device 180 has a plurality of structural members 186 extending from the inner surface 181, where the structural members 186 are defined by a length 164. Other structural shapes could be used to reinforce the circumference of the sealing structure, provided they properly distributed the flow and properly reinforced the outside of the seal holder. The seal holder could also be a multiple piece assembly.

In one or more embodiments, the structural members 186 extend from an inner surface 181 and meet a center ring 190 of the sealing device. The structural members 186 assist in uniformly dispersing the feed water to the membrane assembly.

The at least one sealing device 180 is sealing with the membrane assembly 120 at an end surface projection 178 of the at least one sealing device 180. Since the feed water can only enter the channels of the membrane assembly 120, the permeate exits from the membrane assembly 120 to the permeate port, and the sealing device 180 is sealed against the housing, sealing device 180 assists in preventing the feed water from mixing with the clean permeate. In one or more embodiments, the end surface projection 178 is bonded with the membrane assembly 120. In one or more embodiments, there is a gap 175 disposed between the planar surface 177 of the sealing device 180 and the membrane assembly. In one or more embodiments, there is a gap 175 between the structural members and the membrane assembly, allowing for improved flow during the operation of the filtration assembly since the structural members do not block the ends of the membrane assembly.

The at least one sealing device 180 can be made by molding, printing, 3D printing, stamping, or machining, for example, from thermoplastic or metallic material. In one or more embodiments, the sealing device 180 is formed of glass filled, metal, and/or ceramic material. This will assist with chemical and structural stability during temperature swings during manufacturing or use, as temperatures can move over 38 ºC (100 degrees F).

In one or more embodiments, a method of filtering water with the ceramic membrane filtration assembly as described herein, where the method includes pumping feed water in the through the first end cap, through the first sealing device and into the channels of the membrane assembly, and releasing permeate though the permeate outlet port.

In one or more embodiments, the method further includes periodically interrupting pumping with a reverse flow to clean the membrane assembly.

In one or more embodiments, the method further includes releasing concentrate through a concentrate port while segregating the feed water from the permeate and the concentrate with the

CLAIMS

What is claimed is:

1. A ceramic membrane filtration assembly comprising:

a membrane assembly extending from a first membrane assembly end to a second membrane assembly end, the membrane assembly defined by a membrane assembly length; the membrane assembly including at least one membrane;

at least one membrane having channels therein, at least one channel having channel ends;

at least one sealing device coupled with the membrane assembly adjacent to at least one of the first and second membrane assembly ends;

the sealing device having an inner and outer perimeter;

the sealing device having a sealing feature disposed along the outer perimeter; and

the inner perimeter of the sealing device is sealed with a portion of the membrane assembly, wherein the sealing device further includes structural members extending from an inner surface of the sealing device and meet a center ring, and wherein the structural members do not contact the membrane assembly ends such that a gap is between the structural members and the membrane assembly ends.

2. The ceramic membrane filtration assembly as recited in claim 1, wherein the structural members include an inner open section structural substantially aligned with a feed water input port.

3. The ceramic filtration assembly as recited in claim 1 or 2, further comprising a housing, the membrane assembly disposed within the housing, the housing having a first housing end and second housing end and a housing side therebetween, the housing having an inner diameter, the sealing feature forms a seal between the housing and the sealing device.

4. The ceramic filtration assembly as recited in claim 3, wherein the sealing feature separates feed water and permeate water.

5. The ceramic filtration assembly as recited in claim 3, wherein the housing has a feed port and at least one permeate output port.

6. The ceramic filtration assembly as recited in claim 5, wherein the at least one permeate output port exits the housing side.

7. The ceramic membrane filtration assembly as recited in any one of claims 3 - 6, wherein sealing between the sealing device and the housing occurs outside of the membrane assembly length.

8. The ceramic filtration assembly as recited in any one of claims 3 - 7, further comprising a first end cap disposed within the housing at a first end of the housing, the first end cap having a feed water input, a second end cap disposed within the housing at a second end of the housing, the second end cap having a concentrate port.

9. The ceramic filtration assembly as recited in claim 3, further comprising two sealing devices, each sealing device disposed at each end of the housing, the permeate output port disposed between the two sealing devices fluidly separating permeate from feed water and concentrate solutions.

10. The ceramic membrane filtration assembly as recited in any one of claims 1 - 9, wherein the sealing device further includes a recessed portion disposed along the outer perimeter.

11. The ceramic membrane filtration assembly as recited in claim 10, further comprising a sealing member disposed within the recessed portion.

12. The ceramic membrane filtration assembly as recited in any one of claims 1 - 11, wherein the sealing device is coupled with the membrane such that there is a gap disposed between an end planar surface of the sealing device and the membrane assembly.

13. The ceramic membrane filtration assembly as recited in any one of claims 1 - 12, wherein the sealing feature comprises an O-ring.

14. The ceramic membrane filtration assembly as recited in any one of claims 1 - 12, wherein the sealing feature comprises two O-rings.

15. A method of filtering water with the ceramic membrane filtration assembly as recited in any one of claims 1 - 14, the method comprising:

pumping feed water in the through the first end cap, through the first sealing device, and into the channels of the membrane assembly; and

releasing permeate though the permeate outlet port.

16. The method as recited in claim 15, further comprising periodically interrupting pumping with a reverse flow to clean the membrane assembly.

17. The method as recited in claim 15, further comprising releasing concentrate through a concentrate port while segregating the feed water from the permeate and the concentrate with the sealing device.