WE CLAIM:

1. An intrinsically anti-microbial hollow fiber membrane for filtration of liquids comprising a plurality of porous hollow membrane fibers, wherein the hollow membrane fibers are formed of a polymer or polymer mix by embedding directly into the polymer or polymer mix an anti-microbial substance selected from zinc oxide, zinc or zinc salt as such or in an aqueous or organic solvent, rendering the hollow membrane fibers intrinsically antimicrobial in nature.

2. The intrinsically anti-microbial hollow fiber membrane of claim 1, wherein the hollow fibers are formed from a polymer, optionally a thermosetting polymer.

3. The intrinsically anti-microbial hollow fiber membrane of any of claim 2, wherein a dope solution of the hollow fibers comprise 12% to 25% by weight polyethersulfone, from 5% to 20% by weight polyvinylpyrrolidone, from 40% to 73% by weight N-methyl pyrrolidone solution and of from 10% to 40% by weight polyethylene glycol, optionally the fibers may also comprise aqueous lithium chloride solution, poly carbonates, poly amides, and aqueous iso-propyl or any combination thereof.

4. The intrinsically anti-microbial hollow fiber membrane according to claim 1 or 2, wherein the fibers comprise 10% to 25% by weight polysulfone and 5% to 15% by weight polyvinyl pyrrolidone.

5. The intrinsically anti-microbial hollow fiber membrane according to claim 1 or 2, wherein the fibers comprise 3% to 25% by weight polyethersulfone and from 5% to 15% by weight polyvinylpyrrolidone.

6. The intrinsically anti-microbial hollow fiber membrane of claim 1, wherein the fibers form a one-layer membrane.

7. The intrinsically anti-microbial hollow fiber membrane of claim 1, wherein the fibers form a membrane comprising more than more than one layer.

8. The intrinsically anti-microbial hollow fiber membrane of claim 1, wherein the fibers form a membrane that is a double layer.

9. The intrinsically anti-microbial hollow fiber membrane of claim 6, wherein the single layer membrane is either hydrophobic or hydrophilic.

10. The intrinsically anti-microbial hollow fiber membrane of claim 8, wherein the double layer membrane is either hydrophobic or hydrophilic.

11. The intrinsically anti-microbial hollow fiber membrane of any of claims 6 to 10, wherein the outer side or wall of the membrane layer is a hydrophobic and the inner side layer or wall is hydrophilic.

12. The intrinsically anti-microbial hollow fiber membrane according to any one of claims 9 to 11, wherein the hydrophobic layer reduces the requirement of air trappings and suction pressure.

13. The intrinsically anti-microbial hollow fiber membrane according to anyone of claims 9 to 12, wherein the hydrophobic layer increases the liquid flux.

14. The intrinsically anti-microbial hollow fiber membrane according to any of claims 9 to 11, wherein the hydrophilic layer maintains a capillary action of the liquid through the pores on fiber walls towards the hollow cavity of fibers and decreases the requirement of suction pressure or passage pressure or gravitational head.

15. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 14, wherein the liquid flows with outside-in orientation.

16. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 14, wherein the liquid flows with inside-out orientation.

17. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 15, wherein the filtrate is retained outside of membrane.

18. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 17, wherein the membrane is washable.

19. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 18, wherein the hollow fiber membrane comprises fibers that have a porosity range of from 80% to 90% by volume of fiber wall.

20. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 19, wherein the hollow fiber membrane pores ranging from 0.1 nm to 25 nm in diameter.

21. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 20, wherein the hollow fiber membrane pores range from 50 nm to 150 nm diameter for usage under suction pressure.

22. The intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 21, wherein the hollow fibers form a U-shaped membrane module with open ends where liquid entered in the membrane for filtration and filtered liquid comes out through the open ends of fibers.

23. The intrinsically anti-microbial hollow fiber membrane according to any of the preceding claims, wherein the substantially all or all of the externally facing surface of each fiber includes an anti-microbial substance within the substance of the polymer or polymer mix.

24. The intrinsically anti-microbial hollow fiber membrane according to any of the preceding claims, wherein the substantially all or all of the luminal facing surface of each fiber does not include an anti-microbial substance within the substance of the polymer or polymer mix.

25. The intrinsically anti-microbial hollow fiber membrane according to any of claims 23 to 24, wherein the antimicrobial substance is embedded in the polymer or polymer mix.

26. The intrinsically anti-microbial hollow fiber membrane according any of claims 23 to 25, wherein the anti-microbial substance embedded polymer or polymer mix is from 2-5% by weight of the fiber.

27. The intrinsically anti-microbial hollow fiber membrane according to any of claims 23 to 26, wherein the polymer or polymer mix absent of anti-microbial substance is from 95-98% by weight of the fiber.

28. The intrinsically anti-microbial hollow fiber membrane according to any of claims 23 to 27, wherein the polymer or polymer mix with and absent of the anti-microbial substance is the same polymer or polymer mix.

29. A process to prepare the intrinsically anti-microbial hollow fiber membrane as defined in any of claims 1 to 28, the process comprising the steps of:-
a) mixing an antimicrobial substance embedded polymer or antimicrobial substance embedded polymer mix in 2-5% with a polymer or a polymer mix absent of an antimicrobial substance with a pore former comprising PEG and other additives with a solvent for all the constituents;
b) passing the mixture produced in step a) through a spinneret together with a non-solvent for the polymers.

30. A process according to claim 29, wherein step b) is carried out at a temperature of from 25 to 80ºC.

31. A process according to either of claims 29 to 30, wherein the spinneret operates at a speed of from 350 to 600 rpm.

32. A process according to any of claims 29 to 31, wherein the antimicrobial substance is a metal oxide, metal salt or metal.

33. A process according to any of claims 29 to 32, wherein the anti-microbial substance embedded polymer or polymer mix is from 2-5% by weight of the total polymers in the mixture formed in step a).

34. A process according to any of claims 29 to 33, wherein the polymer or a polymer mix absent of an antimicrobial substance is form 95-98% by weight of the fiber.

35. A process according to any of claims 29 to 34, wherein the antimicrobial substance embedded polymer is polyethersulfon and the polymer or a polymer mix absent of an antimicrobial substance is polyethersulfon, the polymers being provided in a 3% to 97% weight ratio.

36. A process according to any of claims 29 to 35, wherein the polymer or polymer mix with and absent of the anti-microbial substance is the same polymer or polymer mix.

37. A process according to any of claims 29 to 36, wherein the antimicrobial substance has metal oxide particles embedded therein through cross-linking between the polymeric chains.

38. A process according to any of claims 29 to 37, wherein the process produces any of the intrinsically anti-microbial hollow fiber membrane according to any of claims 1 to 28.

39. A device for liquid filtration comprising a hollow fiber membrane as claimed in claims 1 to 28 wherein the membrane is placed in a housing with at least one feed channel and at least one drain channel.

40. A device for liquid filtration comprising a hollow fiber membrane as claimed in claims 1 to 28, wherein the membrane is placed in a housing with multiple openings for inlet, outlet, and backflush drains.

41. A device according to claim 39 or 40 wherein the hydrophilic layer of membrane maintains a capillary action of the liquid through the holes on fiber walls towards the hollow cavity of fibers and decreases the requirement of suction pressure or passage pressure or gravitational head.