Automated sterile sampling system

**System description**

- **Bioreactor**
- **Sample collector module**
- **Sample port module**
- **Filtration module**
- **Dilution module**
- **PC & OPC server**
- **Online analysis**

**Filtration stages**
- 1st adjustable stage during sampling eliminates >500 µm particles
- 2nd customizable stage in the piston eliminates remaining >200 µm particles
- 3rd stage in the Filtration module eliminates remaining >0.2 µm particles in a circulated cross-flow filtration using round 45 mm filter membranes

**Sample volume**
Adjustable 2-10 mL per pull; several pulls per sampling cycle possible

**Sampling interval**
c. 10 min, but depends on the length of the analysis
Sample at the analyser after 2 min

**Sterilization and cleaning**
Sterilization and cleaning with 2 bar steam
Drying with 2 bar air or nitrogen

**Online analysis**
E.g. HPLC or LC-MS analysis

**Control software**
Control software and communication with analyser and bioreactor

**Particle-free sample**

**Freezing**
Samples for later analysis

**Dilution and standard delivery**
Technical data

<table>
<thead>
<tr>
<th>Interfaces and connections</th>
<th>Connection to reactor or pipe into 25 mm Ingold-style port</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Connection to on-line analysers: Sample pumped via 1/8&quot; Teflon tube</td>
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<td>Connection to automation: OPC protocol for data transfer over Ethernet connection</td>
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<tr>
<td></td>
<td>2 bar steam required for sterilization and cleaning</td>
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<tr>
<td></td>
<td>2 bar air or nitrogen required for drying</td>
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<td>The modules use 24 VDC electricity</td>
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</table>

| Multiplexing | 6 Sample ports and Filtration modules can be connected to one Dilution module and on-line analyser |

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Sample port: Length 45 cm, Width 12 cm, Height 30 cm</th>
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<tbody>
<tr>
<td></td>
<td>Filtration module: Length 24 cm, Width 16 cm, Height 20 cm</td>
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<tr>
<td></td>
<td>Dilution module: Length 24 cm, Width 16 cm, Height 20 cm</td>
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Repeatability

- Average 14.35 g/L
- Deviation ±0.21 g/L; <2 %!

For reference, deviation with manual sampling, sample treatment and off-line analysis is generally c. 10 %

Repeatability of sampling, sample treatment and analysis

- Sample volume: 2 x 7 mL
- Sampling interval: 20 min
- On-line analysis: 18 min HPLC run

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