CLAIMS

1. A method of producing a powder comprising an entrapped or encapsulated bioactive and/or bioactive precursor, the method comprising:

i) obtaining an aqueous mixture comprising protein and carbohydrate from a biomass of a single species of organism;

ii) adding oil to the aqueous mixture;

iii) forming an emulsion or suspension comprising the bioactive and/or bioactive precursor; and

iv) forming a powder comprising an entrapped or encapsulated bioactive and/or bioactive precursor from the emulsion or suspension~~.~~,

wherein the biomass is a *Brassica*.

2. The method of claim 1, wherein the powder comprises one or more of the following features:

a) has an induction period of about 10 to about 300 hours, when measured at 80˚C ~~and a 5 bar initial oxygen pressure.~~

~~3. The method of claim 1 or claim 2, wherein the powder comprises~~ ; b) about 5% to about 50% ~~oil~~ w/w oil~~.~~;

~~4. The method of any one of claims 1 to 3, wherein the powder comprises~~c) about 10% to about 40% ~~oil~~ w/w oil~~.~~; and

~~5. The method of any one of claims 1 to 4, wherein~~ d) the oil content of emulsion or suspension before forming the powder is from about 1% to about 10% w/w.

~~6~~3. The method of ~~any one of claims~~claim 1 ~~to 5~~or claim 2, wherein the aqueous mixture further comprises protein and carbohydrate from at least one further biomass from a single species of organism.

~~7~~4. The method of any one of claims 1 to ~~6~~3, wherein the biomass and/or further biomass comprises one or more of:

~~i~~a) a protein to carbohydrate ratio of between about 1:1 to 1:10.5;

~~ii~~b) a protein to carbohydrate ratio of between about 1:4.5 and about 4:1; ~~and~~

~~iii~~c) a protein to carbohydrate ratio of between about 1:2.5 and about 2:1~~.~~;

~~8~~ d) the bioactive is an isothiocyanate;

e) the bioactive precursor is a glucosinolate and/or glucoraphanin.

5. The method of any one of claims 1 to ~~7~~4, wherein the bioactive and/or bioactive precursor is one or more of:

i) a component of the biomass;

ii) the oil or a component thereof in step ii);

iii) a component added to the oil before the oil is added to the aqueous mixture in step ii);

iv) a component infused in the oil before or during step ii);

v) a component of the further biomass; ~~and~~

vi) is a component added in step i), ii) and iii) of the method~~.~~;

~~9. The method of claim 8, wherein~~ vii) the bioactive is ~~i) and~~ a component of the biomass and the oil or a component thereof in step ~~ii).~~);

~~10. The method of claim 8, wherein the bioactive precursor is i).~~

~~11. The method of claim 8, wherein~~ viii) the bioactive is formed in or after step i), ii) or iii~~).~~);

~~12. The method of any one of claims 1 to 11, wherein the bioactive and/or bioactive precursor~~ ix) is sensitive to degradation by one or more of: ~~degradation by~~ oxygen, temperature, pH, moisture and light~~.~~;

~~13. The method of any one of claims 1 to 12, wherein when the biomass and/or further biomass comprises:~~

~~i) *Brassicaceae* and the bioactive is an isothiocyanate;~~

~~ii) *Brassicaceae* and the bioactive precursor is a glucosinolate and/or glucoraphanin;~~

~~iii) onion and the bioactive is one or more of quercetin, allicin and phenolic acid;~~

~~iv) garlic and the bioactive is one or more of allicin and ajoene; or~~

~~v) fruit and/or vegetables containing polyphenols.~~

~~14. The method of any one of claims 1 to 13, wherein the bioactive~~ x) is a phytonutrient~~.~~;

~~15. The method of any one of claims 1 to 14, wherein bioactive~~xi) is selected from one or more of: fatty acid, an isothiocyanate, quercetin, allicin, ajoene, vitamin A, vitamin D, vitamin E, tocopherols, tocotrienols, vitamin K, beta-carotene, lycopene, lutein, zeaxanthin, stigmasterol, beta-sitosterol, campesterol, antioxidants, coenzyme Q10, astaxanthin, cannabinoid, cannabiodiol and a polyphenol~~.~~;

~~16. The method of claim 15, wherein~~ xii) the bioactive is a fatty acid the fatty acid is: omega-3, omega-6 or omega-9 fatty acid~~.~~; and

~~17. The method of claim 16, wherein~~ xiii) the bioactive is an omega-3 fatty acid the omega-3 fatty acid is one or more of α-linolenic acid (ALA), eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA).

~~18~~6. The method of any one of claims 1 to ~~17~~5, further comprising pre-treating the biomass~~.~~

~~19. The method of claim 18~~, wherein pre-treating comprises one or more of:

i) heating;
ii) macerating;
iii) microwaving;
iv) exposure to low frequency sound waves (ultrasound);
v) pulse electric field processing;
vi) static high pressure;
vii) extrusion;
viii) enzyme treatment;
ix) fermentation;
x) an extraction or separation process; and
xi) drying.

~~20~~7. The method of any one of claims 1 to ~~19~~6, wherein the ~~biomass or~~ further biomass is one or more of:

a) from the Plantae or Fungi Kingdom~~.~~;

~~21. The method of claim 20, wherein the~~ b) is a Plantae ~~is~~ selected from: *Brassicaceae, Cannabis Asparagaceae~~, Arecaceae~~, Myrtaceae, Rosaceae, Musaceae, Ericaceae, Saxifragaceae, Cucurbitaceae, Nightshade, Capparaceae, Adoxaceae, Vitaceae, Rutaceae, Actinidiaceae, Sapindaceae, Anacardiaceae, Moraceae, ~~Oleaceae, Cactaceae, ~~Passifloraceae, Bromeliaceae, Cactaceae, Lythraceae, Polygonaceae, ~~Cucurbitaceae, ~~Oxalidaceae, Caesalpinioideae, Compositae, Amaranthaceae~~/ Chenopodiacae~~, Chenopodiaceae, Malvaceae, Amarylidaceae, Fabaceae, Arecaceae* and *Poaceae~~.~~*;

~~22. The method of claim 20, where the~~ c) is a Plantae ~~is~~ selected from: fruit, vegetable, nut, legume, cereal and a grass~~.~~;

~~23. The method of claim 22, wherein the~~ d) is a Plantae ~~is~~ selected from: broccoli, kale, cauliflower, carrot, onion, garlic, tomato, brussel sprouts, spinach, snow peas, asparagus, and avocado~~.~~;

~~24. The method of claim 20, wherein the~~ e) is a Fungi ~~is~~ selected from: *Boletaceae, Cantharellaceae, ~~Tricholomataceae, ~~Cortinariaceae, ~~Cantharellaceae, ~~Meripilaceae, Discinaceae, Pleurotaceae, Tricholomataceae* and *Tuberaceae~~.~~*; and

~~25. The method of any one of claims 1 to 20, wherein the biomass or further biomass~~ f) is matcha, canola meal, nut meal, soybean meal, coconut meal, palm kernel meal, hemp oil press cakes, chia oil seed cake or rice bran.

~~26~~8. The method of any one of claims 1 to ~~25~~7, wherein the oil comprises one or more of the following:

a) one or more fatty acids~~.~~;

~~27. The method of any one of claims 1 to 26, wherein the oil~~ b) is selected from one or more of: fish oil, krill oil, marine oil, canola oil, sunflower oil, avocado oil, soya oil, borage oil, evening primrose oil, safflower oil, flaxseed oil, olive oil, pumpkinseed oil, hemp seed oil, wheat germ oil, palm oil, palm olein, palm kernel oil, coconut oil, medium chain triglycerides and grapeseed oil~~.~~; and

~~28. The method of claim 27,~~ c) wherein the oil is fish oil or marine oil and wherein the fish oil or marine oil is selected from one or more of: tuna oil, herring oil, mackerel oil, sardine oil, cod liver oil, menhaden oil, shark oil, algal oil, squid oil, and squid liver oil.

~~29~~9. The method of any one of claims 1 to ~~28~~8, wherein the method comprises post-treating the emulsion or suspension to reduce microbial activity~~.~~

~~30. The method of claim 29,~~ wherein post-treating comprises one or more of the following:

i) heating;

ii) microwaving;

iii) UV treatment; and

iv) high pressure processing.

~~31~~10. The method of any one of claims 1 to ~~30~~9, wherein forming the powder comprises spray drying, freeze drying, refractance window drying or drum drying~~.~~ and/or

~~32. The method of any one of claims 1 to 31,~~ wherein when the entrapped or encapsulated bioactive and/or bioactive precursor ~~-~~is resistant to degradation for about 3 to about 24 months.

~~33~~11. The method of ~~claim 32~~any one of claims 1 to 10, wherein the ~~degradation is selected from~~method comprises one or ~~more~~both of the following apply:

i) forming a powder comprises drying the emulsion or suspension to reduce the water content to 1 to 14%; and

ii) the emulsion or suspension is dried to produce a mean dry particle size of~~:~~ ~~oxygen, temperature, pH, moisture and light~~ 10 µM to 4000 µM.

~~34~~12. The method of any one of claims 1 to 11, wherein the *Brassica* is *Brassica oleracea.*

13. The method of any one of claims 1 to ~~33~~12, wherein the ~~powder~~*Brassica* is ~~extruded.~~ *Brassica oleracea variety italic.*

~~35~~14. The method of ~~claim 34~~any one of claims 1 to 13, wherein the ~~powder~~*Brassica* is ~~extruded or compressed to form a tablet.~~ *Brassica oleracea variety botrytis*.

~~36~~15. A powder produced by the method of any one of claims 1 to 14, comprising an entrapped or encapsulated bioactive and/or bioactive precursor and comprising protein and carbohydrate from a single species of organism.

~~37.~~16. The powder of claim ~~36, produced by~~15, wherein the ~~method of any one of claims 1 to 35.~~

~~38. The~~ powder ~~of claim 36 or claim 37, wherein~~comprises one or more of the following features:

a) the entrapped or encapsulated bioactive and/or bioactive precursor is resistant to oxygen degradation compared to the unentrapped or unencapsulated bioactive and/or bioactive precursor~~.~~;

~~39. The powder of any one of claims 36 to 38, wherein~~ b) the bioactive and/or bioactive precursor is a fatty acid~~.~~;

~~40. The powder of any one of claims 36 to 39, wherein the powder has~~c) an induction period of about 10 to about 300 hours, when measured at 80˚C and a 5 bar initial oxygen pressure~~.~~;

~~41. The powder of any one of claims 36 to 40, wherein the emulsion or suspension has an induction period of at least 100 hours, when measured at 80˚C and a 5 bar initial oxygen pressure.~~

~~42. The powder of any one of claims 36 to 41, wherein the powder comprises~~ d) about 5% to about 50% ~~oil~~ w/w oil~~.~~;

~~43. The powder of any one of claims 36 to 42, wherein the powder comprises~~ e) about 10% to about 40% ~~oil~~ w/w oil~~.~~;

~~44. The powder of any one of claims 36 to 43, wherein~~ f) the bioactive and/or bioactive precursor of b) is one or more of:

i) a component of the biomass;

ii) the oil or a component thereof in step ii);

iii) a component added to the oil before the oil is added to the aqueous mixture in step ii);

iv) a component infused in the oil before or during step ii);

v) a component of the further biomass; ~~and~~

vi) is a component added in step i), ii) and iii) of the method~~.~~; and

~~45. The powder of claim 44, wherein the~~ vii) the bioactive is i) and ii).

~~46~~17. A product comprising the powder produced by the method of any one of claims 1 to ~~35,~~11, or the powder of claim 15 or ~~the powder of any one of claims 36 to 45~~claim 16.

~~47~~18. The product of claim ~~46~~17, wherein the product comprises one or more of the following features:

a) entrapped or encapsulated bioactive and/or bioactive precursor in the product is more resistant to degradation compared to the same product comprising unentrapped or unencapsulated bioactive and/or bioactive precursor~~.~~;

~~48. The product of claim 46 or 47, wherein the product is~~ b) is a cream, gel tablet, liquid, pill, capsule, powder or extruded product~~.~~;

~~49. The product of any one of claims 46 to 48, wherein the product~~ c) is a food, food ingredient, supplement, cosmetic or cosmetic ingredient~~.~~; and

~~50. The product of any one of claims 46 to 49, wherein the product comprises~~ d) omega-3 polyunsaturated fatty acids.

~~51~~19. The product of ~~any one of claims 46 to 50, wherein the food is an animal feed.~~

~~52. The product of~~claim 17 or claim ~~51~~18, wherein the product is selected from:

a) an animal feed ~~is~~;

b) an aquaculture feed~~.~~;

~~53. A method of producing an emulsion or suspension, the method comprising:~~

i) obtaining an aqueous suspension comprising protein and carbohydrate from a biomass of c) a single species of organism;

ii) optionally adding oil to the aqueous suspension; and

iii) forming an emulsion or suspension comprising a bioactive and/or bioactive precursor.

54. A matrix comprising protein and carbohydrate from a biomass of a single species of organism.

55. A bioactive and/or bioactive precursor entrapped or encapsulated in a matrix comprising protein and carbohydrate of a biomass from a single species of organism, wherein the entrapped or encapsulated bioactive and/or bioactive precursor is resistant to oxygen degradation when compared to the bioactive and/or bioactive precursor before entrapment or encapsulation.

56. An emulsion or suspension produced by the method of claim 53.

57. A product comprising the emulsion or suspension produced by the method of claim 53, the matrix of claim 54, the bioactive and/or bioactive precursor entrapped or encapsulated in the matrix of claim 55, or the emulsion or suspension of claim 56.

58. A pharmaceutical or cosmetic composition, which comprises an isothiocyanate and/or an isothiocyanate precursor, a lipid, and a pharmaceutical and/or cosmetic excipient.composition; and

59. The composition of claim 58, wherein the composition is for topical, enteral/gastrointestinal or parenteral administration.

60. The composition of claim 58 or claim 59, wherein the composition is in the form of a cream, ointment, gel, tablet, liquid, pill, capsule, powder or extruded product.

61. The composition of any one of claims 58 to 60, wherein following storage for a period of about one month, at least 50% of the isothiocyanate and/or isothiocyanate precursor remain in the composition.

62. A method of producing an emulsion comprising an isothiocyanate or isothiocyanate precursor, the method comprising:

providing a mixture comprising water, a lipid, and an isothiocyanate or isothiocyanate precursor, thereby forming an emulsion.

63. The method of claim 62, wherein following about one month of storage at about 4 to about 10°C or at about -18ºC, the concentration of the isothiocyanate and/or isothiocyanate precursor in the emulsion is at least twice the concentration of isothiocyanate and/or isothiocyanate precursor in a corresponding composition lacking the lipid.

64. An emulsion comprising water, a lipid, and an isothiocyanate and/or isothiocyanate precursor.

65. A method of preparing a powder comprising an isothiocyanate and/or isothiocyanate precursor, comprising:

preparing an emulsion according to any one of claims 62 to 64, and

subjecting the emulsion to drying conditions, thereby removing water and forming a powder.

66. The method of claim 65, wherein the emulsion is subjected to freeze-drying, spray drying conditions or refractance window drying thereby forming a powder.

67. The method of claim 65 or claim 66, wherein following about two months of storage at -18ºC, the concentration of the isothiocyanate and/or isothiocyanate precursor in the powder is at least twice the concentration of isothiocyanate and/or isothiocyanate precursor in a corresponding powder lacking the lipid.

68. A method of preparing a pharmaceutical or cosmetic composition, comprising:

preparing an emulsion of any one of claims 62 to 63, or preparing a powder of claim 65 or claim 67, and

converting the emulsion or dried composition to a pharmaceutical or cosmetic composition.

~~69. The composition, method, or emulsion of any one of claims 58 to 68, wherein the isothiocyanate is selected from one or more of: sulforaphane, allyl isothiocyanate, benzyl isothiocyanate and phenethyl isothiocyanate.~~

~~70. The composition, method, or emulsion of any one of claims 58 to 69, wherein the isothiocyanate precursor is selected from one or more of: glucosinolate, glucoraphanin, sinigrin, glucotropaeolin, and gluconasturtiin.~~

~~71. The composition, method, or emulsion of any one of claims 58 to 70, wherein the lipid is an oil.~~

~~72. A method of therapy or prophylaxis of a condition, comprising administering to a subject in need thereof an effective amount of a pharmaceutical composition, emulsion or powder of any one of claims 58 to 71.~~

~~73. A pharmaceutical composition, emulsion or powder of any one of claims 58 to 72, for use in therapy or prophylaxis of a condition.~~

~~74. A method of treating or preventing a condition in a subject, comprising administering to the subject an effective amount of a pharmaceutical composition, emulsion or powder of any one of claims 58 to 73.~~

~~75. Use of the emulsion of claim 64, or the powder of claim 65 or 66 in the manufacture of a medicament for the treatment of a condition.~~

~~76. The method or use of any one of claims 72, 73, 74 or 75, wherein the condition is selected from: cancer, diabetes, cardiovascular disease, autism, osteoporosis, neuroprotective diseases, metabolic syndrome, inflammation, oxidative stress and a gut health condition.~~

d) a cosmetic composition.