finished to take on qualities that are similar in texture, look and performance to plastics, foams and animal skins. The mycelium material may be physically manipulated into different patterns. FIG. 4 shows the monokaryotic hyphae 120 in a flattened stage for manipulation purpose. With the consistent and patterned manipulations, the fungal material can be formed in layered structures with determined arrangements of fungal tissue. Due to such physical manipulation of the fungal material, the hyphae can be grown into particular and determined directions such that they can be arranged into orthogonal structures, lattices, and other two-dimensional and three-dimensional organizations.

[00032] FIG. 5 is a flowchart of a method for producing the monokaryotic mycelium sheet. The method commences by providing the mycelium sheet producing system as shown in block 130. Next, the monokaryon culture is prepared at the culture unit utilizing the live culture sample of fungus as shown at block 132. Then, the plurality of fruit bodies is grown in sterile conditions to create the spore stock at the spore stock unit as shown in block 134. Thereafter, the peroxide-based spore rescue and plating process are performed at the plating unit as indicated at block 136. Upon successful germination of the peroxide-based spore, the robust hyphae are sectioned at the section unit as shown in block 138. Next, the robust hyphae are sub-plated and expanded onto a spawn grain master at the sub-plating unit as indicated at block 140. Then, the spawn grain master is subsequently expanded into the appropriate production of spawn volume at the expanding unit as shown in block 142. Finally, the subsequent colonization of a mycelium substrate is performed thereby creating the sheet of mycelium at the colonization unit as shown in block 144.

[00033] The foregoing description of the preferred embodiment of the present invention has been presented for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teachings. It is intended that the scope of the present invention to not be limited by this detailed description, but by the claims and the equivalents to the claims appended hereto.

CLAIMS

What is claimed is:

- 5 1. A monokaryotic mycelium mass producing system comprising:
 - a growing space comprising a tray having a conveying platform and a permeable membrane with a plurality of pores positioned on the conveying platform;
 - a substrate inoculated with a fungal strain positioned on the permeable
 - 10 membrane;
 - a porous material positioned on top of the substrate;
 - a mass of mycelium grown within said growing space, the mass having a surface of which less than 10% of said surface exhibits the formation of fruiting bodies.
- 15 2. The monokaryotic mycelium mass producing system of claim 1 wherein the environment of the growing space is such that the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above
- 20 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below 20% in steady state conditions to promote mycelium growth without the fruiting body.
3. The monokaryotic mycelium mass producing system of claim 1 wherein less than 5% of said surface exhibits the formation of fruiting bodies.
- 25 4. The monokaryotic mycelium mass producing system of claim 3 wherein the environment of the growing space is such that the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above
- 30 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below 20% in steady state conditions to promote mycelium growth without the fruiting body.

5. The monokaryotic mycelium mass producing system of claim 1 wherein less than 1% of said surface exhibits the formation of fruiting bodies.
6. The monokaryotic mycelium mass producing system of claim 5 wherein the environment of the growing space is the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below 20% in steady state conditions to promote mycelium growth without the fruiting body.
7. A monokaryotic mycelium mass producing system comprising:
- a culture unit for preparing a monokaryon culture;
 - a spore stock unit for creating a spore stock;
 - a plating unit for performing a spore rescue and a plating process;
 - a section unit for sectioning robust hyphae;
 - a sub-plating unit for sub-plating and expanding the robust hyphae onto a spawn grain master;
 - an expanding unit for subsequently expanding the spawn grain master into appropriate production of spawn volume; and
 - a colonization unit for creating a mass of mycelium.
8. The monokaryotic mycelium mass producing system of claim 7 wherein the monokaryon culture is adaptable to prepare substantially defect free mass of mycelium having surface area wherein less than 5% of said surface area exhibits the formation of fruiting bodies.
9. The monokaryotic mycelium mass producing system of claim 7 wherein the monokaryon culture is adaptable to prepare substantially defect free mass of mycelium having surface area wherein less than 1% of said surface area exhibits the formation of fruiting bodies.
10. The monokaryotic mycelium mass producing system of claim 7 wherein the culture unit prepares the monokaryon culture utilizing a live culture sample of a fungal material.

11. The monokaryotic mycelium mass producing system of claim 7 wherein the spore stock unit is designed to grow a plurality of fruit bodies in sterile conditions for creating the spore stock.
12. The monokaryotic mycelium mass producing system of claim 7 wherein the
5 spore rescue process performed by the plating unit is peroxide-based.
13. The monokaryotic mycelium mass producing system of claim 12 wherein the plating unit utilizes the plurality of fruiting bodies for performing the spore rescue and the plating process.
14. The monokaryotic mycelium mass producing system of claim 7 wherein the
10 colonization unit is adaptable to perform a subsequent colonization of a mycelium substrate thereby creating the sheet of mycelium.
15. A method for producing a mycelium mass, the method comprising the steps of:
providing a mycelium mass producing system having a culture unit, a spore stock unit, a plating unit, a section unit, a sub-plating unit, an expanding unit and a colonization
15 unit;
obtaining a live culture sample of fungus to prepare a monokaryon culture at the culture unit;
growing a plurality of fruit bodies in sterile conditions to create a spore stock at the spore stock unit;
20 performing a peroxide-based spore rescue and a plating process at the plating unit;
sectioning robust hyphae upon successful germination of the peroxide-based spore at the section unit;
sub-plating and expanding the robust hyphae onto a spawn grain master at the sub-plating unit;
25 subsequently expanding the spawn grain master into appropriate production of spawn volume at the expanding unit; and
performing subsequent colonization of a mycelium substrate thereby creating a substantially defect free mass of mycelium at the colonization unit.
16. The method for producing a mycelium mass according to claim 15 wherein the
30 defect free mass of mycelium has a surface area wherein less than 5% of said surface area exhibits the formation of fruiting bodies.
17. The method for producing a mycelium mass according to claim 15 wherein the

defect free mass of mycelium has a surface area wherein less than 1% of said surface area exhibits the formation of fruiting bodies.

AMENDED CLAIMS

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1. A monokaryotic mycelium mass producing system comprising:
 - a growing space comprising a tray having a conveying platform and a permeable membrane with a plurality of pores positioned on the conveying platform;
 - a substrate inoculated with a fungal strain positioned on the permeable membrane;
 - a porous material positioned on top of the substrate;
 - a mass of mycelium grown within said growing space, the mass having a surface of which less than 10% of said surface exhibits the formation of fruiting bodies.
2. The monokaryotic mycelium mass producing system of claim 1 wherein the environment of the growing space is such that the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below 20% in steady state conditions to promote mycelium growth without the fruiting body.
3. The monokaryotic mycelium mass producing system of claim 1 wherein less than 5% of said surface exhibits the formation of fruiting bodies.
4. The monokaryotic mycelium mass producing system of claim 3 wherein the environment of the growing space is such that the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below 20% in steady state conditions to promote mycelium growth without the fruiting body.
5. The monokaryotic mycelium mass producing system of claim 1 wherein less than 1% of said surface exhibits the formation of fruiting bodies.
6. The monokaryotic mycelium mass producing system of claim 5 wherein the environment of the growing space is the substrate weight to tray empty space volume ratio is between 0.5 and 5.0 g/cc, the tray empty space volume to substrate volume is between 0.01 and 1.0, the

tray empty space volume to substrate area is between 0.5 and 5.0 cc/cm², wherein the CO₂ concentration is held above 3% in steady state conditions, the relative humidity is held above 40% in steady state conditions, and wherein the O₂ concentration is held below 20% in steady state conditions to promote mycelium growth without the fruiting body.

7. A monokaryotic mycelium mass producing system comprising:
 - a culture unit for preparing a monokaryon culture;
 - a spore stock unit for creating a spore stock;
 - a plating unit for performing a peroxide-based spore rescue and a plating process;
 - a section unit for sectioning robust hyphae;
 - a sub-plating unit for sub-plating and expanding the robust hyphae onto a spawn grain master;
 - an expanding unit for subsequently expanding the spawn grain master into appropriate production of spawn volume; and
 - a colonization unit for performing a subsequent colonization of a mycelium substrate for creating the monokaryotic mass of mycelium.
8. Canceled.
9. The monokaryotic mycelium mass producing system of claim 7 wherein the monokaryon culture is adaptable to prepare substantially defect free mass of mycelium having surface area wherein less than 1% of said surface area exhibits the formation of fruiting bodies.
10. The monokaryotic mycelium mass producing system of claim 7 wherein the culture unit prepares the monokaryon culture utilizing a live culture sample of a fungal material.
11. The monokaryotic mycelium mass producing system of claim 7 wherein the spore stock unit is designed to grow a plurality of fruit bodies in sterile conditions for creating the spore stock.
12. Canceled.
13. The monokaryotic mycelium mass producing system of claim 11 wherein the plating unit utilizes the plurality of fruiting bodies for performing the spore rescue and the plating process.
14. Canceled.
15. A method for producing a mycelium mass, the method comprising the steps of:
 - providing a mycelium mass producing system having a culture unit, a spore stock unit, a plating unit, a section unit, a sub-plating unit, an expanding unit and a colonization unit;

obtaining a live culture sample of fungus to prepare a monokaryon culture at the culture unit;

growing a plurality of fruit bodies in sterile conditions to create a spore stock at the spore stock unit;

performing a peroxide-based spore rescue and a plating process at the plating unit;

sectioning robust hyphae upon successful germination of the peroxide-based spore at the section unit;

sub-plating and expanding the robust hyphae onto a spawn grain master at the sub-plating unit;

subsequently expanding the spawn grain master into appropriate production of spawn volume at the expanding unit; and

performing subsequent colonization of a mycelium substrate thereby creating a substantially defect free mass of monokaryotic mycelium at the colonization unit.

16. The method for producing a mycelium mass according to claim 15 wherein the defect free mass of mycelium has a surface area wherein less than 5% of said surface area exhibits the formation of fruiting bodies.

17. The method for producing a mycelium mass according to claim 15 wherein the defect free mass of mycelium has a surface area wherein less than 1% of said surface area exhibits the formation of fruiting bodies.

STATEMENT UNDER ARTICLE 19 (1)

Claims 1, 7 and 15 have been amended to overcome rejections under PCT Article 33(3) as outlined by the Examiner.

Support for this claim amendment can be found at Paragraphs [00027] and [00028] of the originally filed specification.

Claim 9 has been amended to provide clarity and to overcome rejections under PCT Article 33(3) as outlined by the Examiner.

Support for this claim amendment can be found at Paragraph [00027] of the originally filed specification.

Claim 13 has been amended to provide clarity.

From the foregoing, it will be seen that no new matter is added by the amendments to the claims and specification presented herein.

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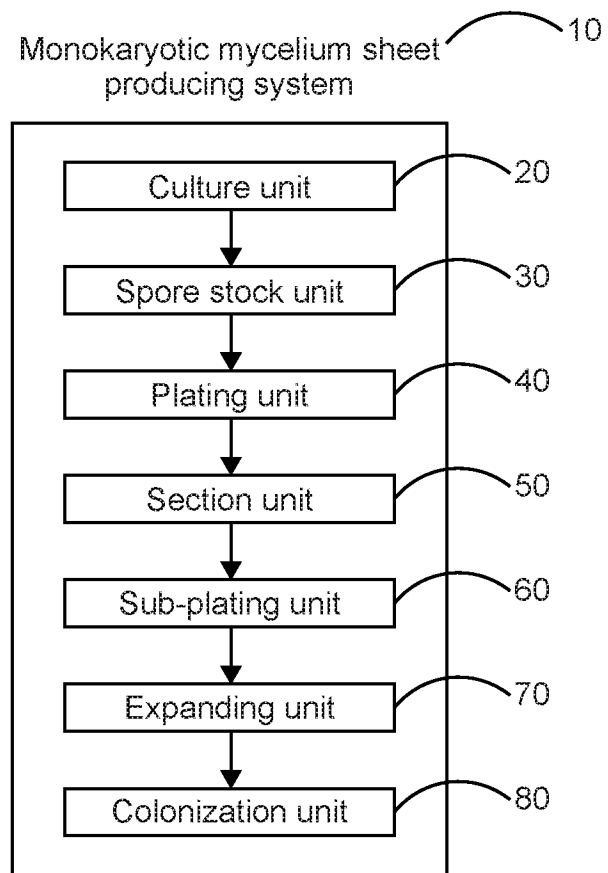


FIG. 1

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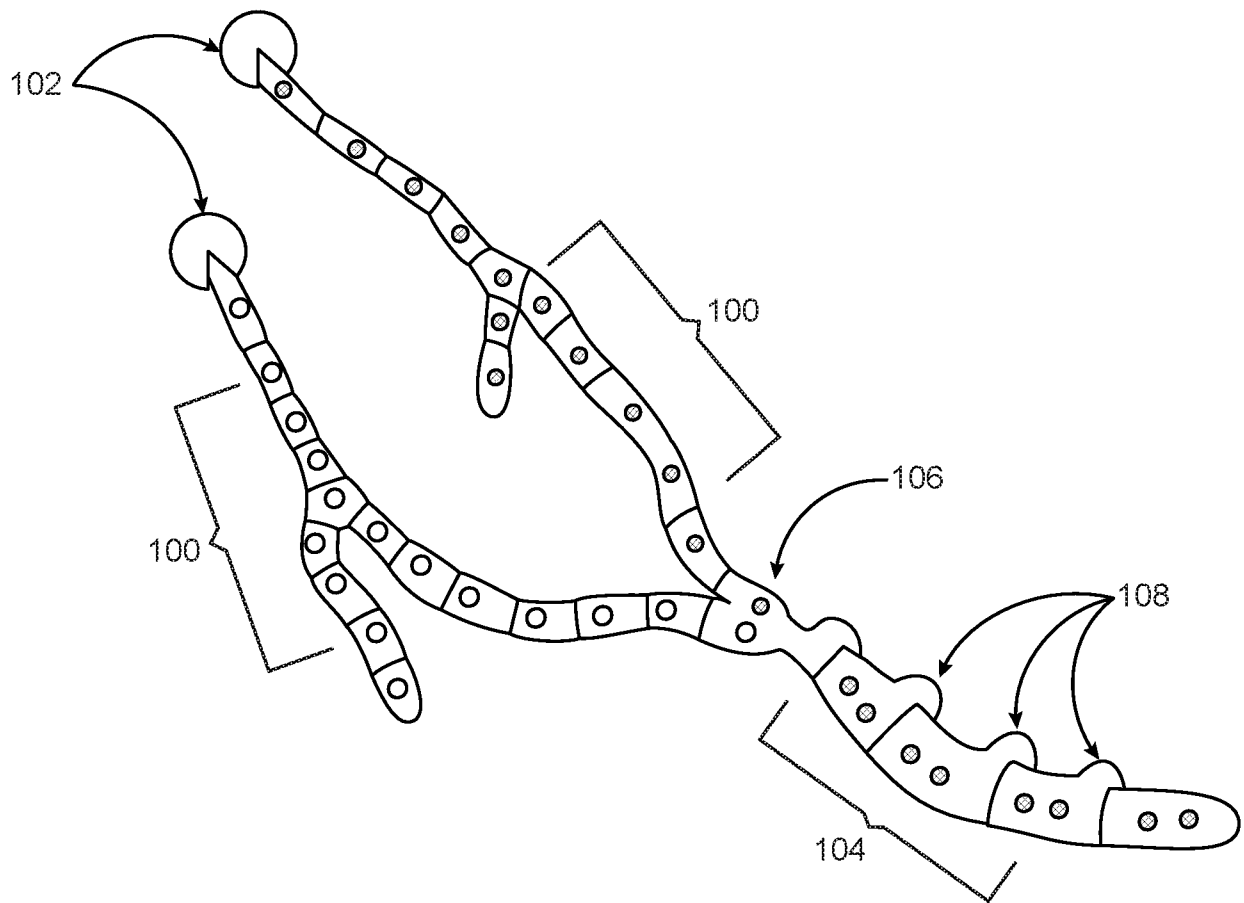


FIG. 2

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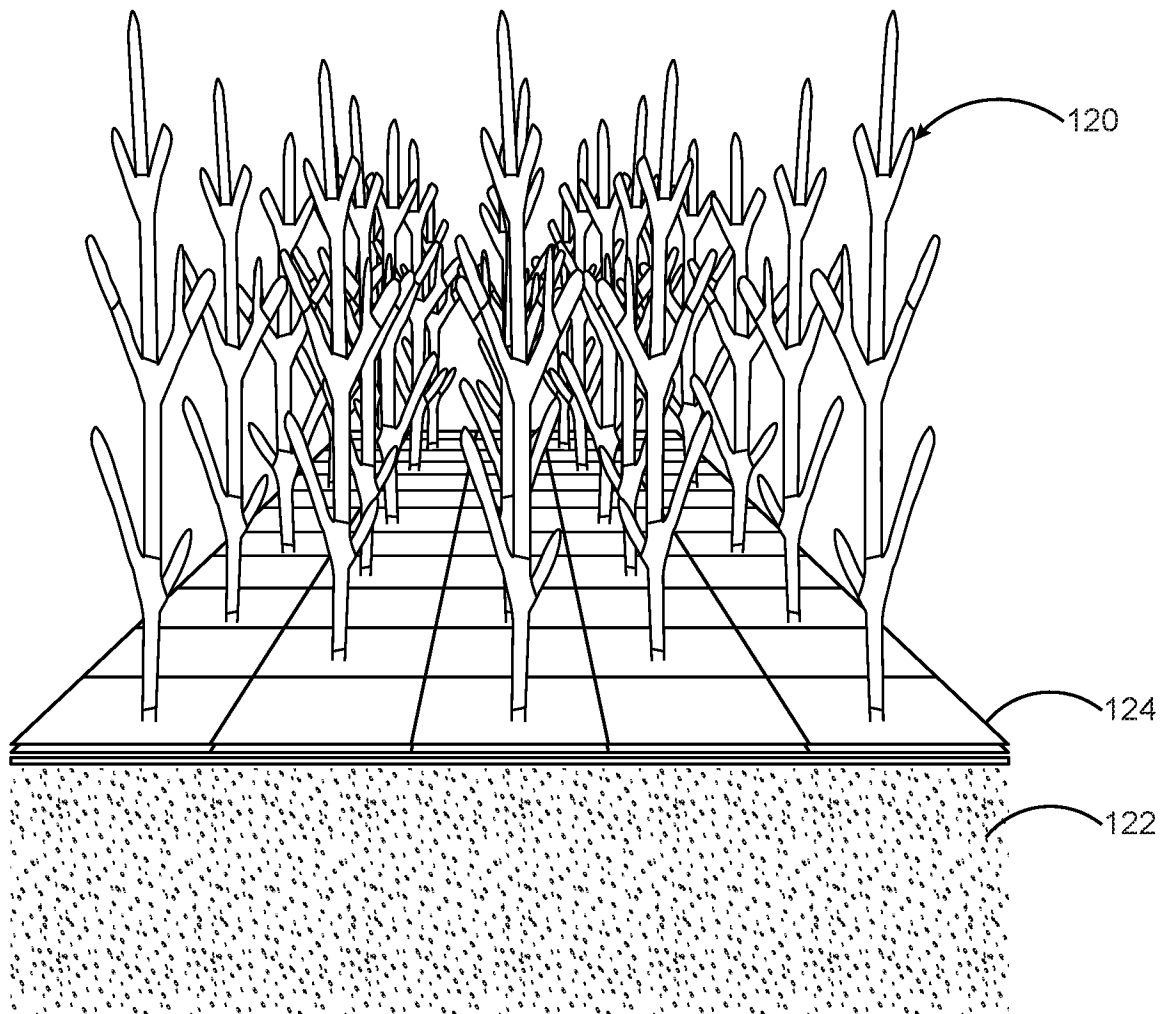


FIG. 3

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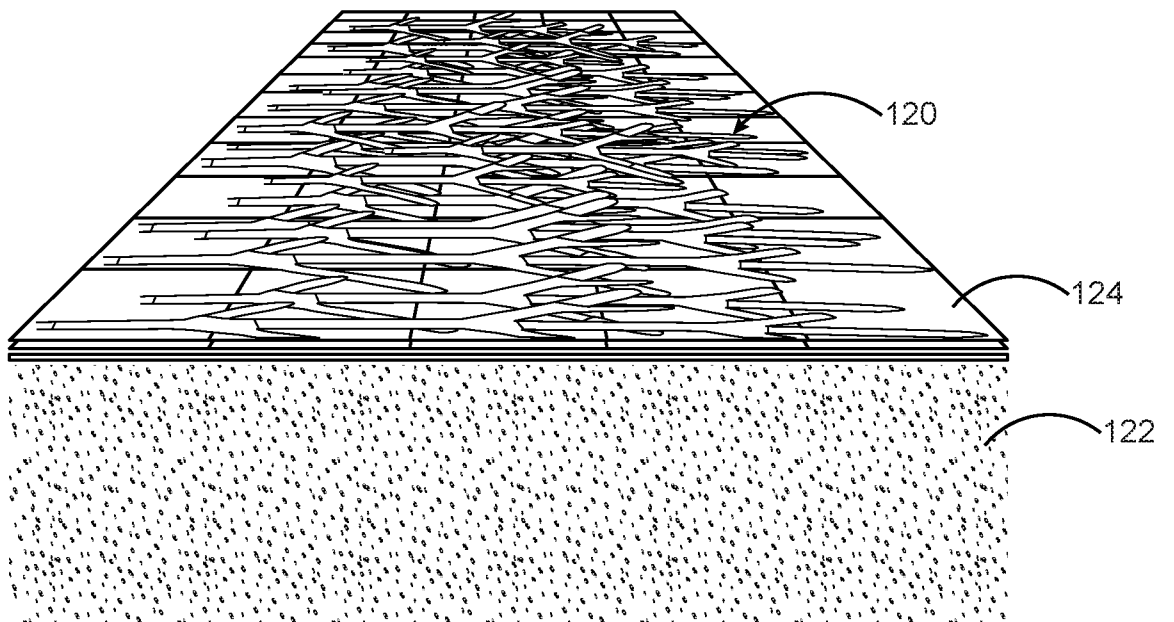


FIG. 4

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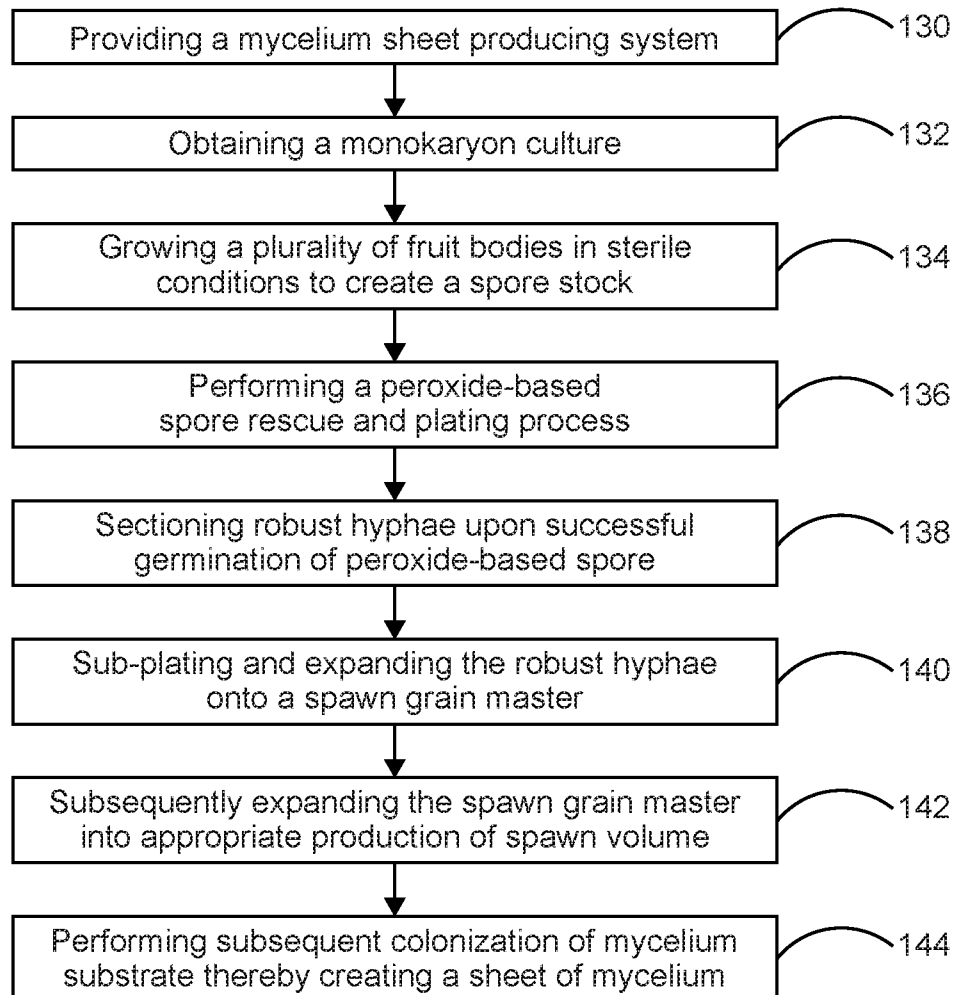


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/057955

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A01G 18/1; A01G 18/6; B32B 5/04; C05F 9/04; C05F 11/08; C12C 1/02; C12N 1/00 (2019.01)
CPC - A01G 18/62; C05F 9/04; C05F 11/08; C12N 15/01; C12P 21/005 (2019.08)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

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

USPC - 47/1.1; 435/101; 435/69.1; 800/297 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2018/0014468 A1 (MYCOWORKS, INC) 18 January 2018 (18.01.2018) entire document	1-6, 14
Y	GB 1566625 A (KUREHA CHEMICAL IND CO LTD) 08 May 1980 (08.05.1980) entire document	1-17
Y	STAMETS et al. "The Mushroom Cultivator: A Practical Guide to Growing Mushrooms at Home," Chapters 2-4 and 7, Agarikon Press, 31 December 1983 (31.12.1983), Pgs. 15-126. Retrieved from the Internet: < http://library.uniteddiversity.coop/Permaculture/Mushroom_Cultivator-A_Practical_Guide_to_Growing_Mushrooms_at_Home.pdf > on 07 December 2019 (07.12.2019). entire document	2, 4, 6-17
Y	LELIVELT, R.J.J. "The Mechanical Possibilities of Mycelium Materials," Masters Thesis, Eindhoven University of Technology, 31 March 2015 (31.03.2015), Pgs. 1-83. Retrieved from the Internet: < https://pure.tue.nl/ws/portalfiles/portal/47018924/793800-1.pdf > on 07 December 2019 (07.12.2019).	12, 13, 15-17
A	HANEEF et al. "Advanced Materials From Fungal Mycelium: Fabrication and Tuning of Physical Properties," Scientific Reports, 24 January 2017 (24.01.2017), Vol. 7, No. 41292, Pgs. 1-11. entire document	1-17
A	US 2018/0148682 A1 (MYCOWORKS, INC) 31 May 2018 (31.05.2018) entire document	1-17
A	US 2012/0135504 A1 (ROSS) 31 May 2012 (31.05.2012) entire document	1-17



Further documents are listed in the continuation of Box C.



See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

07 December 2019

Date of mailing of the international search report

15 JAN 2020

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PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2019/057955

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2017/125602 A1 (STICHTING VOOR DE TECHNISCHE WETENSCHAPPEN) 27 July 2017 (27.07.2017) entire document	1-17