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Heraeus

CONTIFUGE® STRATOS CONTINUOUS FLOW CENTRIFUGE

The mobile separation expert

Quality Products. Lifetime Care.

Kendro Laboratory Products

Kendro is one of the leading international manufacturers of high quality laboratory centrifuges. With the Contifuge® stratos, Kendro has developed a unique and innovative continuous flow system that enables rapid, reliable separations of large volumes of suspension with a low solid matter content. It is therefore ideal for harvesting bio-products and the examination of water samples.

The Contifuge stratos is offered as a practical table top unit which, with the help of a trolley (available as an accessory), can be used almost anywhere.

LIGHTNING FAST AND MOBILE

Why choose the Contifuge stratos?

Time is money

Compared with discontinuous centrifuges, continuous flow operation with the Contifuge stratos enables extremely short processing times. Time savings of up to 80% are possible.

Simply better

Assembling the rotor is very easy. The empty rotor can be used after just a few simple steps. The rotor, turning at low speed, is then filled with a pump.

What counts is mobility

The Contifuge stratos is the only mobile table top centrifuge of its kind in the world. With the mobile centrifuge stand, it can be effortlessly transported from one location to another at any time.

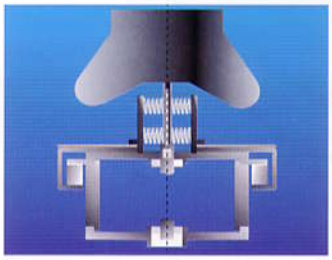
Optimal control

The Contifuge stratos controls the peristaltic pump. It intelligently ensures that the pump switches off during acceleration and braking phases and when the minimum speed falls below 4000 rpm.

Lid closed
Two locks ensure that the lid closes automatically when pushed gently.

Utmost reliability
The Contifuge stratos operates extremely reliably when complex samples are processed. Even the introduction of air/lather does not affect the system's operation.

Ease of cleaning
Once the centrifuge run is completed, the sediment can be removed with ease. Cleaning and drying of the rotor is equally straightforward.



Active run stability
The Contifuge stratos has a unique spindle drive, active damping and a motor that is fully decoupled from the rotor.

This means that instrument movement and vibration during operation are not transferred to the sample.

Fully autoclavable
Expensive rotors made of titanium or a special aluminium alloy are fully autoclavable. This makes the Contifuge stratos particularly suited to bio-science and medical applications.

Rotor diversity
The Contifuge stratos can be quickly and easily converted for discontinuous operation. Eleven different rotors and a variety of adaptors are available for highspeed operation. The system therefore has the most flexible range of accessories available in the entire table top centrifuge market.

THE NUMBER 1 IN LIFE SCIENCE

The Contifuge stratos was developed for the separation of low density particles from aqueous suspensions with a low solid content – a sophisticated task. This mobile, time and cost saving system is ideally suited to a number of different applications.

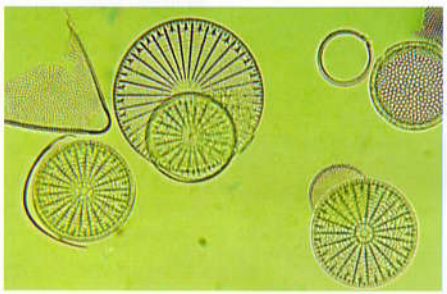
This centrifuge has proven its worth during harvests of fermenter cultures and examinations of many different water samples.

Sewage examinations
- Separation of sediments and suspended matter

Limnology
- Extraction of sediments and suspended matter from inland water

Marine research
- Enrichment of plankton

Drinking water purification
- Extraction of suspended matter as an alternative to filtration



Biochemistry
- Harvest of plant and animal cell cultures, precipitation of protein complexes

Cytology
- Enrichment of cells: bacteria, algae, yeasts, mammalian cells

Medicine
- Harvest of human and animal cell cultures

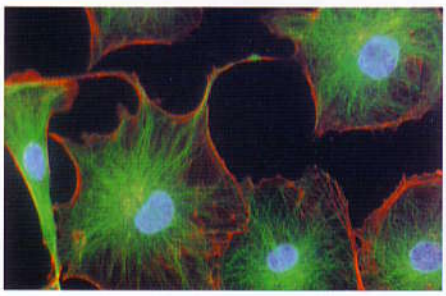


Photo: Soft Imaging System GmbH, Münster

Immunology
- Separation of immunisation globulins/vaccine production, preparation of macrophages

Microbiology
- Harvest of bacteria cultures and virus lysates

Gene technology
- Cultivation of recombination bacteria, yeasts and mammalian cells

Biotechnology
- Harvest of fermenter cultures in large quantities

Brewery process engineering
- Separation of yeasts

Pharmaceutical industry
- Pelleting of proteins/protein complexes, e.g. growth factors

Dairy industry
- Preparation of starter cultures for the dairy industry

Chemical industry
- Concentration of metal and plastic particles, sedimentation of metal hydroxides

Faster as a result of continuity

A CONVINCING COMPARISON

Ideal for large volumes
The Contifuge stratos – a high-speed table top centrifuge with continuous flow operation – fulfils a particularly important task in the Biofuge family: it can process large volumes (e.g. 50 litres) from fermenter cultures, for instance, quicker and more effectively than conventional centrifuges.

No transfer, no division into portions
It therefore represents a convenient alternative to conventional batch processing. Laborious transfers and division of fermenter contents are no longer necessary.

Enormous time savings
Discontinuous centrifugation is very labour intensive and time consuming where large volumes are involved. Depending on the rotors' capacity, repeated runs are necessary. The cell harvest is made up of a large number of relatively small pellets.

Time savings when processing a bacterial culture:

- Using a floor standing centrifuge with a 6 x 500 ml rotor (batch processing), 20 l of culture was harvested in 2 hours and 55 minutes.
- With a Contifuge stratos, only 40 minutes were needed to process the same amount.

Very practical – everything's in the rotor

- Whereas 40 different pellets are generated with batch processing, the entire bacterial culture is contained inside the rotor when using the Contifuge stratos.

COMPACT SYSTEM FOR LARGE VOLUMES

And it all works very easily
The fixed rotor head with inlet and outlet rises above the centrifuge lid.

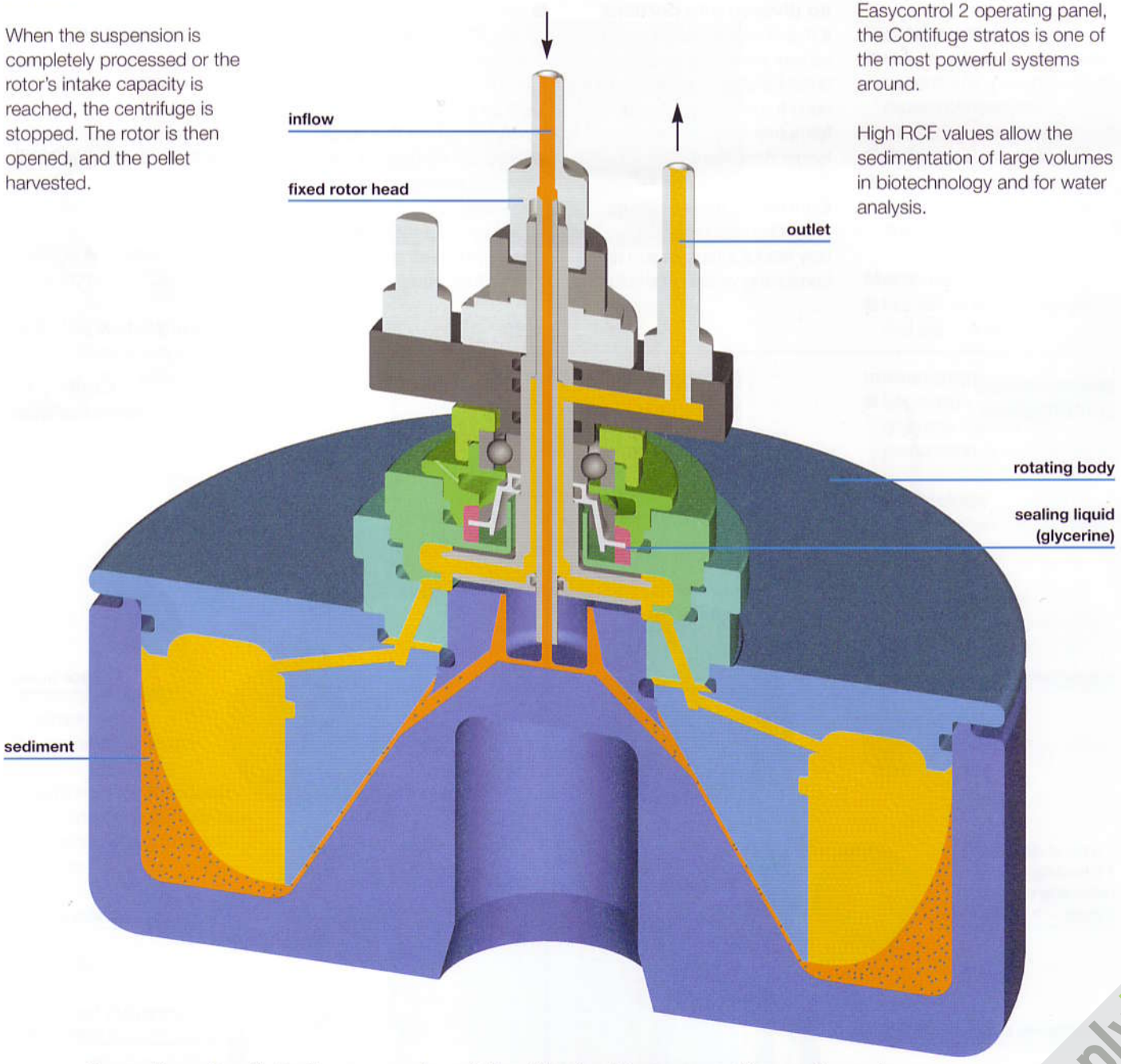
Using a peristaltic pump, the suspension is fed into the rotor body via a rotating joint. The sample flows through the chamber, and sediment particles gather against the rotor walls, while clarified medium is removed.

When the suspension is completely processed or the rotor's intake capacity is reached, the centrifuge is stopped. The rotor is then opened, and the pellet harvested.

Intelligent centrifugation – Contifuge stratos
The Contifuge stratos sensibly combines the benefits of a modern highspeed table top centrifuge with the continuous flow principle.

This model is characterised by particularly intelligent technology. With its unique spindle drive, the electronic imbalance recognition system and the Easycontrol 2 operating panel, the Contifuge stratos is one of the most powerful systems around.

High RCF values allow the sedimentation of large volumes in biotechnology and for water analysis.



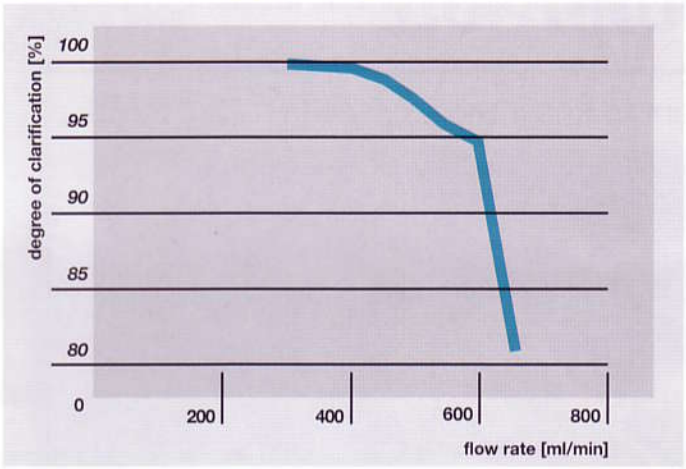
Separation of particles by means of centrifugation in a Heraeus continuous flow rotor

EXAMPLE OF POSSIBLE APPLICATION – CELL HARVESTING

Test parameters

organism	*E. coli*
volume	20 l
optical density (578 nm)	1.2
rotor	75003049
speed	15,000 rpm
flow rate	320 – 650 ml/min

Centrifugation separation capacity



Increase in degree of clarification by decreasing the flow rate

Other applications from the field of cell harvesting

organism	particle size µm	flow rate ml/min	speed rpm	degree of clarification %	comments
Acetobacter woodii	1 – 2	500	15,000	99	difficult to sediment
Methanosarcina barkeri		200	15,000	99	strictly anaerobic
Sulfolobus spec.	2 – 3	440	15,000	99	thermophile
Clostridium acetobutylicum		500	15,000	to 99.7	anaerobic $OD_{578\ nm}$ = 3.6
Saccharomyces cerevisiae	3 – 5	500	8,000	98	
Insect cells/ Sf9 virus culture	16	200	6,000	n.d.	very sensitive cells, nearly complete separation with high vitale
Hela-cells	10	650	9,500	n.d.	90 % vigorous
Animal cells undergone lysis (MKS and RNA virus residue)		400	10,000	95	

Other applications

Macrophages from cattle lungs	7 – 20	760	4,100	n.d.	
Plankton	1 – 5	200	6,000	n.d.	
Suspended matter from River Spree water (heavy metal)	0.2 – 1	360	17,000	n.d.	

Example application

The harvest of an *Escherichia coli* culture with a straight, stick-like bacterium (1.1 – 1.5 x 2.6 – 6.0 µm) is described below.

20 l of an *E. coli* culture in a LB medium were harvested at 15,000 rpm with a varying flow rate. The optical density was determined from the residue and the percentage degree of clarification was calculated from it, i.e. the centrifugation separation capacity was ascertained.

Result

The degree of clarification, depending on the flow rate, is illustrated in the graph. An in-crease in the flow rate in excess of 500 ml/min was connected to a considerable decrease in the separation performance. Within 40 minutes the entire 20 l culture was harvested with a 98% degree of clarification.

Centrifugation parameters in general

A sample's degree of separation depends on the centrifugal force and the flow rate. As with "traditional" centrifuges, acceleration is determined by the rotor speed and increases by the speed squared. The continuous flow speed is adjusted via the peristaltic pump's power. A decrease in the flow rate improves the separation performance as a result of the sample's prolonged length of stay in the rotor.

Application tip

Fluid culture media containing large volumes of yeast extract or other complex ingredients tend to produce large amounts of lather. In this case there was a high production of lather due to the bacteria's formation of gas. However, this did not impair the separation performance in the Centrifuge.

TECHNICAL DATA/ORDER NUMBERS

Contifuge stratos Refrigerated Highspeed Table Top Centrifuge

Model		Contifuge stratos
Drive		induction drive without carbon brushes
Control		microprocessor controlled via Easycontrol II
Min./Max speed	(rpm)	300/23,000 adjustable in 10 rpm increments
Max. RCF	x g	50,377
Max. capacity	ml	400 ml sediment or 4 x 180 ml
Braking/acceleration curves		9/9
Programs		9 + 1 pre-cooling program
Noise level at max. speed	dB (A)	<60
Run time		0 – 9 hrs 59 mins., continuous operation, alternatively 0-99 hrs
Temperature range	°C	–19 to +40
Functions		RCF pre-selection, Quick-run
Rotor recognition		automatic
Imbalance recognition		electronic, depending on speed and ideally suited to every rotor
Construction		galvanised steel chassis with armoured rotor chamber
Safety features		lid lock and interlocks (two automatic locks)
External dimensions (h/w/d)	mm	395 x 640 x 595
Weight (without rotor)	kg	134
Power consumption	W	1,400 (cooling system approx. 900)
Standards		manufactured and tested in accordance with EN 61 010-2-020, EN 50 081-1, EN 50 082-1, no approval required in accordance with UVV VBG 7z

Rotors and accessories

Order no.		75003049	75003054
Recommended area of application		separation of bacteria, cell debris, suspended matter	harvesting of animal and human cells
Material		titanium	aluminium with composite material coating
Max. sediment volume	ml	400	400
with high performance insert		50	50
Autoclavable		indefinitely autoclavable	indefinitely autoclavable
Chemical resistance		to a great extent corrosion resistant	similar to PTFE
Max. speed	rpm	17,000	10,000
Max./min. radius	cm	7.75/5.00	7.75/5.00
with high performance insert		7.75/7.25	7.75/7.25
Max. RCF	x g	25,040	8,665
Acceleration/braking time	s	80/60	36/35
Optimal flow rate	ml x rpm	200 to 600	200 to 600

Order numbers

Model	Equipment	Order no.
Contifuge stratos	230 V, 50/60 Hz	75005283
	200/208 V, 50/60 Hz	75005285
Titanium continuous flow rotor	for 400 ml sediment	75003049
Aluminium continuous flow rotor	for 400 ml sediment	75003054
High performance insert	polypropylene	75015339
Trolley (h x w x d)	764 x 715 x 590 mm	76000083
Peristaltic pump	230 V/50 Hz, max. pump volume 1820 ml x rpm can be switched to 120 V/60 Hz, max. pump volume 1820 ml x rpm	75003503

The heart – the rotor

Continuous flow rotors developed by Kendro are designed to ensure gentle sedimentation of cells without lysis. The titanium rotor has proven to be ideally suited to fermenter harvesting of bacterial cultures. It is chemically inert and is distingnished by its high maximum speed. An aluminium rotor is offered as an economical alternative. It is worth emphasising that for some applications – e.g. the harvest of human or animal cells – lower speeds are sufficient, and these can be achieved with the aluminium rotor. As with the titanium rotor, it is fully autoclavable (20 mins., 121 °C). It has a high quality special coating, the chemical resistance of which is similar to that of Teflon.

titanium rotor

aluminium rotor

Great – the high performance insert

This polypropylene insert improves the rotor's sedimentation capability, particularly for small particles and those with a low density, whilst reducing the sedimentation capacity (50 ml). It has been developed for the separation of suspensions with a low solid material content. A typical area of application is the separation of fine matter in suspensions for water examinations.

Easy – the rotor assembly

For every particular rotor there is an adaptor which houses the automatic rotor recognition system. This avoids any possibility of confusion and guarantees utmost safety as a result of appropriate speed restrictions. Work with the Contifuge stratos is similarly straightforward, as with traditional centrifuges.

- The appropriate adaptor is screwed onto the drive shaft.
- The rotor is simply put on top of the adaptor.
- The centrifuge lid is closed.
- Tubing is fitted to the inlet and outlet points.

Mobile – the trolley

A movable centrifuge table – on which the pump, sample containers and a magnetic stirrer can be placed – makes the entire system mobile. It can be transported to any location.

The trolley constitutes an open, castor-mounted casing in which sample bottles and a magnetic stirring system can be installed. Two locks on the front castors improve stability during operation. The trolley's reinforced metal construction is very sturdy and virtually free from vibration.

Smart – the integrated pump

To maintain defined and reproducible flow rates, the use of a peristaltic pump with a pump range of 100 to 900 ml x min^{-1} is recommended. Kendro offers a peristaltic pump which is controlled via the centrifuge. A minimum speed of 4000 rpm is required to fill and operate the rotor. The centrifuge is equipped with additional electronics and a socket for the pump control which stops the pump as soon as the speed falls below this value. The pump is also automatically switched off during acceleration and braking. When a constant speed is achieved, it resumes operation automatically.