CLAIMS

1. A method for producing silk dope, the method comprising

i) lysing cells producing one or more silk proteins,

ii) solubilising the silk proteins by contacting them with a surfactant or an ionic liquid, and

iii) concentrating the silk proteins to produce silk dope,

wherein the one or more silk proteins are capable of forming a tertiary structure which comprises a coiled-coil structure.

2. The method of claim 1, wherein the silk proteins are concentrated by

a) reducing the amount of surfactant in solution by adding a compound which precipitates the surfactant, and

b) separating the solution comprising the silk proteins from the precipitate formed in step a) to produce the silk dope.

3. The method of claim 1, wherein the compound which precipitates the surfactant is a salt or a carbohydrate; or a combination of two or more thereof.

4. The method of claim 3, wherein the salt is a potassium salt or a sodium salt.

5. The method of claim 1, wherein the silk proteins are concentrated by filtration.

6. The method of claim 5, wherein the silk proteins are concentrated by membrane filtration.

7. The method of claim 6, wherein the membrane filtration is tangential flow filtration.

8. The method according to any one of claims 1 to 7 which further comprises increasing the concentration of silk proteins in the silk dope.

9. The method of claim 8 which comprises dialysing the silk dope against a dehydrating solution.

10. The method of claim 9, wherein the dehydrating solution comprises a hygroscopic polymer.

11. The method of claim 10, wherein the hygroscopic polymer is selected from the group consisting of polyethylene glycol, amylase, and sericin, or a combination of two or more thereof.

12. The method according to any one of claims 1 to 11, wherein the silk dope comprises at least about 0.5% w/v silk proteins.

13. The method of claim 12, wherein the silk dope comprises about 0.5% to about 15% w/v silk proteins.

14. The method according to any one of claims 1 to 13, wherein the cells are bacterial cells, yeast cells, insect cells, plant cells or animal cells, or a combination of two or more thereof.

15. The method of claim 14, wherein the cells are bacterial cells.

16. The method according to any one of claims 1 to 15, wherein step i) further comprises isolating inclusion bodies from the lysed cells.

17. The method according to any one of claims 1 to 16 which further comprises culturing the cells before step i).

18. The method according to any one of claims 1 to 17, wherein the portion of the silk protein that is capable of forming a tertiary structure which comprises a coiled-coil structure comprises at least 10 copies of the heptad sequence *abcdefg*, and wherein at least 25% of the amino acids at positions *a* and *d* are alanine residues.

19. The method according to any one of claims 1 to 18, wherein the silk proteins comprise a sequence selected from:

a) an amino acid sequence as provided in any one of SEQ ID NOs 1, 3, 5, 7, 17, 19, 21, 23, 33, 35, 37, 39, 49, 51, 53, 55, 65, 67, 69, 71, 81, 83, 85, 87 or 97,

b) an amino acid sequence which is at least 30% identical to any one or more of SEQ ID NOs 1, 3, 5, 7, 17, 19, 21, 23, 33, 35, 37, 39, 49, 51, 53, 55, 65, 67, 69, 71, 81, 83, 85, 87 or 97, and

c) a biological fragment of a) or b).

20. The method according to any one of claims 1 to 19, wherein the silk proteins comprise a first silk protein which comprises

a) an amino acid sequence as provided in any one of SEQ ID NOs 1, 17, 33, 49, 65 or 81;

b) an amino acid sequence which is at least 30% identical to any one or more of SEQ ID NOs 1, 17, 33, 49, 65 or 81; and

c) a biologically active fragment of a) or b),

a second silk protein which comprises

d) an amino acid sequence as provided in any one of SEQ ID NOs 3, 19, 35, 51, 67 or 83;

e) an amino acid sequence which is at least 30% identical to any one or more of SEQ ID NOs 3, 19, 35, 51, 67 or 83; and

f) a biologically active fragment of d) or e),

a third silk protein which comprises

g) an amino acid sequence as provided in any one of SEQ ID NOs 5, 21, 37, 53, 69 or 85;

h) an amino acid sequence which is at least 30% identical to any one or more of SEQ ID NOs 5, 21, 37, 53, 69 or 85; and

i) a biologically active fragment of g) or h), and/or

a fourth silk protein which comprises

j) an amino acid sequence as provided in any one of SEQ ID NOs 7, 23, 39, 55, 71 or 87;

k) an amino acid sequence which is at least 30% identical to any one or more of SEQ ID NOs 7, 23, 39, 55, 71 or 87; and

l) a biologically active fragment of j) or k).

21. The method of claim 20, wherein the first silk protein, second silk protein, third silk protein and/or fourth silk protein are produced by the same cells.

22. The method of claim 20, wherein the first silk protein, second silk protein, third silk protein and/or fourth silk protein are produced by different cells.

23. The method according to any one of claims 20 to 22, wherein step ii) comprises approximate equimolar amounts of the first silk protein, the second silk protein, the third silk protein and the fourth silk protein.

24. The method according to any one of claims 1 to 23, wherein the surfactant is an anionic surfactant.

25. The method of claim 24, wherein the anionic surfactant is sodium dodecyl sulfate (SDS), ammonium lauryl sulfate or other alkyl sulfate salts, sodium 1-octanesulfonate monohydrate, sodium lauroyl sarcosinate, sodium lauryl ether sulfate (SLES), sodium taurodeoxycholate hydrate, alkyl benzene sulfonate; or a combination of two or more thereof.

26. The method according to any one of claims 1 to 23, wherein the ionic liquid comprises

i) an anion selected from chloride, bromide, iodide, thiocyanate, acetate, C_1-C_4-alkylsulfates, methanesulfonates, tosylate, C_1-C_4-dialkylphosphates, hydrogensulfate and tetrachloroaluminate, and

ii) a cation selected from 1,3-C_1-C_4-dialkylimidazolium, 3-chloropyridinium, 4-dimethylaminopyridinium, 2-ethyl-4-aminopyridinium, 2-methylpyridinium, 2-ethylpyridinium, 2-ethyl-6-methylpyridinium, quinolinium, isoquinolinium, pyridinium, 1-C_1-C_4-alkylimidazolium, 1-methylimidazolium, 1,2-dimethylimidazolium, 1-n-butyl-imidazolium, 1,4,5-trimethylimidazolium, 1,4-dimethylimidazolium, imidazolium, 2-methylimidazolium, 1-butyl-2-methylimidazolium, 4 methylimidazolium, 1-(2'-aminoethyl)imidazolium, 1-vinylimidazolium, 2-ethylimidazolium and benzotriazolium.

27. A method for producing silk dope, the method comprising

i) obtaining supernatant from cell cultures, or from a cell-free expression system, producing one or more silk proteins,

ii) solubilising the silk proteins by contacting them with a surfactant or an ionic liquid, and

iii) concentrating the silk proteins to produce the silk dope,

wherein the one or more silk proteins are capable of forming a tertiary structure which comprises a coiled-coil structure.

28. The method of claim 27, wherein step i) further comprises increasing the concentration of silk proteins from the supernatant.

29. The method of claim 28, wherein the concentration of silk proteins is increased by contacting the supernatant with an agent which precipitates the silk proteins.

30. A method for producing a silk fibre, the method comprising extruding and/or drawing silk dope produced by the method of any one of claims 1 to 29.

31. The method of claim 30, wherein extruding comprises passing the silk dope through an about 5μm to about 500μm capillary tube.

32. The method of claim 30 or claim 31, wherein the silk dope is extruded into a solution comprising alcohol.

33. The method of claim 32, wherein the alcohol is methanol and the concentration of the methanol in the solution is about 40% to about 80% v/v.

34. A method for producing a silk film, the method comprising casting silk dope produced by the method of any one of claims 1 to 29.

35. Silk dope produced by the method of any one of claims 1 to 29.

36. A silk fibre produced by the method of according to any one of claims 30 to 33.

37. A silk film produced by the method of claim 34.

38. A product comprising a silk fibre of claim 36 and/or a silk film of claim 37.

CLAIMS

1. A method for producing silk dope comprising silk proteins which have a coiled coil tertiary structure, the method comprising

i) lysing cells producing one or more silk proteins capable of forming a coiled coil tertiary structure,

ii) solubilising the silk proteins by contacting them with an amount of anionic surfactant sufficient to solubilize the silk proteins, and

iii) concentrating the silk proteins while reducing the amount of the anionic surfactant to produce the silk dope, wherein the silk dope comprises the anionic surfactant and silk proteins which have a coiled coil tertiary structure.

2. The method of claim 1, wherein the silk proteins are concentrated by

a) reducing the amount of surfactant in solution by adding a compound which precipitates the surfactant, and

b) separating the solution comprising the silk proteins from the precipitate formed in step a) to produce the silk dope.

3. The method of claim 1, wherein the compound which precipitates the surfactant is a salt or a carbohydrate; or a combination of two or more thereof.

4. The method of claim 3, wherein the salt is a potassium salt or a sodium salt.

5. The method of claim 1, wherein the silk proteins are concentrated by filtration.

6. The method of claim 1 which further comprises increasing the concentration of silk proteins in the silk dope.

7. The method of claim 6 which comprises dialysing the silk dope against a dehydrating solution.

8. The method of claim 7, wherein the dehydrating solution comprises a hygroscopic polymer.

9. The method of claim 1, wherein the silk dope comprises at least about 0.5% w/v silk proteins.

10. The method of claim 9, wherein the silk dope comprises about 0.5% to about 15% w/v silk proteins.

11. The method of claim 1, wherein the cells are bacterial cells, yeast cells, insect cells, plant cells or animal cells, or a combination of two or more thereof.

12. The method of claim 11, wherein the cells are bacterial cells.

13. The method of claim 1, wherein step i) further comprises isolating inclusion bodies from the lysed cells.

14. The method of claim 1 which further comprises culturing the cells before step i).

15. The method of claim 1, wherein the portion of the silk protein that is capable of forming a tertiary structure which comprises a coiled-coil structure comprises at least 10 copies of the heptad sequence *abcdefg*, and wherein at least 25% of the amino acids at positions *a* and *d* in the at least 10 copies of the heptad are alanine residues.

16. The method of claim 1, wherein the anionic surfactant is sodium dodecyl sulfate (SDS), ammonium lauryl sulfate or other alkyl sulfate salts, sodium 1-octanesulfonate monohydrate, sodium lauroyl sarcosinate, sodium lauryl ether sulfate (SLES), sodium taurodeoxycholate hydrate, alkyl benzene sulfonate; or a combination of two or more thereof.

17. A method for producing silk dope comprising silk proteins which have a coiled coil tertiary structure, the method comprising

i) obtaining supernatant from cell cultures, or from a cell-free expression system, producing one or more silk proteins capable of forming a coiled coil tertiary structure,

ii) solubilising the silk proteins by contacting them with an amount of anionic surfactant

sufficient to solubilize the silk proteins, and

iii) concentrating the silk proteins while reducing the amount of the anionic surfactant to produce the silk dope, wherein the silk dope comprises the anionic surfactant and silk proteins which have a coiled coil tertiary structure.

18. A method for producing a silk fibre, the method comprising extruding and/or drawing silk dope produced by the method of claim 1.

19. A method for producing a silk film, the method comprising casting silk dope produced by the method of claim 1.

20. The method of claim 16, wherein the anionic surfactant is sodium dodecyl sulfate (SDS).

21. The method of claim 17, wherein the anionic surfactant is sodium dodecyl sulfate (SDS).