**Patent claims**

1. A method of producing a hollow fiber membrane having an outside coating with a thin film composite (TFC) layer comprising a transmembrane protein, said method comprising the steps of:

a) preparing an aqueous solution comprising

- a self-assembled nanostructure comprising polyalkyleneimine (PAI) and a detergent solubilized transmembrane protein and
- a di- or triamine,

b) preparing an apolar solution comprising a di- or triacyl halide in an apolar organic solvent,

c) contacting a hollow fiber membrane with either the aqueous solution or the apolar solution,

d) allowing the hollow fiber membrane to absorb the solution and, optionally, removing excess solution,

e) contacting the hollow fiber membrane with the other solution not used in step c),

f) allowing an interfacial polymerization reaction to take place, and

g) rinsing the hollow fiber membrane with an aqueous solvent.

2. The method according to claim 1, wherein the PAI is polyethyleneimine (PEI).

3. The method according to claim 2, wherein the PEI is a substantially linear polymer having an average molecular weight of between about 2,000 Da to about 10,000 Da, such as between about 3,000 Da to about 5,000 Da.

4. The method according to claim 1, wherein the transmembrane protein is an aquaporin water channel.

5. The method according to claim 4, wherein the aquaporin water channels are AqpZ channels or SoPIP2;1 water channels.

6. The method according to claim 1, wherein the detergent is selected from the group consisting of N,N-dimethyldodecylamine N-oxide (LDAO), octyl-glucoside (OG), *n*-dodecyl β-D-maltoside (DDM), or a combination thereof.

7. The method according to claim 1, wherein the aqueous solution of step a) further comprises a buffer.

8. The method according to claim 1, wherein the self-assembled nanostructure of step a) is prepared by mixing a solution of polyalkyleneimine with a detergent solubilized transmembrane protein.

9. The method according to claim 1, wherein the di- or triamine is *m*-phenylenediamine (MPD).

10. The method according to claim 1, wherein the hollow fiber membrane material is polyethersulfone (PES) or polysulfone (PS).

11. The method according to claim 1, wherein the concentration of the di- or triamine in the aqueous solution is about 1% to about 5 % (w/w).

12. The method according to claim 1, wherein the di- or triacyl halide is benzene-1,3,5-tricarbonyl chloride (TMC).

13. The method according to claim 1, wherein the concentration of the di- or triacyl halide in the apolar solution is 0.05% to about 1% (w/v).

14. The method according to claim 1, wherein the apolar organic solvent is hexane, heptane, octane, or a mixture thereof.

15. The method according to claim 1, wherein the hollow fiber membrane is an endless single hollow fiber.

16. The method according to claim 1, wherein the hollow fiber membrane is a bundle of hollow fibers, the bundle of hollow fibers being arranged in a protective shell having an inlet and an outlet for liquid present outside the fibers and an inlet and an outlet for liquids present in the lumen of the hollow fibers, thereby forming a hollow fiber (HF) module.

17. The method according to claim 16, wherein the protective shell has an elongate form and the bundle of fibers is longitudinally arranged inside the protective shell.

18. A hollow fiber membrane obtainable by the method according to claim 1.

19. A method for the concentration of a product solution by osmosis, said method comprising utilizing a hollow fiber membrane according claim 18 to extract water from a product solution.

20. A method for the production of salinity power using pressure retarded osmosis, said method comprising utilizing a hollow fiber membrane according to claim 18to increase hydrostatic pressure, and using the increase in hydrostatic pressure as a source of salinity power.