**Patent claims**

1. A sampling valve for removing a sample of defined volume from a bioreactor with reduced mechanical loading of the sample, comprising a sample chamber of defined volume, a front sealing element and a rear sealing element, the front sealing element being opened via a connection shaft in the direction of the interior of the bioreactor, and, at the same time, the rear sealing element being closed relative to the sample chamber.

2. The sampling valve as claimed in claim 1, in which the sampling valve is opened by the actuation of a lifting cylinder.

3. The sampling valve as claimed in claim 2, in which the lifting cylinder is driven pneumatically or electrically.

4. The sampling valve as claimed in one of claims 1 to 3, in which a closing force is transmitted by a spring, preferably a spiral spring, from a pressure plate to the rear sealing element via a connection shaft.

5. The sampling valve as claimed in one of claims 1 to 4, in which a guide rod is mounted on the connection shaft for secure positioning of the sealing elements.

6. The sampling valve as claimed in claim 5, in which a membrane is fitted on the guide rod.

7. The sampling valve as claimed in one of claims 1 to 6, in which the sampling valve, at the opening to the interior of the reactor, is protected by a self-cleaning filter against penetration of larger aggregates.

8. The sampling valve as claimed in one of claims 1 to 6, in which the defined volume is 2 to 200 ml.

9. A process analysis system, comprising a device for removal of a sample from a reactor, a sample-transporting device, if appropriate an aliquoting and/or sample preparation station, and at least one sample analyzer, preferably cell counters, chromatography systems and biosensors, characterized in that the device for removal of a sample is a sampling valve as claimed in one of claims 1 to 8.

10. The process analysis system as claimed in claim 9, characterized in that it is connected to an automation system, preferably to a process control system or a programmable controller for guiding, controlling and/or regulating the process in a reactor.

11. The process analysis system as claimed in one of claims 8 and 9, characterized in that the process analysis system has a self-monitoring facility.

12. The process analysis system as claimed in claim 10, characterized in that the self-monitoring facility compares the properties of the sample to the requirements of the analysis station and controls a preparation of the sample.

13. The process analysis system as claimed in one of claims 8 to 12, characterized in that the sample-transporting device for transport of suspensions containing mechanically sensitive material, and in particular of living cells, comprises transport conduits and at least one system for accelerating the sample or aliquot through the transport conduit from at least two burets, the burets being operated with the following steps:

a) a first buret is filled,

b) shortly before the first buret has reached the limit, a second buret is filled and takes over the transport, the sample experiencing no additional acceleration nor a brief intermediate stop,

c) the first buret is uncoupled from the transport conduits and emptied again, such that it is once again available,

d) steps a) to c) are repeated, and, with the transport conduit having a diameter of 0.5 to 3 mm, the sample or aliquot is conveyed at a predefined transport speed of 1 to 10 m/min.

14. The process analysis system as claimed in one of claims 8 to 13, characterized in that the sample analyzer carries out biochemical analysis of reaction products and secondary components.

15. A method for transport of suspensions containing mechanically sensitive material and in particular of living cells, the transport being effected by a sample-transporting device comprising transport conduits and at least one system for accelerating the sample or aliquot through the transport conduit from at least two burets, the burets being operated with the following steps:

a) a first buret is filled,

b) shortly before the first buret has reached the limit, a second buret is filled and takes over the transport, the sample experiencing no additional acceleration nor a brief intermediate stop,

c) the first buret is uncoupled from the transport conduits and emptied again, such that it is once again available,

d) steps a) to c) are repeated, and, with the transport conduit having a diameter of 0.5 to 3 mm, the sample or aliquot is conveyed at a predefined transport speed of 1 to 10 m/min.

**Patent claims**

1. A sampling valve for removing a sample of defined volume from a bioreactor with reduced mechanical loading of the sample, comprising a sample chamber of defined volume having an inlet adapted for installation through a wall of said bioreactor or in a nozzle on a wall of said bioreactor, and an outlet connected to a rear valve interior, and said rear valve interior comprises an outflow nozzle connected to a transport conduit, wherein a front sealing element opens and closes the inlet and a rear sealing element opens and closes the outlet, said front and rear sealing elements being connected to opposite ends of a connecting shaft which shaft is movable by a controller between a first position and a second position in which first position the front sealing element is in an open position and the rear sealing element is in a closed position and in which second position the front sealing element is in a closed position and the rear sealing element is in an open position, whereby the inlet is open at the same time as the outlet is closed, and the outlet is opened at the same time the inlet is closed, wherein the sample chamber is further connected to an inlet channel, wherein to transport the sample, gas or liquid is introduced through the inlet channel and slowly displaces the sample from the sample chamber into the rear valve interior and to the outflow nozzle.

2. The sampling valve as claimed in claim 1, in which the connecting shaft is movable from the first position to the second position and from the second position to the first position by the actuation of a lifting cylinder by the controller.

3. The sampling valve as claimed in claim 2, in which the lifting cylinder is driven pneumatically or electrically.

4. The sampling valve as claimed in claim 1, in which a closing force is transmitted by a spring from a pressure plate to the rear sealing element via a connection shaft.

5. The sampling valve as claimed in claim 1, in which a guide rod is mounted on the connection shaft for secure positioning of the sealing elements.

6. The sampling valve as claimed in claim 5, in which a membrane is fitted on the guide rod.

7. The sampling valve as claimed in claim 1, further comprising a self-cleaning filter at the inlet.

8. The sampling valve as claimed in claim 1, in which the defined volume is 2 to 200 ml.

9. The process analysis system of claim 8, comprising a self-monitoring facility.

10. The process analysis system as claimed in claim 9, wherein the self-monitoring facility is adapted to compare the properties of the sample to the requirements of the analysis station and control preparation of the sample.

11. A process analysis system, comprising a device for removal of a sample from a reactor, a sample-transporting device, optionally an aliquoting and/or sample preparation station, and at least one sample analyzer, wherein the device for removal of a sample is the sampling valve of claim 1.

12. The process analysis system as claimed in claim 11, connected to an automation system for guiding, controlling and/or regulating the process in a reactor.

13. The process analysis system as claimed in claim 11, wherein the sample-transporting device comprises transport conduits and at least one system for accelerating the sample or aliquot through the transport conduit from at least two burets, the burets being operated with the following steps:
a) a first buret is filled,
b) shortly before the first buret has reached its fill limit, a second buret is filled and takes over the transport, the sample experiencing neither additional acceleration nor a brief intermediate stop,
c) the first buret is uncoupled from the transport conduits and emptied again, such that it is once again available,
d) steps a) to c) are repeated, and, with the transport conduit having a diameter of 0.5 to 3 mm, the sample or aliquot is conveyed at a predefined transport speed of 1 to 10 m/min.

14. A method for controlling one or more independently operating reactors which comprises monitoring each reactor with the process analysis system of claim 8, and adjusting reactor conditions in accordance with the results of that analysis.

15. The process analysis system of claim 8 wherein the sample analyzer carries out biochemical analysis of reaction products and secondary components.

16. A method for transport of suspensions containing mechanically sensitive material, the transport being effected by a sample-transporting device comprising transport conduits and at least one

system for accelerating the sample or aliquot through the transport conduit from at least two burets, the burets being operated with the following steps:

a) a first buret is filled,

b) shortly before the first buret has reached its fill limit, a second buret is filled and takes over the transport, the sample experiencing neither additional acceleration nor a brief intermediate stop,

c) the first buret is uncoupled from the transport conduits and emptied again, such that it is once again available,

d) steps a) to c) are repeated, and, with the transport conduit having a diameter of 0.5 to 3 mm, the sample or aliquot is conveyed at a predefined transport speed of 1 to 10 m/min.