Claims

1. A porous block copolymer (BCP) film, comprising at least one ABC triblock copolymer and at least one hydrophilic polymer, wherein

at least a portion of the pores are isoporous and mesoporous, and

the hydrophilic polymer has a molecular weight equal to or greater than 50% of the molecular weight of the at least one ABC triblock copolymer.

2. The BCP film of claim 1, wherein the at least one block copolymer comprises at least one hydrophilic block.

3. The BCP film of claim 1, wherein the film is either symmetric or asymmetric.

4. The BCP film of claim 1, wherein the film exhibits a reduced flux decline over time.

5. The BCP film of claim 1, wherein the at least one hydrophilic polymer comprises: a poly(acrylate), poly(methacrylate), poly(acrylic acid), poly(acrylamide), poly(vinylpyridine), poly(vinylpyrrolidone), poly(vinyl alcohol), a naturally-derived polymer, poly(ether), poly(maleic anhydride), poly(styrene sulfonate), poly(allylamine hydrochloride), poly(sulfone), poly(ethersulfone), poly(ethylene glycol), or any substituted equivalent thereof.

6. The BCP film of claim 1, wherein the hydrophilic polymer is present at a range of 0.1% to 15% by weight relative to the BCP.

7. The BCP film of claim 1, wherein the isoporous BCP film exhibits reduced protein adsorption.

8. The BCP film of claim 1, wherein the film exhibits increased flux retention upon drying after exposure to a humectant solution.

9. The BCP film of claim 1, wherein the hydrophilic polymer is poly(vinylpyrrolidone) and the average molecular weight of the poly(vinylpyrrolidone) is 360,000 Da.

10. The BCP film of claim 1, wherein at least one ABC triblock copolymer is poly(isoprene-b-styrene-b-4-vinylpyridine).

11. A separation or filtration device comprising a BCP film according to any one of claims 1-10.

12. The separation or filtration device of claim 11, wherein the device is packaged as any one of a syringe filter, a capsule, a cartridge, a flat sheet, a spiral wound material, or a hollow fiber.

13. A method for forming an isoporous mesoporous block copolymer (BCP) film, wherein at least a portion of the pores are isoporous and mesoporous, comprising the steps of:

(a) formulating a polymer solution by mixing at least one ABC triblock copolymer with at least one solvent and at least one hydrophilic polymer having a molecular weight equal to or greater than 50% of the molecular weight of the at least one ABC triblock copolymer;

(b) forming the polymer solution into a film;

(c) evaporating a portion of the at least one solvent;

(d) immersing the film into a coagulation bath; and

(e) optionally, rinsing the film with water.

14. The method of claim 13, wherein the at least one ABC triblock copolymer comprises at least one hydrophilic block.

15. The method of claim 13, wherein at least one ABC triblock copolymer has at least one block comprising:

Poly(butadiene), Poly(isobutylene), Poly(isoprene), Poly(ethylene), Poly(styrene), Poly(methyl acrylate), Poly(butyl methacrylate), Poly(ethersulfone), Poly(methyl methacrylate), Poly(n-butyl acrylate), Poly(2-hydroxyethyl methacrylate), Poly(glycidyl methacrylate), Poly(acrylic acid), Poly(acrylamide), Poly(sulfone), Poly(vinylidene fluoride), Poly(N,N-

dimethylacrylamide), Poly(2-vinylpyridine), Poly(3-vinylpyridine), Poly(4-vinylpyridine), Poly(ethylene glycol), Poly(propylene glycol), Poly(vinyl chloride), Poly(tetrafluoroethylene), Poly(ethylene oxide), Poly(propylene oxide), Poly(N-isopropylacrylamide), Poly(dimethylaminoethyl methacrylate), Poly(amic acid), Poly(dimethylsiloxane), Poly(lactic acid), Poly(isocyanate), Poly(ethyl cyanoacrylate), Poly(acrylonitrile), Poly (hydroxy styrene), Poly(methylstyrene), Poly(ethyleneimine), Poly(styrene sulfonate), Poly(allylamine hydrochloride), Poly(pentafluorostyrene), Poly(2-(perfluorohexyl)ethyl methacrylate), or a substituted equivalent of the above.

16. The method of claim 13, wherein the solvent comprises at least one of:

a. Acetaldehyde,
b. Acetic acid,
c. Acetone,
d. Acetonitrile,
e. Benzene,
f. Chloroform,
g. Cyclohexane,
h. Dichloromethane,
i. Dimethoxyethane,
j. Dimethyl sulfoxide,
k. Dimethylacetamide,
1. Dimethylformamide,
m. 1,4-Dioxane,
n. Ethanol,
o. Ethyl acetate,
p. Formic acid
q. Hexane,
r. Methanol,
s. N-Methyl-2-pyrrolidone,
t. Propanol
u. Pyridine,

v. Sulfolane,

w. Tetrahydrofuran, or

x. Toluene.

17. The method of claim 13, wherein the film is formed on a substrate.

18. The method of claim 13, wherein the weight hydrophilic polymer comprises: a poly(acrylate), poly(methacrylate), poly(acrylic acid), poly(acrylamide), poly(vinylpyridine), poly(vinylpyrrolidone), polyvinyl alcohol), a naturally-derived polymer, poly(ether), poly(maleic anhydride), poly(styrene sulfonate), poly(allylamine hydrochloride), poly(sulfone), poly(ethersulfone), poly(ethylene glycol), or substituted equivalent of the above.

19. The method of claim 13, wherein the hydrophilic polymer is present in the solution at a range of 0.1% to 15% by mass relative to the BCP.

20. The method of claim 13, wherein the block copolymer is present in the solution at a range of about 5% to 25% by weight.