CLAIMS

1. An alternating tangential flow system for continuous processing comprising:

a feed line containing a fluid;

a retentate line in fluid communication with the feed line;

a first diaphragm at an inlet of the retentate line configured to pump fluid toward an outlet of the retentate line;

a second diaphragm at the outlet of the retentate line configured to pump fluid toward the inlet of the retentate line;

a membrane in fluid communication with the retentate line between the first diaphragm and the second diaphragm; and

a retentate pump at the retentate outlet configured to pump the fluid out of the retentate line.

2. The system of claim 1, wherein the first diaphragm and the second diaphragm are synchronized with each other in an alternating fashion.

3. The system of claim 1, wherein a flux of the retentate pump is less than each of a flux of the first diaphragm and a flux of the second diaphragm.

4. The system of claim 1, wherein the feed line is in fluid communication with a first fluid system process and the retentate line is in fluid communication with a second fluid system process.

5. The system of claim 1, wherein a fluid volume of each of the first diaphragm and the second diaphragm are more than a volume of a portion of the retentate line that is within the membrane.

6. The system of claim 1, furthering comprising a metering valve at the retentate outlet.

7. The system of claim 1, wherein a flux of the feed line is substantially equal to a flux of the fluid of the retentate outlet.

8. The system of claim 1, further comprising:

a filtrate line in fluid communication with the membrane;

a first sensor in line with the filtrate line; and

a second sensor at the retentate outlet.

9. An alternating tangential flow device for continuous processing comprising a housing including:

an inlet configured to receive a feed line containing a fluid;

a retentate line configured for fluid communication with the feed line via the inlet;

a first diaphragm at the inlet configured to pump fluid toward an outlet of the retentate line;

a second diaphragm at the outlet of the retentate line configured to pump fluid toward the inlet; and

a membrane in fluid communication with the retentate line between the first diaphragm and the second diaphragm.

10. The device of claim 9, wherein a fluid volume of each of the first diaphragm and the second diaphragm are more than a volume of a retentate flow path within the membrane.

11. The device of claim 9, wherein the first diaphragm and the second diaphragm are each configured to synchronize with each other in an alternating fashion.

12. The device of claim 9, further comprising a metering valve at the outlet of the retentate line.

13. A method of alternating tangential flow in an alternating tangential flow system for continuous processing,

(a) wherein the alternating tangential flow system comprises:

a feed line containing a fluid;

a retentate line in fluid communication with the feed line;

a first diaphragm at an inlet of the retentate line configured to pump fluid toward an outlet of the retentate line;

a second diaphragm at the outlet of the retentate line configured to pump fluid toward the inlet of the retentate line;

a membrane in fluid communication with the retentate line between the first diaphragm and the second diaphragm; and

a retentate pump at the retentate outlet configured to pump the fluid out of the retentate line; and

(b) wherein the method comprises the steps of:

feeding the fluid directly from a first fluid process into fluid communication with the membrane;

reciprocating the fluid tangentially across the membrane; and

pumping the fluid directly from the membrane to a second fluid process.

14. The method of claim 13, further comprising adjusting a flux of the fluid reciprocating tangentially across the membrane such that a desired concentration of fluid is pumped from the membrane to the second fluid process.

15. The method of claim 13, wherein a flux of the fluid pumped from the membrane to the second fluid process is less than a flux of the reciprocating fluid.

16. The method of claim 13, wherein the second fluid process comprises reciprocating the fluid tangentially across another membrane.

17. The method of claim 13, wherein the reciprocating step is performed continuously for more than 24 hours.

18. The method of claim 13, further comprising adjusting a ratio of a filtrate fluid flow across the membrane to the fluid flow pumped to the second fluid process to adjust a concentration factor of the fluid pumped to the second fluid process.

19. The method of claim 13, further comprising metering a flux of the fluid to the second fluid process.

20. The method of claim 13, further comprising increasing a feeding rate of the fluid in the feeding step and increasing a frequency of the reciprocating fluid.