

Claims

1. A process for coiling a collagen carrier, the collagen carrier comprising (i) a collagen layer and (ii) a coating layer comprising fibrinogen and thrombin, said
5 process comprising the sequential steps of:
- *humidifying* at least part of said collagen carrier,
 - *coiling* said collagen carrier by gripping the collagen carrier between a pair of elongated members, and rotating the pair of elongated members about an axis
10 being parallel to a longitudinal extension of the elongated members in order to coil the collagen carrier on the members, while the collagen carrier is supported by a support device,
 - *drying* the coiled collagen carrier,
- thereby providing a form-stable coiled collagen carrier.
- 15 2. A process according to claim 1, wherein the coiling is performed by gripping the collagen carrier using at least one pair of tweezers or pincers.
3. A process according to claim 1, wherein the drying is performed by blowing air with a humidity lower than the coiled collagen carrier and optionally applying heat
20 to the air.
4. A process according to any of the preceding claims, wherein at least the coating layer of said collagen carrier is humidified.
- 25 5. A process according to claim 4, wherein the coating layer has been humidified using a solvent.
6. A process according to claim 5, wherein the collagen carrier is humidified on the coating layer by a solvent in an amount 1.2-10.75 mg/cm² surface of the
30 coating layer.
7. A process according to claims 5-6, wherein the solvent comprises or consists of ethanol.

8. A process according to any of the preceding claims further comprising compressing the collagen carrier to reduce the thickness of the collagen carrier.
9. A process according to claim 8, wherein the collagen carrier is compressed with
5 a compression ratio between 6-12.
10. A process according to claim 8 or 9, wherein the compression is performed by passing the humidified collagen carrier through a set of rollers having a gap size being smaller than the thickness of the collagen carrier before passing through the
10 set of rollers.
11. A process according to claim 10, wherein the gap size is between 0.5-1.0 mm, or no more than 0.75 mm.
- 15 12. A process according to any of the preceding claims wherein at least the edge of the coiled collagen carrier is fixed by the support device relatively to the coiled collagen carrier during drying.
13. A process according to any of the preceding claims, wherein the support
20 device is a cavity shaped as a segment of a cylinder having at least one open end, and wherein the curved part of the cylinder segment extends at least 180°.
14. A process according to claim 12 and 13, wherein during the coiling process, the edge of the coiled collagen carrier is arranged inside the segment of the
25 cylinder and the edge abuts the inner surface of the cylinder.
15. A process according to any of the preceding claims, further comprising extracting the elongated members from the coiled collagen carrier.
- 30 16. A process according to any of the preceding claims further comprising arranging the form-stable coiled collagen carrier in a container and subsequently sealing the container.

17. A process according to claim 16, further comprising arranging the form-stable coiled collagen carrier in an inner container and arranging the inner container in an outer container.
- 5 18. A process according to claim 17, further comprising arranging a desiccator inside the outer container prior to sealing of the container.
19. A process according to any of the preceding claims, further comprising sterilizing the coiled collagen carrier.
- 10 20. A process according to any of the preceding claims, further comprising maintaining the atmosphere surrounding the collagen carrier and humidification device while being humidified compressed and coiled at a temperature of 18-22° C and a relative humidity of 30-50%.
- 15 21. A coiled collagen carrier obtainable by the process of claims 1-20.
22. A coiled collagen carrier obtained by the process of claims 1-20.
- 20 23. A coiled collagen carrier
- comprising a collagen layer and a coating layer on top of the collagen layer, the coating layer comprising thrombin and fibrinogen, and
 - having the shape of an elongate element with a number of windings of the collagen carrier about the longitudinal axis of the elongate element and at
- 25 least the outer winding(s) being orientated so that the coating layer constitutes the outer surface of each of said outer winding(s),
- wherein
- the coiled collagen carrier is form-stable and defines a collagen carrier in a coiled configuration where said outer winding(s) proceed along a spiral in a
- 30 cross section of the collagen carrier.
24. A coiled collagen carrier according to any one of claims 21-23, wherein the collagen carrier in an unrolled configuration is a rectangular sheet, preferably having a width, a length and a thickness of the most 4 mm, such as at the most 5
- 35 mm, preferably at the most 6 mm, such as at the most 7 mm.

25. A coiled collagen carrier according to any one of claims 21-24, comprising three, four or five windings.
- 5 26. A coiled collagen carrier according to any one of claims 21-25, wherein the coiled collagen carrier has a cylindrical shape with an outer diameter of less than 12 mm, such as less than 11 mm, such as less than 10 mm, such as less than 9 mm, such as less than 8 mm, such as less than 7 mm, such as less than 6 mm, such as less than 5 mm, such as less than 4 mm, such as less than 3 mm.
- 10 27. A coiled collagen carrier according to any one of claims 21-26, wherein the coiled collagen carrier has an s-shaped inner most winding about the longitudinal extension of the coiled collagen carrier.
- 15 28. A coiled collagen carrier according to any one of claims 21-27, wherein the coating layer has no through-going cracks.
29. A packed coiled collagen carrier, comprising a coiled collagen carrier according to any of the claims 21-28 arranged in a container.
- 20 30. A packed coiled collagen carrier according to claim 29, wherein the container is sealed to prevent contamination and/or degradation and/or to maintain form-stability of the coiled collagen carrier.
- 25 31. A packed coiled collagen carrier according to claims 29 or 30, further comprising a desiccant, such as silica gel, arranged in the container.
32. A packed coiled collagen carrier according to any of the claims 29-31, wherein the container comprises an inner container and an outer container,
- 30 - the inner container comprises a cavity shaped as a segment of a cylinder, and wherein the curved part of the cylinder segment extends at least 180°, the cavity being sealed by a tear-off or breakable foil,
- the outer container comprising a sealed pouch inside which the sealed inner container is arranged together with a dessicant.

33. A method for delivering a coiled collagen carrier according to any one of claims 21-28 to a target location, comprising the step of passing said coiled collagen carrier through an orifice or access tube to the target location.

5 34. A method according to claim 33, further comprising the step of un-rolling the coiled collagen carrier onto the target location.

35. A method according to claim 33 or 34, wherein said target location is tissue which has been isolated from a human being or animal.

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36. A method of arresting hemorrhage associated with performing minimally invasive surgery using the coiled collagen carrier according to any one of claims 21-28.

15 37. A method of treating injury associated with performing minimally invasive surgery using the coiled collagen carrier according to any one of claims 21-28.

38. A method of treating injury associated with performing endoscopic treatment, laparoscopy treatment, or thoracoscopy treatment using the coiled collagen
20 carrier according to any one of claims 21-28.

39. A method of treating injury associated with performing endoscopic surgery using the coiled collagen carrier according to any one of claims 21-28.

25 40. A method of treating hemorrhage in human or animal tissue or a tissue sample in need of haemostasis using the coiled collagen carrier according to any one of claims 21-28.

41. A method of treating human or animal tissue or a tissue sample in need of
30 sealing and/or glueing using the coiled collagen carrier according to any one of claims 21-28.

42. The coiled collagen carrier according to any one of claims 21-32 for use in therapy.

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43. The coiled collagen carrier according to any one of claims 21-32 for use in surgery.
44. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of hemorrhage in human or animal tissue or a tissue sample in need of haemostasis.
45. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of injury associated with performing minimally invasive surgery.
46. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of injury associated with performing endoscopic treatment, laparoscopy treatment, or thoracoscopy treatment.
47. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of injury associated with performing endoscopic surgery.
48. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of post-surgical tissue adhesions.
49. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of post-surgical tissue adhesions in human or animal tissue or a tissue sample in need of coverage.
50. The coiled collagen carrier according to any one of claims 21-32 for use in the prevention or treatment of tissue or a tissue sample in need of sealing/glueing.
51. An apparatus for providing a coiled collagen carrier, the apparatus comprising
- a device for applying moisture to a collagen carrier prior to coiling of the collagen carrier,
 - a coiling device comprising
 - rotatable gripping means for gripping the collagen carrier along an edge and coiling the collagen carrier, and
 - a support device supporting the collagen carrier while being coiled.

52. An apparatus according to claim 51, wherein the gripping device comprises a pair of elongated members, such as a pair of tweezers or pincers.
- 5 53. An apparatus according to claim 51 or 52, wherein the support device is a cavity shaped as a segment of a cylinder having at least one open end, and wherein the curved part of the cylinder segment extends at least 180°.
54. An apparatus according to any of the claims 51-53, further comprising a
10 compressing device arranged to compress the moisturised collagen carrier prior to coiling of the moisturised collagen carrier.
55. An apparatus according to any of the claims 51-54, wherein the compressing device comprises a pair of rollers arranged to compress the moisturised collagen
15 carrier prior to coiling of the moisturised collagen carrier.
56. An apparatus according to any of the claims 51-54, further comprising at least a drying means for drying one or more coiled collagen carriers subsequently to the coiling.
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57. An apparatus according to any of the claims 51-56, further comprising a first conveyer device which conveys collagen carriers prior to coiling past the moisturiser device and to the coiling device.
- 25 58. An apparatus according to any of the claims 51-57, comprising a pair of rollers arranged to compress the moisturised collagen carrier prior to coiling of the moisturised collagen carrier, wherein the first conveyer device conveys the moisturised collagen carriers to the pair of rollers.
- 30 59. An apparatus according to any of the preceding claims 53-58, wherein the cavity is formed in a second conveyer device.
60. An apparatus according to any of the preceding claims, the apparatus comprising a cabinet sealing the moisturiser device, and/or the rollers, and/or the

coiling device, and/or the support device, and/or the first and/or the second conveyer device.

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Claims

1. A process for coiling a collagen carrier, the collagen carrier comprising (i) a collagen layer and (ii) a coating layer comprising fibrinogen and thrombin, said
5 process comprising the sequential steps of:
- *humidifying* at least part of said collagen carrier,
 - *coiling* said collagen carrier by gripping the collagen carrier between a pair of elongated members, and rotating the pair of elongated members about an axis being parallel to a longitudinal extension of the elongated members in order to
10 coil the collagen carrier on the members, while the collagen carrier is supported by a support device,
 - *drying* the coiled collagen carrier,
- thereby providing a form-stable coiled collagen carrier.
- 15 2. A process according to claim 1, wherein the coiling is performed by gripping the collagen carrier using at least one pair of tweezers or pincers.
3. A process according to claim 1 or 2, wherein at least the coating layer of said collagen carrier is humidified, and wherein the coating layer has been humidified
20 using a solvent.
4. A process according to claim 3, wherein the solvent comprises or consists of ethanol.
- 25 5. A process according to any of the preceding claims further comprising compressing the collagen carrier to reduce the thickness of the collagen carrier.
6. A process according to any of the preceding claims further comprising arranging the form-stable coiled collagen carrier in a container and subsequently
30 sealing the container.
7. A coiled collagen carrier obtainable by the process of claims 1-6.
8. A coiled collagen carrier obtained by the process of claims 1-7.

9. A coiled collagen carrier

- comprising a collagen layer and a coating layer on top of the collagen layer, the coating layer comprising thrombin and fibrinogen, and
- having the shape of an elongate element with a number of windings of the collagen carrier about the longitudinal axis of the elongate element and at least the outer winding(s) being orientated so that the coating layer constitutes the outer surface of each of said outer winding(s),

wherein

- the coiled collagen carrier is form-stable and defines a collagen carrier in a coiled configuration where said outer winding(s) proceed along a spiral in a cross section of the collagen carrier.

10. A coiled collagen carrier according to any one of claims 7-9, wherein the collagen carrier in an unrolled configuration is a rectangular sheet, preferably having a width, a length and a thickness of the most 4 mm, such as at the most 5 mm, preferably at the most 6 mm, such as at the most 7 mm.

11. A coiled collagen carrier according to any one of claims 7-10, comprising three, four or five windings.

12. A coiled collagen carrier according to any one of claims 7-11, wherein the coiled collagen carrier has a cylindrical shape with an outer diameter of less than 12 mm, such as less than 11 mm, such as less than 10 mm, such as less than 9 mm, such as less than 8 mm, such as less than 7 mm, such as less than 6 mm, such as less than 5 mm, such as less than 4 mm, such as less than 3 mm.

13. A coiled collagen carrier according to any one of claims 7-12, wherein the coating layer has no through-going cracks.

14. A packed coiled collagen carrier, comprising a coiled collagen carrier according to any of the claims 7-13 arranged in a container.

15. A method for delivering a coiled collagen carrier according to any one of claims 7-13 to a target location, comprising the step of passing said coiled collagen carrier through an orifice or access tube to the target location.

16. The coiled collagen carrier according to any one of claims 7-15 for use in therapy.
- 5 17. The coiled collagen carrier according to any one of claims 7-15 for use in surgery.
18. The coiled collagen carrier according to any one of claims 7-15 for use in the prevention or treatment of injury associated with performing minimally invasive
10 surgery.
19. The coiled collagen carrier according to any one of claims 7-15 for use in the prevention or treatment of injury associated with performing endoscopic surgery.
- 15 20. The coiled collagen carrier according to any one of claims 7-15 for use in the prevention or treatment of tissue or a tissue sample in need of sealing/glueing.
21. An apparatus for providing a coiled collagen carrier, the apparatus comprising
- a device for applying moisture to a collagen carrier prior to coiling of the
20 collagen carrier,
 - a coiling device comprising
 - rotatable gripping means for gripping the collagen carrier along an edge and coiling the collagen carrier, and
 - a support device supporting the collagen carrier while being coiled.
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22. An apparatus according to claim 21, wherein the gripping device comprises a pair of elongated members, such as a pair of tweezers or pincers.
23. An apparatus according to claim 21 or 22, further comprising a compressing
30 device arranged to compress the moisturised collagen carrier prior to coiling of the moisturised collagen carrier.
24. An apparatus according to any of the claims 21-23, further comprising at least
35 a drying means for drying one or more coiled collagen carriers subsequently to the coiling.