CLAIMS

1. A tubular membrane comprising on a surface thereof a Thin Film Composite (TFC) layer incorporating a vesicle comprising an amphiphilic diblock copolymer of the $PMOXA_{10-40}$-$PDMS_{25-70}$ type as vesicle membrane forming material, a reactive end group functionalised $PDMS_{30-50}$ as an additive, and a transmembrane protein, characterised in that said reactive end group functionalized $PDMS_{30-50}$ is functionalized with one or more carboxylic acid and/or hydroxy groups.

2. The tubular membrane according to claim 1, wherein the TFC layer is on the inside of the tubular membrane.

3. The tubular membrane according to claim 1 or 2, wherein the internal diameter of the tubular membrane is between 2mm to 10mm, such as 3mm to 15mm.

4. The tubular membrane according to claim 3 comprising at least a first amphiphilic diblock copolymer of the general formula $PMOXA_{10-28}$-$PDMS_{25-70}$ and a second amphiphilic diblock copolymer of the general formula $PMOXA_{28-40}$-$PDMS_{25-70}$.

5. The tubular membrane according to claim 4, wherein the weight proportion between the first and the second amphiphilic diblock copolymer is in the range of 0.1:1 to 1:0.1.

6. The tubular membrane according to any one of the claims 1 to 5, wherein the reactive end group functionalised $PDMS_{30-50}$ is selected from the group consisting of HOOC-$PDMS_{30-50}$, and HO-$PDMS_{30-50}$ and mixtures thereof.

7. The tubular membrane according to any one of the claims 1 to 6, wherein the transmembrane protein is an aquaporin water channel.

8. The tubular membrane according to any one of the claims 1 to 7, further comprising a triblock copolymer of the $PMOXA_{10-20}$-$PDMS_{25-70}$-$PMOXA_{10-20}$ type.

9. A tubular membrane module comprising a bundle of tubular membranes according to any one of the claims 1 to 8.

10. The tubular membrane module according to claim 9, wherein the bundle of tubular membranes is surrounded by a shell, wherein an inlet for passing a first solution is connected to the lumen of the tubes in one end of the bundle and an outlet is connected to the lumen in the other end of the bundle, and an inlet is provided in the shell for passing a second solution outside the bundle of tubular membranes to an outlet provided at another location of the shell.

11. A method for preparing a tubular membrane comprising

- providing a mixture in an aqueous liquid composition comprising vesicles, a di-amine or tri-amine compound, and a transmembrane protein, wherein said vesicles comprise an amphiphilic diblock copolymer of the $PMOXA_{10-40}$-$PDMS_{25-70}$ type as vesicle membrane forming material, and a reactive end group functionalized $PDMS_{30-50}$ as an additive, and wherein said reactive end group functionalized $PDMS_{30-50}$ is functionalized with one or more carboxylic acid, and/or hydroxy groups,
- covering a surface of a porous tubular membrane support with the mixture,
- applying a hydrophobic solution comprising an acyl halide compound, and
- allowing the di-amine or tri-amine compound of the aqueous composition and the acyl halide compound of the hydrophobic solution to perform an interfacial polymerization reaction to form the Thin Film Composite (TFC) layer.

12. The method according to claim 11, wherein the di-amine compound is 1,3-diaminobenzene.

13. The method according to any one of claims 11 or 12, wherein the proportion by weight of the di-amine or tri-amine compound to acyl halide compound is from 0:1 to 30:1 by weight.

14. The method according to any one of the claims 11 to 13, wherein the hydrophobic solution further comprises a TFC layer modifying agent in an amount of 0.1 to 10% by volume.

15. The method according to claim 14, wherein the TFC layer modifying agent is a C3 to C8 carbonyl compound or mesitylene.

16. The method according to any one of claims 14 or 15, wherein the TFC layer modifying agent is selected among the group consisting of diethylene ketone, 2-pentanone, 5-pentanone, and cyclopentanone.

17. The method according to any one of the claims 11 to 16, wherein the porous support tubular membrane is formed by a polysulfone or a polyethersulfone polymer.

18. The method according to any one of the claims 11 to 17, wherein the inner surface of the porous tubular membrane support is covered with the aqueous liquid composition to provide the TFC layer on the lumen side.

19. The method according to any one of the claims 11 to 18, wherein the reactive end group functionalised $PDMS_{30-50}$ present in a concentration of from 0.05% to 1% v/v of the aqueous liquid composition comprising the vesicle.

20. The method according to any one of the claims 11 to 19, wherein the internal diameter of the porous tubular membrane is between 2mm to 10mm, such as 3mm to 8mm.

21. The method according to any one of the claims 11 to 20, wherein the vesicles comprises at least a first amphiphilic diblock copolymer of the general formula $PMOXA_{10-28}$-$PDMS_{25-70}$ and a second amphiphilic diblock copolymer of the general formula $PMOXA_{28-40}$-$PDMS_{25-70}$.

22. The method according to claim 21, wherein the weight proportion between the first and the second amphiphilic diblock copolymer is in the range of 0.1:1 to 1:0.1.

23 The method according to any one of the claims 11 to 22, wherein the concentration of amphiphilic diblock copolymer in the liquid composition is in the range of 0.1 to 50 mg/ml, such as 0.5 to 20 mg/ml, and preferably 1 to 10 mg/ml.

24. The method according to any one of the claims 11 to 23, wherein the reactive end group functionalised $PDMS_{30-50}$ is selected from the group consisting of HOOC-$PDMS_{30-50}$, and HO-$PDMS_{30-50}$ and mixtures thereof as cross-linking agent.

25. The method according to any one of the claims 11 to 24, wherein the transmembrane protein is an aquaporin water channel.

26. The method according to any one of the claims 11 to 25, wherein the liquid composition comprising the vesicle further comprises from 1 % v/v to 12 % v/v of triblock copolymer of the $PMOXA_{10-20}$-$PDMS_{25-70}$-$PMOXA_{10-20}$ type.

27. The method according to any one of the claims 11 to 26, wherein the liquid composition comprising the vesicle further comprises a flux improving agent.

28. The method according to claim 27, wherein the flux improving agent is an alkylene glycol monoalkyl ether alkylat, beta cyclodextrin, or polyethylene glycol (15)-hydroxystearate.

29. The method according to claim 27 or claim 28, wherein the flux increasing agent is present in an amount of 0.1% to 1% by weight of the liquid composition.

30. The method according to any one of the claims 11 to 29, wherein the vesicle prior to incorporation in the TFC layer is present in a liquid composition comprising a buffer.

31. The method according to claim 30, wherein the liquid composition further comprises a detergent or a surfactant.

32. The method according to claim 31, wherein the detergent is selected from the group consisting of lauryldimethylamine N-oxide (LDAO), octyl glucoside (OG), dodecyl maltoside (DDM) or combinations thereof.

33. The method according to any one of the claim 11 to 32, wherein the porous tubular membrane support comprises a bundle of tubular membranes.

34. The method according to any one of the claims 11 to 33, wherein the mixture of vesicles in an aqueous liquid composition and a di-amine or tri-amine compound, and a transmembrane protein is contacted with a surface of the porous tubular membrane support for at least 7 min to saturate the porous tubular membrane support.

35. The method according to any one of the claims 11 to 34, wherein the mixture is dried in 2 or more steps using different pressures of the drying air.

36. The method according to any one of the claims 11 to 35, wherein a first initial drying step uses a pressure of the drying air, which is at least 2 times higher than the pressure in the subsequent step.

37. The method according to claim 36, wherein the first initial drying step uses a pressure of the drying air, which is the least 3 times, such as 4 times, such as 5 times higher than the pressure in the subsequent step.

38. The method according to any one of the claims 11 to 37, wherein the total time for drying the mixture is at least 15 minutes and preferably 20 minutes.

39. Use of the tubular membrane according to any one of the claims 1 to 8, or the tubular membrane module according to claims 9 or 10, for the concentration of a product solution by forward osmosis.