WHAT IS CLAIMED:

1. An unsupported, permanently hydrophilic filtration membrane comprising:

a polymeric matrix material and

a cross-linked polyoxazoline hydrophilic additive blended throughout said matrix material.

2. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane is a microporous membrane or an ultrafiltration membrane.

~~3. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane is an ultrafiltration membrane.~~

3~~4~~. The permanently hydrophilic filtration membrane of claim 1, wherein the extractable total organic carbon of the permanently hydrophilic filtration membrane is less than 20 μgC/cm^2, or wherein the extractable total organic carbon of the permanently hydrophilic filtration membrane is less than 10 μg C/cm^2.

~~5. The permanently hydrophilic filtration membrane of claim 1, wherein the extractable total organic carbon of the permanently hydrophilic filtration membrane is less than 10 μg C/cm^2.~~

4~~6~~. The permanently hydrophilic filtration membrane of claim 1, wherein the polyoxazoline is selected from the group consisting of poly (2-ethyl-2-oxazoline), poly(2-methyl-2-oxazoline), and poly(2-propyl-2-oxazoline), preferably wherein the polyoxazoline is poly (2-ethyl-2-oxazoline).

~~7. The permanently hydrophilic filtration membrane of claim 6, wherein the polyoxazoline is poly (2-ethyl-2-oxazoline).~~

5~~8~~. The permanently hydrophilic filtration membrane of claim 1, wherein the polyoxazoline is cross-linked by electron beam with a dose of from about 20 to 150 kGy.

6~~9~~. The permanently hydrophilic filtration membrane of claim 1, wherein the polymeric matrix material is one or more polymers independently selected from the group consisting of PVDF, polyamides, polyimides, polyether sulphones, polysulphones, polyaryl sulphones, cellulose esters, polyetherimides, acrylic polymers, methacrylic polymers, and copolymers of acrylic and methacrylic polymers.

7~~10~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane comprises polyether sulfone and poly (2-ethyl-2-oxazoline).

8~~11~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane is symmetric.

9~~12~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane is asymmetric.

10~~13~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane has a breaking strain of at least 20%, wherein the membrane has a breaking strain of at least 25%, or wherein the membrane has a breaking strain of at least 30%.

~~14. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane has a breaking strain of at least 25%.~~

~~15. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane has a breaking strain of at least 30%.~~

11~~16~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane has one or more distinct zones, preferably wherein the membrane has three distinct zones.

~~17. The permanently hydrophilic filtration membrane of claim 16, wherein the membrane has three distinct zones.~~

12~~18~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane has a total thickness from about 65 to 300µm.

13~~19~~. The permanently hydrophilic filtration membrane of claim 1, wherein the membrane is pleated.

14~~20~~. A filtration cartridge comprising:

a housing; and

the membrane of any one of claims 1-13 positioned within the housing.

~~21. The cartridge of claim 20, wherein the membrane has an extractable total organic carbon less than 20 µgC/cm^2.~~

~~22. The cartridge of claim 21, wherein the membrane has an extractable total organic carbon less than 10 µgC/cm^2.~~

~~23. The cartridge of claim 20, wherein the polyoxazoline is selected from the group consisting of poly (2-ethyl-2-oxazoline), poly(2-methyl-2-oxazoline), and poly(2-propyl-2-oxazoline).~~

~~24 The cartridge of claim 23, wherein the polyoxazoline is poly (2-ethyl-2-oxazoline).~~

~~25. The cartridge of claim 20, wherein the polyoxazoline is cross-linked by electron beam with a dose of from about 20 to 150 kGy.~~

~~26. The cartridge of claim 20, wherein the polymeric matrix material is one or more polymers independently selected from the group consisting of PVDF, polyamides, polyimides, polyether sulphones, polysulphones, polyaryl sulphones, cellulose esters, polyetherimides, acrylic polymers, methacrylic polymers, and copolymers of acrylic and methacrylic polymers.~~

~~27. The cartridge of claim 20, wherein the membrane comprises polyether sulfone and poly (2-ethyl-2-oxazoline).~~

~~28. The cartridge of claim 20, wherein the membrane has a breaking strain of greater than 20%.~~

~~29. The cartridge of claim 28, wherein the membrane has a breaking strain of greater than 25%.~~

~~30. The cartridge of claim 29, wherein the membrane has a breaking strain of greater than 30%.~~

15~~31~~. The filtration cartridge of claim 14~~20~~, wherein the housing contains greater than 0.11 m^2 of effective membrane area per 1 inch of housing height.

16~~32~~. A process of forming the~~a~~ permanently hydrophilic filtration membrane of any one of claims 1-13 comprising:

providing one or more casting solutions of a polymer comprising polyoxazoline and a solvent for said polymer;

simultaneously or sequentially applying the casting solution or solutions onto a support to form a liquid sheet;

effecting, in the liquid sheet, a phase separation of the casting solution or solutions to form a membrane;

immersing the membrane with water or an aqueous solution;

treating the wet membrane with an electron beam to crosslink the polyoxazoline; and

separating the permanently hydrophilic filtration membrane from the support.

17~~33~~. The process of claim 16~~32~~, wherein the aqueous solution is selected from a mixture of mixture of water and multi-functional monomer or monomers.

~~34. The process of claim 33, wherein the monomer or monomers are methylene bis-acrylamide, Sartomer 9035, Tetra(ethylene glycol) diacrylate, and mixtures thereof.~~

~~35. The process of claim 33, wherein the membranes extractable total organic carbon is less than 20 μgC/cm^2.~~

~~36. The process of claim 35, wherein the membranes extractable total organic carbon is less than 10 μgC/cm^2.~~

~~37. The process of claim 32, wherein the polyoxazoline is selected from the group consisting of poly (2-ethyl-2-oxazoline), poly(2-methyl-2-oxazoline), and poly(2-propyl-2-oxazoline).~~

~~38. The process of claim 37, wherein the polyoxazoline is poly (2-ethyl-2-oxazoline).~~

~~39. The process of claim 32, wherein the polyoxazoline is cross-linked by electron beam with a dose of from about 20 to 150 kGy.~~

~~40. The process of claim 32, wherein the casting solution comprises polyether sulfone, N-methyl-2-pyrrolidone, triethylene glycol, and poly (2-ethyl-2-oxazoline).~~

~~41. The process of claim 32, wherein the membrane has a breaking strain of greater than 20%.~~

~~42. The process of claim 41, wherein the membrane has a breaking strain of greater than 25%.~~

~~43. The process of claim 42, wherein the membrane has a breaking strain of greater than 30%.~~

~~44. The process of claim 32, wherein said polymer is one or more polymers independently selected from the group consisting of PVDF, polyamides, polyimides, polyether sulphones, polysulphones, polyaryl sulphones, cellulose esters, polystyrenes, polyetherimides, acrylic polymers, methacrylic polymers, and copolymers of acrylic and methacrylic polymers.~~

~~45. The process of claim 32, further comprising:~~

~~pleating the membrane.~~

18~~46~~. The process of claim 16~~32~~, wherein the casting solutions have an upper critical solution temperature and, wherein said effecting a phase separation is carried out by cooling the solutions below their upper critical solution temperature.

19~~47~~. The process of claim 16~~32~~, wherein the casting solutions have a lower critical solution temperature and, wherein said effecting a phase separation is carried out by heating the solutions above their lower critical solution temperature.

20~~48~~. The process of claim 16~~2~~, wherein said effecting a phase separation is carried out by vapor induced phase separation.

~~49. The process of claim 32, wherein the casting solutions further comprise one or more porogens independently selected from a group consisting of formamide, alcohols, polyhydric compounds, water, polyethylene glycol, calcium chloride, and lithium chloride.~~

~~50. The process of claim 32, wherein said applying the casting solution is carried out sequentially.~~

~~51. The process of claim 32, wherein said applying the casting solution is carried out simultaneously.~~

~~52. The process of claim 50, wherein said applying the casting solution is carried out by co-casting.~~