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We claim:

1. A copolymer, comprising a plurality of zwitterionic repeat units, and a plurality of hydrophobic repeat units; wherein at least some of the hydrophobic repeat units each independently comprise a cross-linkable moiety.

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

3. The copolymer of claim 1, wherein each of the zwiterionic 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 copolymer 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 copolymer of any one of claims 1-4, wherein the cross-linkable moiety comprises a carbon-carbon double bond~~.~~ and/or

~~6. The copolymer of claim 5,~~ wherein the cross-linkable moiety comprises an allyl (CH_2-CH=CH_2), a vinyl (-CH=CH_2 or -CH=CH-), a vinyl ether (-O-CH=CH_2), or a vinyl ester (-CO-O-CH=CH_2}.

~~7.~~ 6. The copolymer of any one of claims 1 – ~~6~~ 5, wherein the copolymer is poly((allyl methacrylate)-*random*-(sulfobetaine methacrylate)) or poly((allyl methacrylate)-*random*-(2-methacryloyloxyethyl phosphorylcholine)).

~~8.~~ 7. The copolymer of any one of claims 1-~~7~~ 6, 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, an alkyl methacrylate, an alkyl acrylamide, an acrylonitrile, an aryl acrylate, an aryl methacrylate, and an aryl acrylamide~~.~~ and/or

~~9. The copolymer of claim 8,~~ wherein the second type of hydrophobic repeat units are formed from 2,2,2-trifluoroethyl methacrylate.

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~~10.~~8. The copolymer of claim ~~9~~ 7, wherein the copolymer is poly(allyl methacrylate-*random* -trifluoroethyl methacrylate- *random* -2-methacryloyloxyethyl phosphorylcholine).

~~11.~~9. The copolymer of any one of claims 1-~~10~~ 8, wherein the copolymer has a molecular weight of about 10,000 to about 10,000,000 Dalton~~.~~; or

~~12. The copolymer of claim 11, wherein foe copolymer has~~ a molecular weight of about 20,000 to about 500,000 Dalton.

~~13.~~ 10. The copolymer of any one of claims 1-~~12~~ 9, wherein the zwitterionic repeat units and the hydrophobic repeat units each constitute 20-80% by weight of the copolymer.

~~14.~~ 11. The copolymer of claim ~~13~~ 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.

~~15.~~ 12. The copolymer of any one of claims 1-~~14~~ 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.

~~16.~~ 13. A cross-linked copolymer network, comprising the copolymer of any one of claims

1-~~15~~ 12.

~~17.~~14. A thin film composite membrane, comprising a porous substrate, and a selective layer comprising the cross-linked copolymer network of claim ~~16~~ 13, wherein the average effective pore size of the porous substrate is larger than the average effective pore size of the selective layer; and the ~~the~~ selective layer is disposed on top of the porous substrate.

~~18.~~ 15. The thin film composite membrane of claim ~~17~~ 14, wherein the selective layer has an average effective pore size of about 0.1 nm to about 2.0 nm~~.~~;

~~19. The thin film composite membrane of claim 17, wherein the selective layer has an average effective pore size of~~ about 0.1 nm to about 1.2 nm~~.~~; or

~~20. The thin film composite membrane of claim 17, wherein the selective layer has an average effective pore size of~~ about 0.5 nm to about 1.0 nm.

~~21.~~ 16. The thin film composite membrane of any one of claims ~~17-20~~ 14-15, wherein the selective layer has a thickness of about 10 nm to about 10 µm; or

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~~22.The thin film composite membrane of claim 21, wherein the selective layer has~~ a thickness of about 100 nm to about 2 µm.

~~23.~~17. The thin film composite membrane of any one of claims ~~17-22~~ 14-16, wherein the thin film composite membrane rejects charged solutes and salts.

~~24.~~18. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits sulfonate (SO_4^{2-}) rejection of greater than 99%.

~~25.~~19. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits sulfonate (SO_4^{2-}) / chloride (Cl-) separation factor of greater than 50~~.~~ or

~~26. The thin film composite membrane of claim 25, wherein the selective layer exhibits sulfonate (SO_4^{2-}) / chloride (Cl-)~~ separation factor of about 75.

~~27.~~20. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits different anion rejections for salts with the same cation.

~~28.~~ 21. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits different anion rejections for salts selected among NaF, NaCl, NaBr, NaI, and $NaClO_4$

~~29.~~ 22. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits a fluoride (F^-) / chloride (Cl^-) separation factor of greater than 5~~.~~ or

~~30. The thin film composite membrane of any one of claims 17-23, wherein the selective layer exhibits a fluoride (F^-) / chloride (Cl^-)~~ separation factor of about 8.

~~31.~~ 23. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits different rejections for monosaccharides and disaccharides.

~~32.~~ 24. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits a glucose / sucrose separation factor of greater than 10.

~~33.~~ 25. The thin film composite membrane of any one of claims ~~17-23~~ 14-17, wherein the selective layer exhibits a xylose / sucrose separation factor of greater than 18.

~~34.~~ 26. The thin film composite membrane of any one of claims ~~17-33~~ 14-25, wherein the selective layer exhibits resistance to fouling by an oil emulsion.

~~35~~. 27. The thin film composite membrane of any one of claims ~~17-33~~ 14-25, wherein the selective layer is stable upon exposure to chlorine bleach (e.g., at pH 4).

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~~36.~~ 28. The thin film composite membrane of any one of claims ~~17-325~~ 14-27, wherein the selective layer exhibits size-based selectivity between uncharged organic molecules.

~~37.~~ 29. The thin film composite membrane of claim ~~36~~ 28, wherein the selective layer exhibits rejection of > 99% for neutral molecule with hydrated diameter of about or greater than 1 nm.