A POROUS ABPBI [~~PHOSPHORIC ACID DOPED~~ POLY (2, 5-BENZIMIDAZOLE)] MEMBRANE AND PROCESS OF PREPARING THE SAME

FIELD OF THE INVENTION

The present invention relates to a porous ABPBI (phosphoric acid doped poly (2, 5-benzimidazole)) membrane and process of preparing the same. More particularly, the present invention provides a process for the preparation of ABPBI based porous membranes. The ABPBI porous membranes have excellent stability towards strong acids, bases, common organic solvents and harsh environmental conditions.

BACKGROUND AND PRIOR ART

It is known that Polybenzimidazole(PBI) based on diaminobenzidine (DAB) and isophthalic acid (IPA) as PBI-I and is soluble in polar aprotic solvents such as *N,N*-dimethyl acetamide [Li et al. Chem. Mater. 15 (2003) pp. 4896-4915]; while AB(polybenzimidazole) (ABPBI) is soluble only in strong acids such as sulfuric acid, formic acid, trifluoroacetic acid, phosphoric and poly(phosphoric acid) [Asensio et al. Fuel cells 5 No. 3 (2005) pp. 336-343]. Monomer cost and synthesis time for ABPBI are much lower than that for PBI-I.

Chung et al. in US 4842740 disclosed a membrane prepared from the blend of polyarylates with PBI-I polymer. The addition of polyarylate to the polybenzimidazole membrane allows the composition to be more thermally processable and less susceptible to moisture. These membranes show high regeneration capacity while retaining good flux ranges.

Asensio et al. in J. Electrochem. Soc. 151 (2) (2004) pp. A304-A310 prepared membrane based on poly(2,5-benzimidazole) (ABPBI) by simultaneously doping and casting from ABPBI/phosphoric acid/methane sulfonic acid solution. However, these membranes are used for polymer electrolyte membrane fuel cell (PEMFC).

Wang et al. in AIChe 52 (2006) pp. 1363-1377 reported PBI based nanofiltration (NF) membranes (hollow fibers) with mean effective pore radius of 0.348 nm for cephalexin separation, which was dependent on the pore size and the electrostatic interactions between solute and the membrane.

Wang et al, J. Membr. Sci. 281 (2006) pp. 307-315 prepared PBI based NF membranes with molecular weight cut-off (MWCO) of 525 Da exhibited V-shaped chromate rejection curve with an increase in pH.

We Claim:

1. A porous ABPBI (Phosphoric Acid Doped Poly(2,5-benzimidazole)) membrane wherein the membrane is stable to acids, bases, organic solvents and autoclaving.
2. The membrane of claim 1, wherein said membrane is stable to organic solvents comprising of protic and aprotic polar solvents and non polar solvents.
3. The membrane of claim 1, wherein said membrane is stable in concentrated inorganic acids.
4. The membrane of claim 1, wherein said membrane is stable in concentrated base solutions.
5. The membrane of claims 3 and 4, wherein the concentrated acid is 25 N sulfuric acid and the concentrated base is 2.5N sodium hydroxide.
6. The membrane as claimed in any of the preceding claims wherein the concentration of used ABPBI is up to 15%.
7. A process for the preparation of the porous ABPBI membrane as claimed in claim 1, wherein said process comprises:
    a. dissolving ABPBI polymer in a solvent to form dope solution;
    b. casting a film of dope solution as obtained in step (a) optionally on a porous support;
    c. holding film as obtained in step (b) in air up to 5 minutes in ambient condition and
    d. coagulating film as obtained in step (c) in a non solvent bath at temperature up to 150 °C to obtain porous membrane.
8. The process of claim 7, wherein solvent used in step (a) is concentrated acid, selected from the group consisting of methane sulfonic acid, sulfuric acid, phosphoric acid, formic acid, trifluoro acetic acid, poly(phosphoric acid), alone or in combinations thereof.
9. The process of claim 7, wherein, the ABPBI polymer is dissolved in a solvent or combination of solvents.
10. The process of claim 7, wherein the solvent is optionally heated to dissolve the polymer.

11. The process of claim 7, wherein the membrane is casted on support selected from the group consisting of glass, polyester, polypropylene, polyethylene, polyetheretherketone, metallic plates and ceramics.
12. The process of claim 7, wherein, the coagulation bath comprises non solvent, alone or in combination with a solvent.
13. The process of claim 12, wherein, the non solvent used is selected from water, alcohol, and base solution, preferably inorganic base.
14. The process of claim 7, wherein, the solvent used is acid selected from methane sulfonic acid, sulfuric acid, phosphoric acid, formic acid, trifluoro acetic acid, poly(phosphoric acid), alone or in combinations thereof.
15. The membrane as claimed in any of the preceding claims, wherein said membrane is used for separations of solute from solvents selected from acids, bases and organic solvents, alone or in combinations thereof.

CLAIMS

1. A process for the preparation of a porous ABPBI membrane, the process comprising:

dissolving an ABPBI polymer in a solvent to form a dope solution;

casting a film of the dope solution;

holding the film in air up to 5 minutes in ambient condition; and

coagulating the held film in a non solvent bath at temperature up to 150° C. to obtain the porous membrane;

wherein the membrane is stable to acids, bases, organic solvents and autoclaving.

2. The process of claim **1**, wherein the solvent is selected from the group consisting of concentrated methane sulfonic acid, concentrated sulfuric acid, concentrated phosphoric acid, concentrated formic acid, concentrated trifluoro acetic acid, concentrated poly(phosphoric acid), and mixtures thereof

3. The process of claim **1**, wherein the solvent comprises a mixture of solvents.

4. The process of claim **1**, further comprising heating the solvent to dissolve the polymer.

5. The process of claim **1**, wherein casting comprises casting the membrane on a support selected from the group consisting of glass, polyester, polypropylene, polyethylene, polyetheretherketone, a metallic plate, and a ceramic.

6. The process of claim **1**, wherein the non solvent is selected from water, alcohol, and base solution.

7. The process of claim **1**, wherein, the solvent comprises methane sulfonic acid, sulfuric acid, phosphoric acid, formic acid, trifluoro acetic acid, poly(phosphoric acid), or a mixture thereof

8. The process of claim **1**, wherein casting comprises casting on a porous support.

9. The process of claim **6**, wherein the non solvent comprises inorganic base.

10. A process for the preparation of a porous ABPBI membrane, the process comprising:

dissolving an ABPBI polymer in a solvent to form a dope solution;

casting a film of the dope solution;

holding the film in air up to 5 minutes in ambient condition; and

coagulating the held film in a bath comprising non solvent and solvent at temperature up to 150° C. to obtain the porous membrane;

wherein the membrane is stable to acids, bases, organic solvents and autoclaving.