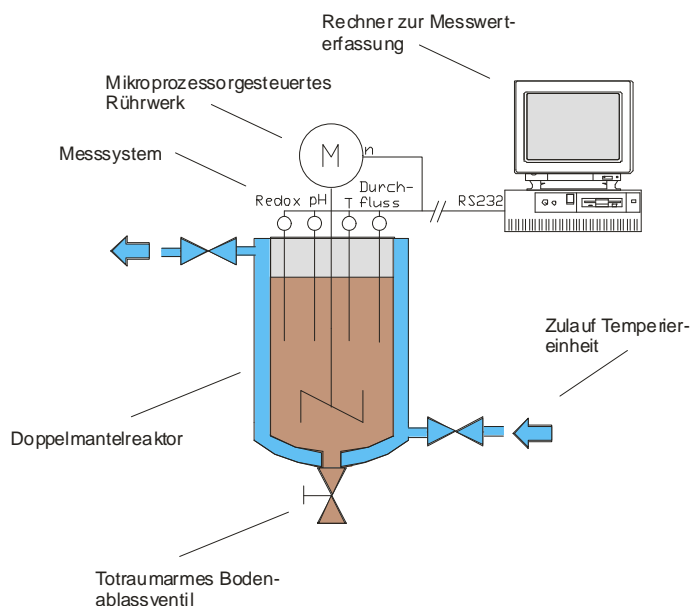




Applications

- biological reactions, e.g. for biogas production
- chemical reactions
- enzymatic reactions
- development of fermentation processes for substances of different consistency
 - aqueous media
 - slurry
 - biomass
 - etc.
- production



Instrumentation

- pH-value
- redox potential
- medium temperature

Optional:

- detecting of the amount of gas
- gas composition
- visual display software
- statistic software

Advantages

- very good price performance ratio
- modular structure and extremely flexible in terms of the design:
 - dimensions of the vessels
 - agitator and speed
 - data logging
 - Handling of the medium (depending on texture and composition)

Customized Fermentors for Research and Production



"Your Custom Made – Molecular Designed Biological Surface"

		MS Ferm 10	MS Ferm 50	MS Ferm 100	MS Ferm 150	MS Ferm 250
media	fermentation of aqueous media (low dried matter)	x	x	x	x	x
	fermentation of media with high dried matter (e.g. slurry with co-ferment) ¹⁾	optional	optional	optional	optional	optional
volume	operating volume	10 l	50 l	100 l	150 l	250 l
	total volume	15 l	75 l	150 l	220 l	340 l
reactor construction	jacket for temp. control	x	x	x	x	x
reactor material / surface finish	1.4301		x	x	x	x
	1.4571/1.4404	x	optional	optional	optional	optional
	inside	grounded / electropolished				
	outside	electropolished				
recirculation	agitator ²⁾	x	x	x	x	x
	speed control	x	optional	optional	optional	optional
	output of speed as standard signal / display	optional	optional	optional	optional	optional
	type ³⁾	blade agitator (1 blade)	blade agitator (2 blades)	blade agitator (3 blades)	blade agitator (3 blades)	blade agitator (4 blades)
	air lift	optional	optional	optional	optional	optional
bleed valve	penstock	x	x	x	x	x
	dead space free bottom drain valve ⁴⁾	optional	optional	optional	optional	optional
fill level control	mechanical	x	x	x	x	x
	ultrasonic	-	-	optional	optional	optional
instrumentation control	pH-value	x	x	x	x	x
	medium temperature	x	x	(2 pcs.)	(2 pcs.)	(2 pcs.)
	redox potential	x	x	x	x	x
	gas meter per reactor	optional	optional	optional	optional	optional
	gas composition	optional	optional	optional	optional	optional
	PC-interface	x	x	x	x	x
	analysis software „Statgraphics“ ⁵⁾	optional	optional	optional	optional	optional
temperature-control	heating / cooling ⁶⁾	x	x	x	x	x
	cryostat	optional	optional	optional	optional	optional
filling / emptying / cleaning	manual: Opening the cover (ball valve)	x	x	optional	optional	optional
	by pump: filling connection (ball valve or slide)	optional	optional	x	x	x
	drain by the bottom drain valve / slide	x	x	x	x	x
	removable cover	x	x	x	x	x
	manway	-	-	-	x	x
	sanitiseable up to 121°C	optional	optional	optional	optional	optional

¹⁾ maximum dry matter content depends on the design (in consultation with the manufacturer)

²⁾ constant speed, agitator driven from the top, directly coupled (design of the agitator, depending on the viscosity of the medium and the required excess pressure of the medium)

³⁾ other types of agitators / processes available (e.g. via external circulation pump)

⁴⁾ maximum particle size of the solid fraction 5 mm

⁵⁾ Software, e.g. for static data analysis and visualization but also for the design of experiments including ODBC interface

⁶⁾ closed cycle, temperature standard 20 ... 60°C adjustable

The design of the reactors can be made even according the requirements of food and pharmaceutical industries, e.g.:

- window for visual inspection
- dosage of additives
- gassing
- dosage of the medium / level control
- gas-tight design (up to 0.2 bar overpressure)
- Surface finish (roughness, etc.), use of aseptic flanges, stainless steel components and sealing material with Factory certificate

Autoclavable jacketed reactors from laboratory to pilot scale for cell culture technology, microbial applications, as well as photochemical synthesis and light-initiated reactions

Application Range

- Research and Development
- improvement of fermentation and synthesis processes
- lab- and up- scale studies
- screening tests
- studies and teaching
- pilot test and production

Properties

- positive and negative radiation geometry available
- the culture vessel is not coupled to the lighting unit and can be assembled easily after sterilization
- spectrum of the lamps adaptable to application
- photosynthetically active radiation (PAR), ideal for the growth of phototrophic microorganisms, feasible
- depending on the model, all necessary process parameters can be recorded and an transferred online to PC

Advantages

- very good price performance ratio
- modular structure and extremely flexible in terms of the design:
 - reactor volume
 - lamp geometry
 - lamp spectrum
 - amount and type of sensors



Customized Reactors for Photochemistry and Photobiology



"Your Custom Made – Molecular Designed Biological Surface"

		MS Photo 10	MS Photo 15	MS Photo 30	MS Photo 100
application	photochemistry	x	x	x	x
	photobiology	–	x	x	x
lightning unit	lamp power ⁵⁾	1 x 15 W	4 x 15 W	8 x 15 W	8 x 15 W
volume / surface	total volume	1.5 l	2 l	4 l	15 l
	radiated useable volume	1 l	1.5 l	3 l	10 l
reactor construction	jacket for temp. control	x	x	x	x
	radiation geometry	negative	positive	positive	negative
	inspection glass	–	–	–	x
reactor material / surface finish	glass	x	x	x	–
	stainless steel	–	–	–	x
	outside electropolished	–	–	–	x
	inside electropolished	–	–	–	optional
recirculation	airlift	optional	x	x	x
	magnetic stirrer	optional	optional	optional	optional
	agitator	–	–	optional	optional
	Speed control of the agitator	–	–	optional	x
adjustment	illuminance	x	x	x	x
	illuminance cycles	–	x	x	x
	pH-value	–	optional	optional	optional
	temperature (cryostat)	optional	optional	optional	x
	flow rate delivery air ¹⁾	optional	x	x	x
instrumentation / control	pH-value	–	optional	x	x
	temperature	–	x	x	x
	illuminance	–	x	x	x ²⁾
	dissolved oxygen	–	optional	optional	optional
	CO ₂ - concentration exhaust	–	optional	optional	optional
	O ₂ - concentration exhaust	–	optional	optional	optional
	flow rate delivery air	–	optional	optional	optional
	autoclavable sensors / electrodes	–	optional	optional	optional
	PC-interface	–	optional	optional	optional
analysis software „Statgraphics“ ⁴⁾	–	optional	optional	optional	
filling / emptying / cleaning	manual filling ³⁾	x	x	x	x
	valve with low dead space	–	–	–	x
	removable cover	x	x	x	x
	autoclavable	x	x	x	optional

¹⁾ Adjustment by Rotameter; optional mass flow controller (not MS Photo 10)

²⁾ in dependence of the optical density

³⁾ Filling by opening or valve opening

⁴⁾ Software, e.g. for static data analysis and visualization but also for the design of experiments including ODBC interface

⁵⁾ in standard case

Universel Reactor for Photochemistry and Photobiology

- autoclavable jacketed reactor in laboratory scale
- for cell culture technology, microbial applications, as well as photochemical synthesis and light-initiated reactions

Application Range

- research and development
- improvement of fermentation and synthesis processes
- lab- and up- scale studies
- screening tests
- studies and teaching
- pilot test and production

Properties

- positive and negative radiation geometry available
- the culture vessel is not coupled to the lighting unit and can be assembled easily after sterilization
- spectrum of the lamps adaptable to application
- photosynthetically active radiation (PAR), ideal for the growth of phototrophic microorganisms, feasible
- depending on the model, all necessary process parameters can be recorded and an transferred online to PC



Dimensions

- | | |
|----------------------------|------------------------|
| ▪ radiated useable volume | ca. 1,5L |
| ▪ radiated surface | ca. 750cm ² |
| ▪ reactor unit (W x H x D) | 500 x 450 x 800mm |
| ▪ control unit (W x H x D) | 400 x 350 x 150mm |

Instrumentation

measurable parameters	adjustable parameters
<ul style="list-style-type: none"> ■ medium temperature [°C] ■ pH value ■ CO₂-concentration exhaust [Vol%] ■ illuminance [$\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$] 	<ul style="list-style-type: none"> ■ flow rate delivery air [0,5...5L/min] ■ flow rate additional air [0,01...0,1L/min] ■ illuminance [0...300 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$] ■ simulation of day/night cycles

Using an additional module with RS232/USB interface the online transfer of measurements to a PC or laptop is possible. This allows the chronological presentation and also store of the measured values. The corresponding software is available in English. Due to the modular design of the photobioreactor system, multiple systems can be connected via an interface to the PC / laptop.



Coupling and interpretation of 4 photobioreactor systems

The Benefits

- full customized design
- modular structure and extremely flexible in terms of the design:
 - reactor volume
 - lamp geometry and spectrum
 - amount and type of sensors
 - peripheral devices and instrumentation
- very good price performance ratio



Front view of the operating- and display-element



Back of the operating- and display-element with connectors for instrumentation and air supply