CLAIMS

1. A fluid treatment assembly comprising:

at least one fluid treatment unit including a permeable fluid treatment medium having a feed side and a permeate side;

a feed inlet and a feed passage extending from the feed inlet through the fluid treatment unit to the feed side of the fluid treatment medium;

a permeate outlet and a permeate passage extending from the permeate side of the fluid treatment medium to the permeate outlet;

first and second end pieces, wherein each fluid treatment unit is positioned between the first and second end pieces and wherein at least one of the first and second end pieces is formed from a nonmetallic material and has a flexural modulus of at least about $8x10^5$ psi; and

a retainer extending between the first and second end pieces and arranged to press the at least one fluid treatment unit and the first and second end pieces against one another.

2. The fluid treatment assembly of claim 1 further comprising a manifold positioned between the first and second end pieces, wherein the manifold includes the feed inlet and the feed passage or includes the permeate outlet and the permeate passage.

3. The fluid treatment assembly of claim 1 further comprising a retentate outlet and a retentate passage extending from the feed side of the permeable fluid treatment medium through the fluid treatment unit to the retentate outlet.

4. The fluid treatment assembly of claim 3 further comprising a manifold positioned between the first and second end pieces, wherein the manifold includes the feed inlet and the feed passage, includes the permeate outlet and the permeate passage, or includes the retentate outlet and the retentate passage.

5. The fluid treatment assembly of any preceding claim wherein the retainer comprises a compression rod assembly including a compression rod extending between the first and second end pieces and a fastener attached to the compression rod.

6. The fluid treatment assembly of any preceding claim wherein the retainer is formed from a nonmetallic material.

7. The fluid treatment assembly of any preceding claim wherein each end piece includes a thermoset as a nonmetallic material.

8. The fluid treatment assembly of any preceding claim wherein at least one end piece comprises an end plate having no fluid passages.

9. A fluid treatment assembly comprising:

first and second opposite end pieces, each end piece being formed from a nonmetallic material and having a flexural modulus of at least about $8x10^5$ psi;

one or more manifolds positioned between the end pieces, wherein each manifold has at least one of a feed inlet, a permeate outlet, and a retentate outlet;

one or more fluid treatment units positioned between the end pieces, wherein each fluid treatment unit includes a permeable fluid treatment medium having a feed side and a permeate side;

a feed passage extending from the feed inlet through at least one manifold and at least one fluid treatment unit to the feed side of a permeable medium;

a permeate passage extending from the permeate side of each permeable medium through at least one fluid treatment unit and to the permeate outlet;

a retentate passage extending from the feed side of the permeable medium through at least one fluid treatment medium and to the retentate outlet; and

a retainer extending between the first and second end pieces and arranged to press the one or more manifolds, the one or more fluid treatment units, and the end pieces against one another.

10. The fluid treatment assembly of claim 9 wherein two or more of the feed inlet, the permeate outlet, and the retentate outlet are positioned on the same manifold.

11. The fluid treatment assembly of claim 9 or 10 wherein the retainer comprises a compression rod assembly including a compression rod extending between the first and second end pieces and a fastener attached to the compression rod

12. The fluid treatment assembly of claim 9, 10, or 11 wherein the retainer is formed from a nonmetallic material.

13. The fluid treatment assembly of claim 9, 10, 11, or 12 wherein each end piece includes a thermoset as a nonmetallic material.

14. The fluid treatment assembly of claim 9, 10, 11, 12, or 13 wherein each end piece comprises an end plate having no fluid passages.

15. The fluid treatment assembly of any preceding claim having no metal components.

Claims

1. A fluid treatment assembly comprising:

at least one fluid treatment unit including a permeable fluid treatment medium having a feed side and a permeate side;

a feed inlet and a feed passage extending from the feed inlet to the feed side of the permeable fluid treatment medium;

a permeate outlet and a permeate passage extending from the permeate side of the fluid treatment medium to the permeate outlet;

first and second end pieces, each closes off fluid passages of an adjacent fluid treatment unit, wherein each fluid treatment unit is positioned between the first and second end pieces and wherein each of the first and second end pieces is formed from a nonmetallic material and has a flexural modulus of at least about $1.5x10^6$ psi; and

a retainer extending between the first and second end pieces and arranged to press the at least one fluid treatment unit and the first and second end pieces against one another, wherein the retainer extends between the first and second end pieces along the at least one fluid treatment unit and a distance between the outer periphery of the retainer and the outer periphery of a fluid treatment is less than or equal to about 0.25 inch (six millimeters).

2. The fluid treatment assembly of claim 1 further comprising a manifold positioned between the first and second end pieces, wherein the manifold includes the feed inlet and the feed passage or includes the permeate outlet and the permeate passage.

3. The fluid treatment assembly of claim 1 further comprising a retentate outlet and a retentate passage extending from the feed side of the permeable fluid treatment medium through the fluid treatment unit to the retentate outlet.

4. The fluid treatment assembly of claim 3 further comprising a manifold positioned between the first and second end pieces, wherein the manifold includes the feed inlet and the feed passage, includes the permeate outlet and the permeate passage, or includes the retentate outlet and the retentate passage.

5. The fluid treatment assembly of any preceding claim wherein the retainer comprises a compression rod assembly including a compression rod extending between the first and second end pieces and a fastener attached to the compression rod.

6. The fluid treatment assembly of any preceding claim wherein the retainer is formed from a nonmetallic material.

7. The fluid treatment assembly of any preceding claim wherein each end piece includes a thermoset as a nonmetallic material.

8. The fluid treatment assembly of any preceding claim wherein at least one end piece comprises an end plate having no fluid passages.

9. A fluid treatment assembly comprising:

first and second opposite end pieces, each end piece being formed from a nonmetallic material and having a flexural modulus of at least about 1.5×10^6 psi;

one or more manifolds positioned between the first and second opposite end pieces, wherein each manifold has at least one of a feed inlet, a permeate outlet, and a retentate outlet;

one or more fluid treatment units positioned between the first and second opposite end pieces, each of the first and second opposite end pieces closes off fluid passages of an adjacent fluid treatment unit, wherein each fluid treatment unit includes a permeable fluid treatment medium having a feed side and a permeate side;

a feed passage extending from the feed inlet through at least one manifold and at least one fluid treatment unit to the feed side of a permeable fluid treatment medium;

a permeate passage extending from the permeate side of each permeable medium through at least one fluid treatment unit and to the permeate outlet;

a retentate passage extending from the feed side of the permeable fluid treatment medium through at least one fluid treatment medium and to the retentate outlet; and

a retainer extending between the first and second end pieces and arranged to press the one or more manifolds, the one or more fluid treatment units, and the end pieces against one another, wherein the retainer extends between the first and second

end pieces along the one or more fluid treatment units and a distance between an outer periphery of the retainer and an outer periphery of a fluid treatment unit is less than or equal to about 0.25 inch (six millimeters).

10. The fluid treatment assembly of claim 9 wherein two or more of the feed inlet, the permeate outlet, and the retentate outlet are positioned on the same manifold.

11. The fluid treatment assembly of claim 9 or 10 wherein the retainer comprises a compression rod assembly including a compression rod extending between the first and second end pieces and a fastener attached to the compression rod

12. The fluid treatment assembly of claim 9, 10, or 11 wherein the retainer is formed from a nonmetallic material.

13. The fluid treatment assembly of claim 9, 10, 11, or 12 wherein each end piece includes a thermoset as a nonmetallic material.

14. The fluid treatment assembly of claim 9, 10, 11, 12, or 13 wherein each end piece comprises an end plate having no fluid passages.

15. The fluid treatment assembly of any preceding claim having no metal components.