(e.g., comestible cells) to grow (taking into account how those cells will be supplied with nutrients), and the robustness of the fibres for the culturing process, including during cell growth and harvesting. The inventors have advantageously defined a food product cell culture construct and food product bioreactor module that balances these parameters and provides for improved culturing of cells in food production.

[0007] According to the present disclosure there is provided a food product cell culture construct for a food product bioreactor module that is attachable to a food product cell culturing system. The food product bioreactor module has a housing adapted to receive the food product cell culture construct for culturing cells on the food product cell culture construct within the housing.

[0008] The food product cell culture construct comprises a plurality of fibres and an end support. The plurality of fibres having external surfaces for cell adhesion and culturing, and have ends embedded within the end support and extend from the end support such they extend into the housing when the food product cell culture construct is received in the housing of the food product bioreactor system.

[0009] At a plane coincident with the end support the plurality of fibres are arranged in a fibre distribution defining an envelope.

[0010] In examples, the food product cell culture construct for a food product bioreactor module may be a meat culture construct for a meat culture bioreactor module that is attachable to a meat culturing system. In other examples, the food product cell culture construct for a food product bioreactor module may be a plant cell culture construct for a plant culture bioreactor module that is attachable to a plant cell culturing system. In other examples, the food product cell culture construct for a food product bioreactor module may be a fungal cell culture construct for a fungal culture bioreactor module that is attachable to a fungal cell culturing system. In other examples, the food product cell culture construct for a food product bioreactor module may be a bacterial cell culture construct for a bacterial culture bioreactor module that is attachable to a bacterial cell culturing system. In other examples, the food product cell culture construct for a food product bioreactor module may be an algal cell culture construct for an algal culture bioreactor module that is attachable to an algal cell culturing system.

[0010a] In one aspect, the present disclosure refers to a food product cell culture construct for a food product bioreactor system that is attachable to a food product cell culturing system, the food product bioreactor system having a housing adapted to receive the food product cell culture construct for culturing cells on the food product cell culture construct within the housing, wherein the food product cell culture construct comprises a plurality of inedible fibres and an end support, the plurality of inedible fibres having external surfaces for cell adhesion and culturing, and having ends embedded within the end support and extending from the end support such they extend into the housing when the food product cell culture construct is received in the housing of the food product bioreactor system, and wherein at a plane coincident with the end support the plurality of inedible fibres are arranged in a fibre distribution defining an envelope, and wherein the fibre distribution comprises a fibre density of between about 50 fibres/cm^2 and about 330 fibres/cm^2.

In one aspect, the present disclosure refers to a food product bioreactor module comprising the food product cell culture construct as disclosed herein and a housing having a cavity within which the food product cell culture construct is receivable such that the plurality of inedible fibres extend into the cavity.

In one aspect, the present disclosure refers to a food product cell culturing system comprising the food product bioreactor system as disclosed herein and a base unit, the food product bioreactor system being detachable from the base unit.

In one aspect, the present disclosure refers to a method of seeding cells and/or cell precursors in the food product bioreactor module as disclosed herein, the method comprising: inclining the food product bioreactor module, introducing a cell suspension into the housing, and rotating the food product bioreactor module.

In one aspect, the present disclosure refers to a method of culturing a food product, the method comprising: providing the food product cell culturing system as disclosed herein, seeding the food product bioreactor system with cells and/or cell precursors, and circulating a cell culture medium through the food product bioreactor system.

[0011] *Fibre Distribution Parameter (FDP)*

[0012] In examples, the fibre distribution comprises a Fibre Distribution Parameter, FDP, of between 9 cm^3 and 24 cm^3. The FDP is the product of the sum of the circumferences of the

CLAIMS

1. A food product cell culture construct for a food product bioreactor system that is attachable to a food product cell culturing system, the food product bioreactor system having a housing adapted to receive the food product cell culture construct for culturing cells on the food product cell culture construct within the housing,

wherein the food product cell culture construct comprises a plurality of inedible fibres and an end support, the plurality of inedible fibres having external surfaces for cell adhesion and culturing, and having ends embedded within the end support and extending from the end support such they extend into the housing when the food product cell culture construct is received in the housing of the food product bioreactor system, and

wherein at a plane coincident with the end support the plurality of inedible fibres are arranged in a fibre distribution defining an envelope, and wherein the fibre distribution comprises a fibre density of between about 50 fibres/cm^2 and about 330 fibres/cm^2.

2. The food product cell culture construct of claim 1, wherein the outer fibre diameter of the plurality of inedible fibres is at least 0.3mm, for example at least 0.5mm.

3. The food product cell culture construct of claim 1 or 2, wherein the outer fibre diameter of the plurality of inedible fibres is between 0.3mm and 1 mm, for example between 0.4mm and 0.9mm, for example between 0.5mm and 0.8mm, for example between 0.5mm and 0.7mm, for example one of 0.3mm, 0.4mm, 0.5mm, 0.6mm, 0.7mm, 0.8mm, 0.9mm or 1mm.

4. The food product cell culture construct of any preceding claim, wherein a cross-sectional area of the envelope is smaller than the cross-sectional area of the end support.

5. The food product cell culture construct of any preceding claim, wherein at the end support the fibre density is substantially uniform across the envelope.

6. The food product cell culture construct of any one of claims 1 to 4, wherein at the end support the fibre density varies across the envelope.

7. The food product cell culture construct of claim 6, wherein the fibre density at a centre of the fibre distribution is higher than a fibre density at an edge of the fibre distribution.

8. The food product cell culture construct of any preceding claim, further comprising a second end support, wherein opposite ends of the plurality of inedible fibres are embedded in the second end support, and wherein the end support and second end support are receivable at opposite ends of the housing such that the plurality of inedible fibres extend between the end support and the second end support within the housing.

9. The food product cell culture construct of any preceding claim, wherein the plurality of inedible fibres are hollow fibres.

10. The food product cell culture construct of any one of claims 1 to 9, wherein the plurality of inedible fibres are solid fibres.

11. The food product cell culture construct of any preceding claim, wherein the plurality of inedible fibres comprise polystyrene and/or polysulfone.

12. The food product cell culture construct of claim 11, wherein the plurality of inedible fibres comprise polystyrene and a second polymer.

13. The food product cell culture construct of claim 11, wherein the plurality of inedible fibres comprise polysulfone and a second polymer.

14. A food product bioreactor module comprising the food product cell culture construct of any one of claims 1 to 13 and a housing having a cavity within which the food product cell culture construct is receivable such that the plurality of inedible fibres extend into the cavity.

15. A food product cell culturing system comprising the food product bioreactor system of claim 14 and a base unit, the food product bioreactor system being detachable from the base unit.

16. The food product cell culturing system of claim 15, wherein the base unit is adapted to hold the food product bioreactor system such that the housing is inclined from a horizontal position.

17. The food product cell culturing system of claim 15 or 16, wherein the base unit comprises an actuator arranged to rotate the housing.

18. A method of seeding cells and/or cell precursors in the food product bioreactor module of claim 14, the method comprising:

inclining the food product bioreactor module,
introducing a cell suspension into the housing, and
rotating the food product bioreactor module.

19. A method of culturing a food product, the method comprising:
providing the food product cell culturing system of any one of claims 16 to 18,
seeding the food product bioreactor system with cells and/or cell precursors, and
circulating a cell culture medium through the food product bioreactor system.

20. The method of claim 19, comprising harvesting the cultured cells from the food product bioreactor system by separating the cells from the inedible fibres.

21. The food product cell culture construct of any one of claim 1 to claim 13, the food product bioreactor module of claim 14, the food product cell culturing system of any one of claim 15 to claim 17, or the method of any of claim 18 to claim 20, wherein the cells comprise animal cells, in particular muscle cells or muscle cell precursors, plant cells, fungal cells, bacterial cells, and/or algal cells.