Patent Claims

1. Micro flow filtration system, wherein the system ~~(100)~~ comprises a fluid circuitry ~~(3)~~ and first reservoir ~~(1)~~ outside of the circuitry ~~(3)~~ suitable for containing a fluid,

the fluid circuitry ~~(3)~~ comprising:

- a tangential flow filtration module ~~(10)~~ (TFF-module) having a feed inlet ~~(18)~~, a retentate outlet ~~(19)~~, a permeate outlet ~~(20)~~ and a semi-permeable membrane ~~(21)~~ capable of separating the fluid sample into a retentate stream and a permeate stream upon passage of the fluid sample into the tangential flow filtration module ~~(10)~~ through the feed inlet,
- a second reservoir ~~(2)~~ integrated into the fluid circuitry ~~(3)~~ having a reservoir inlet ~~(11)~~ and reservoir outlet ~~(12)~~ both in connection to the circuitry ~~(3)~~, avoids an increasing of the minimum working volume or minimum recirculation volume which is defined as a minimal volume with which the circuitry can be driven without pumping air into the conduits or the circuitry of the circuitry,
- a pump ~~(5)~~ for creating and driving a fluid flow of the fluid sample through the fluid circuitry ~~(3)~~ and the tangential flow filtration module ~~(10)~~,
- a plurality of conduits ~~(14)~~ forming the fluid circuitry, through which a fluid stream of the fluid sample is conducted, together with the second reservoir ~~(2)~~, the TFF-module ~~(10)~~ and the pump ~~(5)~~;

wherein

- the volume of the outside first reservoir ~~(1)~~ is ~~significantly~~ larger than the volume of the second reservoir ~~(2)~~;
- the first reservoir ~~(1)~~ outside of the circuitry ~~(3)~~ is connected to the circuitry ~~(3)~~ via a connection conduit ~~(31)~~ in such a manner that the fluid flows unidirectionally out of the first reservoir ~~(1)~~ into the circuitry ~~(3)~~, and the fluid flows continuously into the circuitry until the first reservoir is empty, wherein the connection conduit ~~(31)~~ prevents fluid from flowing back from the circuitry ~~(3)~~ into the first reservoir ~~(1)~~ and

wherein the concentration of the fluid in the first reservoir ~~(1)~~ is constant.

2. Micro flow filtration system according to claim 1, ~~characterized in that~~ wherein the volume of the first reservoir ~~(1)~~ is at least two times larger than the volume of the circuitry ~~(3)~~, preferably at least ten times larger, further preferably at least 50 times larger, particularly preferably at least 100 times larger, also particularly preferably at least 1000 times larger.

3. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the second reservoir ~~(2)~~ is a discrete fluidic element or that the functionality of the second reservoir ~~(2)~~ is provided by another structural element of the fluidic circuitry ~~(3)~~.

4. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the first reservoir ~~(1)~~ and the second reservoir ~~(2)~~ contain the same fluid sample.

5. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the system comprises at least one of the pressure sensors ~~(6, 7, 8)~~, preferably at least two pressure sensors ~~(6, 7, 8)~~, and preferably at least one pressure sensor ~~(6, 7, 8)~~ is used for acquiring information about the transmembrane pressure and/or the physical properties, preferably the viscosity, of the fluid sample.

6. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the circuitry ~~(3)~~ comprises an optical measuring device ~~(30)~~ for acquiring information about the concentration of the components contained in the fluid sample.

7. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the system comprises a pressure regulation means ~~(9)~~ for regulating the transmembrane pressure and the pressure in the fluidic circuitry.

8. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the first reservoir ~~(1)~~ and the second reservoir ~~(2)~~ are in fluid connection in such a manner that the fluid sample of the first reservoir ~~(1)~~ flows directly into the second reservoir ~~(2)~~, preferably via a direct-line connection conduit ~~(4)~~.

9. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the first reservoir ~~(1)~~ is a discrete element, preferably a tank or a container, and the first reservoir ~~(1)~~ is preferably disposable from the circuitry ~~(3)~~ and/or from the second reservoir ~~(2)~~.

10. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the connection conduit ~~(31)~~ is a capillary or a capillary channel or a tube and/or the connection conduit ~~(31)~~ has a length of at least 10 mm, preferably of at least 50 mm, further preferably of at least 100 mm and particularly preferably of at least 200 mm.

11. Micro flow filtration system according to any one of the preceding claims, ~~characterized in that~~wherein the connection conduit ~~(31)~~ has a diameter of at most 1 mm, preferably of at most 0.75 mm and particularly preferably of at most 0.5 mm.

12. Flow filtration method for increasing the concentration of a component contained in a fluid sample using a tangential flow filtration module ~~(10)~~, the method comprising the following steps:

- providing a micro flow filtration system ~~(100)~~, preferably according to any one of the preceding claims, comprising a first reservoir ~~(1)~~ and a fluid circuitry ~~(3)~~, wherein the first reservoir ~~(1)~~ is connected via a connection conduit ~~(31)~~ with the circuitry ~~(3)~~ in such a manner that fluid flows unidirectionally from the first reservoir ~~(1)~~ to the circuitry, wherein the connection conduit ~~(31)~~ prevents fluid from flowing back from the circuitry ~~(3)~~ into the first reservoir ~~(1)~~ and wherein the concentration of the fluid in the first reservoir ~~(1)~~ is constant, the circuitry comprising:

- the micro tangential fluid filtration-module ~~(10)~~ having a feed inlet ~~(18)~~, a retentate outlet ~~(19)~~ and a permeate outlet ~~(20)~~, and a membrane ~~(21)~~ capable for separating the fluid sample into a retentate stream and a permeate stream,
- a second reservoir ~~(2)~~ integrated into the fluid circuitry ~~(3)~~ having a reservoir inlet ~~(11)~~ and a reservoir outlet ~~(12)~~ both being connected to the circuitry ~~(3)~~, avoids an increasing of the minimum working volume or minimum recirculation volume which is defined as a minimal volume with which the circuitry can be driven without pumping air into the conduits or the circuitry of the circuitry,
- a pump ~~(5)~~ for creating and driving a fluid flow of the fluid sample through the fluid circuitry ~~(3)~~,
- a plurality of conduits ~~(14)~~ forming the fluid circuitry ~~(3)~~, through which a fluid stream of the fluid sample is conducted, together with the second reservoir ~~(2)~~, the TFF-module ~~(10)~~ and the pump ~~(5)~~

wherein the volume of the first reservoir ~~(1)~~ is ~~significantly~~ larger than the volume of the second reservoir ~~(2)~~,

- filling at least the first reservoir ~~(1)~~ with a fluid sample,
- driving the fluid sample through the circuitry ~~(3)~~ and passing the TFF-module ~~(10)~~ thereby increasing the concentration of the components in the fluid sample in the circuitry ~~(3)~~ and withdrawing an amount of fluid in a permeate stream,
- establishing a flow of fluid from the first reservoir ~~(1)~~ into the circuitry ~~(3)~~ via the connection conduit ~~(31)~~ which is ~~preferably~~ a continuous flow so that the amount of fluid withdrawn from the circuitry ~~(3)~~ as permeate stream is balanced during operation of the system.

13. Flow filtration method according to claim 12, ~~characterized in~~ further comprising the step of monitoring the concentration of the components in the fluid sample and/or the physical properties of the fluid sample.

14. Flow filtration method according to any one of the preceding claims 12 to 13, ~~characterized in that~~ wherein increase in concentration of the components contained in the fluid sample is a factor of at least two, preferably

of at least 10, further preferably of at least 50, particularly preferably at least 100, further particularly preferably at least 1000.

15. Flow filtration method according to any one of the preceding claims 12 to 14, ~~characterized in that~~wherein the fluid sample flows out of the first reservoir ~~(1)~~ into the second reservoir ~~(2)~~ of the circuitry ~~(3)~~.

16. Flow filtration method according to any one of the preceding claims 12 to 15, ~~characterized by~~ further comprising the following step:

controlling the flow in the circuitry ~~(3)~~ in such a manner that a predetermined pressure or a predetermined flow in the circuitry ~~(3)~~ is adjusted .

17. Flow filtration method according to any one of the preceding claims 12 to 16, ~~characterized in that~~ wherein the flow of the fluid from the first reservoir ~~(1)~~ into the circuitry ~~(3)~~ is controlled by a pressure force, ~~preferably~~ by a under-pressure, preferably generated by the pump, or that the respective amount of fluid is sucked out of the first reservoir ~~(1)~~ or a pressure is applied in the first reservoir ~~(1)~~, and/or that the flow is controlled such that a predetermined amount of sample fluid is contained in the circuitry ~~(3)~~ or that the circuitry ~~(3)~~ is completely filled with fluid such that the circuitry ~~(3)~~ is free of air.

18. Flow filtration method according to any one of the preceding claims 12 to 17, ~~characterized in that~~wherein the pressure in the system and/or the transmembrane pressure is controlled by a pressure regulation means.