CLAIMS

1. A method for the production of a fungal fermentation medium from at least one lignocellulosic material, wherein the at least one lignocellulosic material is at least one industrial and/or agricultural side stream, the method comprising:

(a) aqueous extraction of the at least one industrial and/or agricultural side stream; and

(b) combination of the aqueous extract(s) obtained in (a) with optionally at least one nutrient supplement for fungal cultivation.

2. The method according to claim 1, wherein the step (a) includes the step of prehydrolysis with steam followed by washing step performed with liquid water at the temperature of 50°C to 100°C, preferably at the temperature of 50°C to 70°C, more preferably at the temperature of 50°C to 60°C, preferably preceded by the step of prehydrolysis with steam.

2.3. The method according to claim 12, wherein during the prehydrolysis with steam the lignocellulosic materials are contacted with steam at the temperature of more than 100 °C, preferably at the temperature of between 150 °C and 300 °C, more preferably at the temperature of between 130 °C and 180 °C, preferably between 160 °C and 180 °C, even more preferably at the temperature of about 170 °C, for a time of up to 20 minutes, preferably for a time of between 5 and 15 minutes, more preferably for a time of between 7.5 and 15 minutes.

4. The method according to claim 2 or 3, wherein the lignocellulosic material upon prehydrolysis with steam is washed with liquid water, preferably at the temperature of 50°C to 100°C, more preferably at the temperature of 50°C to 70°C, even more preferably at the temperature of 50°C to 60°C.

53. The method according to claim 1 or 2, wherein (a) is performed with water at a pressure of between 1.25 and 220 bar, preferably at a pressure of between 2 and 220 bar and at a temperature of between 90 and 374 °C for a time of between 10 and 200 minutes,

and/or

wherein (a) is performed with water at a pH of between 2.0 and 12.0, preferably of between 3.0 and 10.0, more preferably of between 4.0 and 8.0, most preferably of between 5.0 and 8.0.

and/or

6. The method according to any one of preceding claims, further comprising steps of processing the aqueous extract(s) obtained in (a) before the step (b) as follows:

i. proteins are separated from the aqueous extract(s) preferably by flocculation or by precipitation with CO_2;

ii. optionally proteins obtained in i. are hydrolyzed, preferably by using proteolytic enzymes, in particular selected from alcalases, papain, proteinase K, and trypsin, at a concentration of between 0.01% and 5% (w/w) and/or at a temperature of between 15 and 100 °C and/or for a time of between 0.5 and 96 hours;

iii. C5-polysaccharides present in the product of i. are hydrolyzed optionally using hemicellulases to monosaccharides, in particular xylose and/or arabinose; and

iv. product(s) of steps ii. and/or iii. are further used in step (b).

4. The method according to any one of claims 1 to 3, wherein the water used in step (a) comprises not more than 1% w/w of acid or base.

7. The method according to claim 1, wherein (a) involves the steps of:

(a1) extraction of the industrial and/or agricultural side stream with water, optionally supplemented by NaOH at a concentration of between 0.1% to 1.0% w/w, at a temperature of between 90 to 374 °C, preferably of between 100 and 220 °C, more preferably of between 100 to 180 °C, for a time of between 10 to 200 minutes; and

(a2) extraction of the industrial and/or agricultural side stream with water at a temperature of between 120 and 220 °C, preferably of between 130 and 200 °C, for a time of between 5 and 150 minutes,

preferably wherein proteins present in the aqueous extract obtained in (a1) are isolated preferably by flocculation or by precipitation with CO_2,

~~optionally further comprising a step wherein proteins present in the aqueous extract obtained in (a1) are hydrolyzed before the step (b),~~

~~optionally further comprising a step wherein C5-polysaccharides present in the aqueous extract obtained in (a2) are further hydrolyzed to monosaccharides optionally using hemicellulases before the step (b), preferably wherein hemicellulases, in particular selected from xylanase, β-glycosidase, α-arabinofuranosidase, α-glucuronidase, and β-xylosidase, are used at a concentration of between 0.01% and 5% (w/w) and/or at a temperature of between 15 and 100 °C and/or for a time of between 0.5 and 96 hours;~~

5~~8~~. The method according to any one of preceding claims, further comprising the step (a') of enzymatic hydrolysis of a solid lignocellulosic residue obtained in (a) with cellulase, and separating a liquid product of hydrolysis from a solid residue, preferably wherein (a') is performed at a temperature of between 15 and 100°C and/or at a pH of between 3.0 and 8.0, and/or for a time of between 10 and 200 hours.

6~~9~~. The method of any one of preceding claims, wherein the lignocellulosic material is an industrial and/or agricultural side stream~~.~~

~~10. The method according to claim 9, wherein the industrial and/or agricultural side stream is a solid side stream~~

~~11. The method of claim 10, wherein the solid side stream is~~ selected from spent grain, cereal brans, cotton, cotton seed husks, bagasse, cocoa shells, cocoa, cocoa pods, cotton and oil press cakes from sunflower, peanut, hazelnut, palm oil, olive, shells and husks from nuts, grass and leaves waste, wood chips, coffee grounds, coffee husks, coffee silverskin, rapeseed and/or byproducts from the soy industry like soybean pulp ("okara"), preferably ~~.~~

~~12. The method of any one of preceding claims,~~ wherein the lignocellulosic material is spent grain.

713. The method according to any one of preceding claims, further comprising a step of extraction of lipids using supercritical CO_2 and their mechanical separation before the step (a),

and/or

further comprising a step of removal of toxic compounds present in the aqueous extract of (a) and/or optionally in the liquid product of (a'), such as furfural and/or hydroxymethylfurfural, before step (b),

and/or

further comprising the step of recovering a solid lignin residue of step (a').

814. A protein composition obtainableed according to claim 36 or 7.

915. A fungal fermentation medium obtainableed in the method according to any one of claims 1 to 173., .

16. preferably The fungal fermentation medium of claim 15, wherein said medium is further supplemented with nitrogen source(s), in particular selected from ammonia, urea, yeast extract, malt extract, corn steep liquor and peptone,.

and/or

17. preferably The fungal fermentation medium of claim 16 or 17, wherein said medium is further processed into a dried form,.

and/or

18. preferably The fungal fermentation medium of any one of claims 15 to 17, wherein C5-polysaccharides constitute at least 50% of all sugars in said medium, preferably wherein C5-polysaccharides constitute at least 65% of all sugars in said medium, more preferably wherein C5-polysaccharides constitute at least 80% of all sugars in said medium said medium.

109. A method for producing a fungal biomass by submerged fermentation of at least one fungal strain, the method comprising:

(a) providing the pH-adjusted fungal fermentation medium of any one of claims 915 to 18 to a fermenter suitable for growing fungal mycelium;

(b) cultivating fungal mycelium; and

(c) retrieving and concentrating the fungal biomass to achieve a dry fungal biomass content of between 2 to 100%, preferably wherein step (b) is performed at a temperature of between 15 and 40°C and/or at a pH of between 3.0 and 8.5 and/or for a time of between 12 and 240 hours.

1120. The method according to claim 109, wherein the at least one fungal strain is an edible fungus.

~~21. The method according to claim 19 or 20, wherein the at least one fungal strain is selected from Basidiomycota and Ascomycota.~~

~~22. The method according to any one of claims 19 to 21, wherein the at least one fungal strain is selected from Pezizomycotina and Agaromycotina.~~

~~23. The method according to any one of claims 19 to 22, wherein the at least one fungal strain is selected from Peziomycetes, Agaricomycetes and Sordariomycetes.~~

~~24. The method according to any one of claims 19 to 23, wherein the at least one fungal strain is selected from Pezizales, Boletales, Cantharellales, Agaricales, Polyporales, Russulales, Auriculariales, Sordoriales and Hypocreales.~~

~~25. The method according to any one of claims 19 to 24,~~ preferably wherein the at least one fungal strain is selected from Morchellaceae, Tuberaceae, Pleurotaceae, Agaricaceae, Marasmiaceae, Cantharellaceae, Hydnaceae, Boletaceae, Meripilaceae, Polyporaceae, Strophariaceae, Lyophyllaceae, Tricholomataceae, Omphalotaceae, Physalacriaceae, Schizophyllaceae, Sclerodermataceae, Ganodermataceae, Sparassidaceae, Hericiaceae, Bondarzewiaceae, Cordycipitaceae, Auriculariaceae, Sordoriaceae, Nectriaceae and Fistulinaceae.

1226. The method of ~~any one of~~ claim~~s~~ 1119 ~~to 25~~, wherein the at least one fungal strain is P. pulmonarius P. ostreatus, P. citrinopileatus or P.

salmoneostramineus or wherein the at least one fungal strain is M. esculenta, M angusticeps or M. deliciosa.

~~27. The method of any one of claims 19 to 26, wherein the at least one fungal strain is P. pulmonarius or P. ostreatus.~~

~~28. The method according to any one of claims 19 or 27, wherein the submerged fermentation is operated as a batch, a fed-batch or a continuous process.~~

~~29. The method of any one of claims 19 to 28, wherein more than one fungal strains are co-fermented.~~

13~~30~~. A fungal biomass produced according to the method of any one of claims 1~~09~~ to 12~~29~~.

~~31. The fungal biomass of claim 30, wherein the fungal strain is selected from Pleurotaceae, in particular wherein the fungal strain is P. pulmonarius P. ostreatus, P. citrinopileatus or P. salmoneostramineus, or wherein the at least one fungal strain is selected from Morchellaceae, in particular wherein the fungal strain is M. esculenta, M angusticeps or M. deliciosa.~~

14~~32~~. Use of the fungal biomass of claim 13~~30 or 31~~ in production of a fungal-based food product, preferably ~~.~~

~~33. The use of claim 32,~~ wherein the solid lignin residue recovered according to claim 7~~15~~ is further used in production of the fungal-based food product.~~,~~

and/or

~~34. The use of claim 32 or 33,~~ wherein the protein composition of claim ~~14~~ 9 is used in the preparation of the fungal based food product.

15~~35~~. A fungal-based food product prepared using the fungal biomass of claim 13~~30 or 31~~.