Claims

1. Electrospun fibres containing:

i) a first and a second hydrophilic fibre-forming polymer that are soluble in a hydrophilic solvent,

ii) a bioadhesive substance that is at the most soluble in a range of 100 mL per 1 g to 1000 mL per 1 g in said hydrophilic solvent,

iii) a drug substance,

wherein the first hydrophilic fibre-forming polymer has a solubility in water at 37°C that is at least 10 times greater than the solubility in water at 37°C of the second hydrophilic fibre-forming polymer, and wherein the bioadhesive substance is present in solid form.

2. Electrospun fibres according to claim 1, wherein said first and the second hydrophilic fibre-forming polymer has a solubility in said hydrophilic solvent of 3 g/100 ml or more at 25 °C or 10 g/100 ml or more at 25 °C.

3. Electrospun fibres according to any of the preceding claims, wherein said hydrophilic solvent is selected from ethanol, or ethanol-water mixtures.

4. Electrospun fibres according to claim 3, wherein said ethanol-water mixtures contain 20% v/v water or less or 10% v/v water or less.

5. Electrospun fibres according to claim 3 or 4, wherein said ethanol-water mixtures contain 5% v/v water or less or 3% v/v water or less.

6. Electrospun fibres according to any of the preceding claims, wherein said first hydrophilic fibre-forming polymer has a solubility in water that is at least 50 times greater than the water solubility of said second hydrophilic fibre-forming polymer in water, both measured at 37°C.

7. Electrospun fibres according to any of the preceding claims, wherein said first hydrophilic fibre-forming polymer has a solubility in water that is at least 100 times greater or at least 500 times greater than the water solubility of said second hydrophilic fibre-forming polymer in water, both measured at 37°C.

8. Electrospun fibres according to any of the preceding claims, wherein the bioadhesive substance is at the most soluble in a range of 1000 mL per 1 g to 10,000 mL per 1 g in said solvent selected from ethanol, or ethanol-water mixtures at a temperature of 25 °C.

9. Electrospun fibres according to any of the preceding claims, wherein the bioadhesive substance has a solubility of at the most 0.1% w/w in said solvent selected from ethanol, ethanol-water mixtures at a temperature of 25 °C.

10. Electrospun fibres according to any of the preceding claims, wherein the bioadhesive substance has a solubility of at the most 0.01% w/w in said solvent selected from ethanol, ethanol-water mixtures at a temperature of 25 °C.

11. Electrospun fibres according to any of the preceding claims, wherein at least 90% w/w of the bioadhesive substance is present in solid form.

12. Electrospun fibres according to any of the preceding claims, wherein at least 95% w/w or 99% w/w of the bioadhesive substance is present in solid form.

13. Electrospun fibres according to any of the preceding claims, wherein said first hydrophilic fibre-forming polymer is selected from polyvinylpyrrolidone (PVP), hydroxypropylcellulose, and mixtures thereof.

14. Electrospun fibres according to any of the preceding claims, wherein said second hydrophilic fibre-forming polymer is selected from ethylcellulose, acrylates and acrylic copolymers, and mixtures thereof.

15. Electrospun fibres according to any of the preceding claims, wherein the first hydrophilic fibre-forming polymer is PVP and the second hydrophilic fibre-forming polymer is an acrylic copolymer.

16. Electrospun fibres according to any of the preceding claims, wherein the bioadhesive substance is selected from dextrans, polyethylene oxides (PEOs), alginate, tragacanth, carrageenan, pectin, gelatin, guar, xanthan, gellan, methylcellulose, hydroxypropylmethylcellulose (HPMC), polyvinylalcohol (PVA), polymers of acrylic acids (PAA derivatives), chitosan, lectins, thiolated polymers, polyoxo WSRA (WSRA is water-soluble resin adhesive), PAA-co-PEG (PEG is polyethylene glycol), and mixtures thereof.

17. Electrospun fibres according to any of the preceding claims, wherein the bioadhesive substance is dextran having an average molecular weight of from 400,000 Da to 2,000,000 Da.

18. Electrospun fibres according to any of the preceding claims, wherein the bioadhesive substance is dextran having an average molecular weight of about 2,000,000 Da.

19. Electrospun fibres according to any of claims 1-16, wherein the bioadhesive substance is polyethylene oxide having an average molecular weight of from 100,000 Da to 4,000,000 Da.

20. Electrospun fibres according to any of claims 1-16, wherein the bioadhesive substance is polyethylene oxide having an average molecular weight of 2,000,000 Da.

21. Electrospun fibres according to any of the preceding claims, wherein the weight ratio between the bioadhesive substance and the hydrophilic fibre-forming polymers in the fibres is in a range of from 0.1 to 10.

22. Electrospun fibres according to any of the preceding claims, wherein the drug substance is selected from drug substances, which are indicated for treatment of a disease of the skin or mucosa.

23. Electrospun fibres according to any of the preceding claims, wherein the drug substance is selected from drug substances, which are indicated for treatment of a disease in the oral or vaginal cavity.

24. Electrospun fibres according to claim 23, wherein the drug substance is selected from drug substances, which are indicated for local treatment of a disease in the oral cavity.

25. Electrospun fibres according to any of the preceding claims, wherein the water content is at the most about 5% w/w.

26. Electrospun fibres according to any of the preceding claims for use in medicine.

27. Electrospun fibres according to any of claims 22-24 for use in the treatment of diseases of the oral or vaginal cavity.

28. A composition comprising electrospun fibres as defined in any of claims 1-21 and 25-27.

29. A composition according to claim 28, wherein the concentration of the electrospun fibres in the composition is from 70 to 100% w/w.

30. A composition according to claim 28 or 29 in the form of a layered composition.

31. Electrospun fibres according to any one of claims 1-27 or a composition according to any one of claims 28-30, wherein an outer surface of said electrospun fibres or composition is provided with a coating.

32. Electrospun fibres or a composition according to claim 31, wherein the coating is water-impermeable.

33. Electrospun fibres or a composition according to claim 31 or 32, wherein the coating comprises carbothane, polycaprolactone or polyethylene-co-vinyl acetate, or mixtures thereof.

34. Electrospun fibres as defined in any of claims 31-33 or a composition as defined in any of claims 28-33 for use in medicine.

35. A composition comprising electrospun fibres as defined in any of claims 22-24.

36. A composition according to claim 35, wherein the concentration of the electrospun fibres in the composition is from 70 to 100% w/w.

37. A composition according to claim 35 or 36 in the form of a layered composition.

38. Electrospun fibres according to any of claims 22-24 or a composition as defined in any of claims 35-37 for use in the treatment of diseases of the oral cavity.

39. A kit comprising

i) electrospun fibres or a composition as defined in any of the preceding claims, and

ii) an applicator for applying the composition in the oral cavity.

40. A method for preparing electrospun fibres as defined in any of claims 1-27, the method comprising

i) dissolving the first and the second hydrophilic fibre-forming polymer in a solvent selected from ethanol, or ethanol-water mixtures,

ii) suspending the bioadhesive substance in the resulting solution from step i),

iii) adding the drug substance to the resulting dispersion from step ii), and

iv) electrospinning the dispersion of step iii),

wherein said first and second hydrophilic fibre-forming polymer is soluble in said solvent, and said bioadhesive substance is at the most soluble in a range of 100 mL per 1 g to 1000 mL per 1 g in said solvent,

to obtain electrospun fibres, wherein at least 90% w/w of the bioadhesive substance is present in solid form.

41. A method for preparing electrospun fibres according to any of claims 1-27, the method comprising

i) dissolving the first and second hydrophilic fibre-forming polymer in a solvent selected from ethanol, water or mixtures thereof to obtain a first solution,

ii) dissolving or suspending the drug substance in said solution to obtain a mixture,

iii) suspending the bioadhesive substance in the solvent to obtain a dispersion, and

iv) dual-electrospinning the mixture from step ii) and the dispersion from iii),

wherein said first and second hydrophilic fibre-forming polymer is soluble in said solvent, and said bioadhesive substance is soluble in a range of 100 mL per 1 g to 1000 mL per 1 g in said solvent,

to obtain electrospun fibres, wherein at least 90% w/w of the bioadhesive substance is present in solid form.

42. A method according to claim 40 or 41 further comprising a step of coating an outer surface of the fibres with a hydrophobic polymer.

43. A method according to claim 42, wherein the coated fibres are subject to heating to melt or soften the hydrophobic polymer.