We claim:

1. A crosslinked copolymer network, comprising:

a copolymer, comprising a plurality of zwitterionic repeat units, and a plurality of a first type of hydrophobic repeat units;

a plurality of crosslinking units; and

a plurality of crosslinks;

wherein each crosslinking unit comprises a first terminal thiol moiety and a second terminal thiol moiety; each hydrophobic repeat unit comprises an alkene; and each crosslink is formed from (i) the first terminal thiol moiety of a crosslinking unit and the alkene of a first hydrophobic repeat unit, and (ii) the second terminal thiol moiety of the crosslinking unit and the alkene of a second hydrophobic repeat unit.

2. The crosslinked copolymer network of claim 1, wherein each of the zwitterionic repeat units independently comprises sulfobetaine, carboxybetaine, phosphorylcholine, imidazolium alkyl sulfonate, or pyridinium alkyl sulfonate.

3. The crosslinked copolymer network of claim 1, wherein each of the zwitterionic repeat units is independently formed from sulfobetaine acrylate, sulfobetaine acrylamide, carboxybetaine acrylate, carboxybetaine methacrylate, 2-methacryloyloxyethyl phosphorylcholine, acryloxy phosphorylcholine, phosphorylcholine acrylamide, phosphorylcholine methacrylamide, carboxybetaine acrylamide, 3-(2-vinylpyridinium-1-yl)propane-1-sulfonate, 3-(4-vinylpyridinium-1-yl)propane-1-sulfonate, or sulfobetaine methacrylate.

4. The crosslinked copolymer network of any one of claims 1-3, wherein each of the hydrophobic repeat units is independently formed from a styrene, an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an acrylonitrile, an aryl acrylate, an aryl methacrylate, and an aryl acrylamide.

5. The crosslinked copolymer network of any one of claims 1-4, wherein the copolymer is poly((allyl methacrylate)-*random*-(sulfobetaine methacrylate)) or poly((allyl methacrylate)-*random*-(2-methacryloyloxyethyl phosphorylcholine)), poly((allyl

methacrylate)-*random*-(trifluoroethyl methacrylate)-*random*-(sulfobetaine methacrylate)) or poly((allyl methacrylate)-*random*-(trifluoroethyl methacrylate)-*random*-(2-methacryloyloxyethyl phosphorylcholine)).

6. The crosslinked copolymer network of any one of claims 1-5, further comprising a plurality of a second type of hydrophobic repeat units, wherein the second type of hydrophobic repeat units are each independently formed from an alkyl acrylate, a alkyl methacrylate, an alkyl acrylamide, an acrylonitrile, an aryl acrylate, an aryl methacrylate, and an aryl acrylamide.

7. The crosslinked copolymer network of claim 6, wherein the second type of hydrophobic repeat units are formed from 2,2,2-trifluoroethyl methacrylate.

8. The crosslinked copolymer network of claim 7, wherein the copolymer is poly(allyl methacrylate-*random*-trifluoroethyl methacrylate-*random*-2-methacryloyloxyethyl phosphorylcholine).

9. The copolymer network of any one of claims 1-8, wherein the copolymer has a molecular weight of about 3,000 to about 10,000,000 Dalton.

10. The copolymer network of any one of claims 1- 9, wherein the zwitterionic repeat units and the hydrophobic repeat units each constitute 20-80% by weight of the copolymer.

11. The crosslinked copolymer network of claim 10, wherein the zwitterionic repeat units constitute 25-75% by weight of the copolymer, and the hydrophobic repeat units constitute 25-75% by weight of the copolymer.

12. The copolymer network of any one of claims 1-11, wherein the copolymer is poly((allyl methacrylate)-*random*-(sulfobetaine methacrylate)), the zwitterionic repeat units constitute 25-75% by weight of the copolymer, and the copolymer has a molecular weight of about 20,000 to about 100,000 Dalton.

13. The crosslinked copolymer network of any one of claims 1-12, wherein the plurality of crosslinking units is represented by FG-CL-FG, wherein FG is a linker-thiol moiety, and

CL is a C_1-C_{20} bivalent aliphatic radical, a C_1-C_{20} bivalent heteroaliphatic radical, a bivalent aryl radical, or a bivalent heteroaryl radical.

14. The crosslinked copolymer network of claim 13, wherein CL is a C_1-C_{20} bivalent aliphatic radical or a C_1-C_{20} bivalent heteroaliphatic radical.

15. The crosslinked copolymer network of claim 13, wherein FG-CL-FG is –S-$(CH_2)_6$-S–, or –S-$(CH_2)_2$-O-$(CH_2)_2$-O-$(CH_2)_2$-S–.

16. A thin film composite membrane, comprising a porous substrate, and a selective layer comprising the crosslinked copolymer network of claim 1, wherein an average effective pore size of the porous substrate is larger than an average effective pore size of the selective layer; and the selective layer is disposed on a surface of the porous substrate.

17. The thin film composite membrane of claim 16, wherein the selective layer has the average effective pore size of about 0.1 nm to about 2.0 nm.

18. The thin film composite membrane of any one of claims 16-17, wherein the selective layer has a thickness of about 10 nm to about 10 μm.

19. The thin film composite membrane of any one of claims 16-18, wherein the thin film composite membrane rejects charged solutes and salts.

20. The thin film composite membrane of claim 19, wherein the selective layer exhibits sulfonate (SO_4^{2-}) rejection of greater than 95%.

21. The thin film composite membrane of claim 19 or 20, wherein the selective layer exhibits chloride (Cl^-) rejection of less than 35%.

22. The thin film composite membrane of claim 21, wherein the selective layer exhibits sulfonate (SO_4^{2-}) / chloride (Cl-) separation factor of greater than 50.

23. The thin film composite membrane of claim 22, wherein the selective layer exhibits sulfonate (SO_4^{2-}) / chloride (Cl-) separation factor of about 75.

24. The thin film composite membrane of any one of claims 16-23, wherein the selective layer exhibits different anion rejections for salts with the same cation.

25. The thin film composite membrane of any one of claims 16-24, wherein the selective layer exhibits different anion rejections for salts selected from NaF, NaCl, NaBr, NaI, Na_2SO_4, and $NaClO_4$.

26. The thin film composite membrane of any one of claims 16-25, wherein the selective layer exhibits different rejections for different anionic dyes.

27. The thin film composite membrane of any one of claims 16-19, wherein the selective layer exhibits a Chicago Sky Blue 6B / methyl orange separation factor of about 10.

28. The thin film composite membrane of any one of claims 16-19, wherein the selective layer exhibits Vitamin B12 rejection of greater than about 95%.

29. The thin film composite membrane of any one of claims 16-19, wherein the selective layer exhibits Riboflavin rejection of greater than about 35%.

30. The thin film composite membrane of any one of claims 16-29, wherein the selective layer exhibits antifouling properties.

31. The thin film composite membrane of any one of claims 16-30, wherein the selective layer exhibits resistance to fouling by an oil emulsion.

32. The thin film composite membrane of any one of claims 16-30, wherein the selective layer exhibits resistance to fouling by a Bovine Serum Albumin solution.

33. The thin film composite membrane of any one of claims 16-31, wherein the selective layer is stable upon exposure to chlorine bleach.

34. The thin film composite membrane of any one of claims 16-33, wherein the selective layer exhibits size-based selectivity between uncharged organic molecules.

35. The thin film composite membrane of claim 34, wherein the selective layer exhibits rejection of > 95% or > 99% for neutral molecule with hydrated diameter of about or greater than 1.5 nm.

36. A method of making the crosslinked copolymer network of claim 1, the method comprising:

providing a copolymer comprising a plurality of zwitterionic repeat units, and a plurality of a first type of hydrophobic repeat units; wherein each hydrophobic repeat unit comprises an alkene, and

providing a plurality of crosslinking units; wherein each crosslinking unit comprises a first terminal thiol moiety and a second terminal thiol moiety;

providing a photo initiator, and

admixing the copolymer, the plurality of crosslinking units, and the photo initiator, thereby forming a mixture; and

irradiating the mixture with UV light, thereby forming the crosslinked copolymer.

37. The method of claim 36, wherein the mixture further comprises a solvent.

38. The method of claim 37, wherein the solvent is mixture of isopropanol and hexane.

39. The method of any one of claims 36-38, wherein the irradiation is performed at room temperature.

40. The method of any one of claims 34-39, wherein the photo initiator is 2-phenylacetophenone.

41. The method of any one of claims 36-39, wherein the irradiation is performed for about 10 seconds to about 20 minutes.

42. A method of pharmaceutical manufacturing, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with a mixture comprising one or more pharmaceutical compounds; and

separating one or more pharmaceutical compounds via size-selective filtration.

43. A method of textile dying and processing, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with a mixture comprising one or more textile dyes; and

separating one or more textile dyes via size-selective filtration.

44. A method of buffer exchange, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with a first buffer solution; and

replacing the first buffer solution with a second buffer solution.

45. A method of purifying a peptide, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with a mixture comprising one or more peptides; and

separating one or more peptides via size-selective filtration.

46. A method of removing a divalent ion from water, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with an aqueous mixture comprising a divalent ion; and

removing some or all of the diavalent ion from the aqueous mixture via size-selective filtration.

47. A method of removing an organic solute from water, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with an aqueous solution comprising an organic solute; and

separating the organic solute via size-selective filtration.

48. A method of removing disease-causing microorganisms, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with an mixture comprising one or more disease-causing microorganisms; and

separating the one of more disease-causing microorganisms via reverse osmosis.

49. A method of size-selective separation, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with a mixture comprising one or more particles of differing sizes; and

separating one or more particles via size-selective filtration.

50. A method of processing food, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with a impure food ingredient; and

separating a contaminant from the impure food ingredient via size-selective filtration.

51. A method of printing, comprising:

contacting the thin film composite membrane of any one of claims 16-35 with one or more ink; and

applying the one or more ink to a surface of an article.