two or more polytetrafluoroethylene membranes containing therein first inorganic particles having a first nominal particle size and second inorganic particles having a second nominal particle size,

wherein at least one of the first inorganic particles, the second inorganic particles, or any combination thereof has covalently bonded thereto affinity ligands comprising Fc binding proteins, that reversibly binds to a targeted protein or antibody,

and wherein the affinity chromatography device is configured to provide: a dynamic binding capacity of at least 30 mg/ml at 10% breakthrough; and a residence time of 20 seconds or less,

wherein the device is configured such that said flow fluid flows through the at least one polymer membrane in the wound membrane assembly in the direction orthogonal to areal thickness of said at least one polymer membrane.

[0003b] In another aspect, there is provided an affinity chromatography device comprising:

a housing;

an inlet configured to permit fluid flow into the housing;

first and second flow distributors, the first flow distributor and the second flow distributor positioned at opposing ends of the housing;

an outlet configured to permit fluid flow out of the housing, and

a stacked membrane assembly disposed within the housing, the stacked membrane assembly comprising:

two or more polytetrafluoroethylene membranes containing therein inorganic particles of the same type having a nominal particle size,

wherein the inorganic particles have covalently bonded thereto affinity ligands comprising Fc binding proteins, that reversibly bind to a targeted protein or antibody,

and wherein the affinity chromatography device is configured to provide a dynamic binding capacity of at least 30 mg/ml at 10% breakthrough and; a residence time of 20 seconds or less,

wherein the device is configured such that said flow fluid flows through the at least one polymer membrane in the wound membrane assembly in the direction orthogonal to areal thickness of said at least one polymer membrane.

[0004] One example relates to an affinity chromatography device that includes a housing, a first flow distributor and a second flow distributor positioned at opposing ends of the housing, an inlet to permit fluid flow into the housing, an outlet to permit

[0005] fluid flow out of the housing, and a stacked membrane assembly disposed within the housing. The stacked membrane assembly includes two or more polymer membranes that contain therein first inorganic particles having a first nominal particle size and second inorganic particles having a second nominal particle size. At least one of the polymer membranes, the first inorganic particles, and the second inorganic particles has covalently bonded thereto an affinity ligand that reversibly

WHAT IS CLAIMED IS:

1. An affinity chromatography device comprising:

a housing;

an inlet configured to permit fluid flow into the housing;

first and second flow distributors, the first flow distributor and the second flow distributor positioned at opposing ends of the housing;

an outlet configured to permit fluid flow out of the housing, and

a stacked membrane assembly disposed within the housing, the stacked membrane assembly comprising:

two or more polytetrafluoroethylene membranes containing therein first inorganic particles having a first nominal particle size and second inorganic particles having a second nominal particle size,

wherein at least one of the first inorganic particles, the second inorganic particles, or any combination thereof has covalently bonded thereto affinity ligands comprising Fc binding proteins, that reversibly binds to a targeted protein or antibody,

and wherein the affinity chromatography device is configured to provide: a dynamic binding capacity of at least 30 mg/ml at 10% breakthrough; and a residence time of 20 seconds or less,

wherein the device is configured such that said flow fluid flows through the at least one polymer membrane in the wound membrane assembly in the direction orthogonal to areal thickness of said at least one polymer membrane.

2. The affinity chromatography device of claim 1, wherein the first and second inorganic particles are chosen from silica particles, zeolite particles, hydroxyapatite particles, metal oxide particles or any combination thereof.

3. The affinity chromatography device of claim 1, wherein the two or more polytetrafluoroethylene membranes are expanded polytetrafluoroethylene membranes.

4. The affinity chromatography device of claim 1, wherein the affinity ligands are chosen from Protein A, Protein G, Protein L, human Fc receptor protein, antibodies, polysaccharides, or any combination thereof.

5. The affinity chromatography device of claim 1, wherein the first nominal particle size and the second nominal particle size are chosen from 0.1 microns, 0.5 microns, 1 micron, 5 microns, 10 microns, 15 microns, 20 microns, 25 microns, or any combination thereof.

6. The affinity chromatography device of claim 1, wherein the first nominal particle size is different from the second nominal particle size.

7. An affinity chromatography device comprising:

a housing;

an inlet configured to permit fluid flow into the housing;

first and second flow distributors, the first flow distributor and the second flow distributor positioned at opposing ends of the housing;

an outlet configured to permit fluid flow out of the housing, and

a stacked membrane assembly disposed within the housing, the stacked membrane assembly comprising:

two or more polytetrafluoroethylene membranes containing therein inorganic particles of the same type having a nominal particle size,

wherein the inorganic particles have covalently bonded thereto affinity ligands comprising Fc binding proteins, that reversibly bind to a targeted protein or antibody,

and wherein the affinity chromatography device is configured to provide a dynamic binding capacity of at least 30 mg/ml at 10% breakthrough and; a residence time of 20 seconds or less,

wherein the device is configured such that said flow fluid flows through the at least one polymer membrane in the wound membrane assembly in the direction orthogonal to areal thickness of said at least one polymer membrane.

8. The affinity chromatography device of claim 7, wherein the nominal particle size is chosen from 0.1 microns, 0.5 microns, 1 micron, 5 microns, 10 microns, 15 microns, 20 microns, or 25 microns.

9. The affinity chromatography device of claim 7, wherein the two or more polytetrafluoroethylene membranes are expanded polytetrafluoroethylene membranes.

10. The affinity chromatography device of claim 7, wherein the inorganic particles are chosen from silica particles, zeolite particles, hydroxyapatite particles, metal oxide particles, or any combination thereof.

11. The affinity chromatography device of claim 7, wherein the affinity ligands are chosen from Protein A, Protein G, Protein L, human Fc receptor protein, antibodies that specifically bind to other proteins, polysaccharides or any combination thereof.

12. The affinity chromatography device of claim 7, wherein the inorganic particles are first inorganic particles having a first nominal particle size, and wherein each of the at least two polytetrafluoroethylene membranes further comprise second inorganic particles having a second nominal particle size.

13. The affinity chromatography device of claim 7, wherein the second inorganic particles have covalently bonded thereto affinity ligands that reversibly bind to a targeted protein or antibody.

14. The affinity chromatography device of claim 7, wherein the first and second inorganic particles are chosen from: silica particles, zeolite particles, hydroxyapatite particles, metal oxide particles, or any combination thereof.

15. The affinity chromatography device of claim 7, wherein the affinity ligands are chosen from: Protein A, Protein G, Protein L, human Fc receptor protein, antibodies, polysaccharides, or any combination thereof.

16. The affinity chromatography device of claim 12, wherein the first nominal particle size and the second nominal particle size are chosen from: 0.1 microns, 0.5 microns, 1 micron, 5 microns, 10 microns, 15 microns, 20 microns, 25 microns, or any combination thereof.

17. The affinity chromatography device of claim 12, wherein the first nominal particle size is different from the second nominal particle size.

18. The affinity chromatography device of claim 12, wherein the first and second inorganic particles are of the same nominal particle size.