



Cell Disruption Made Easy



John Innes Centre - *"Our Constant Systems cell disruptor is a heavily used and essential instrument. It has been in use for some years now, and has proved to be durable, reliable and easy to use. It is backed up by good customer support and extremely helpful engineers."*

Edinburgh University - *"We run our TS Benchtop 1.1 kW multiple times daily with various samples. It is an essential bit of equipment in the EPPF labs and continues to be extremely reliable and robust. The service support is also second to none!"*

University of Sienna - *"After the introduction of Constant Systems Cell Disruption in our laboratory, protocols of bacterial lysis were greatly improved."*

Queens University Belfast - *"We like the Constant System very much to disrupt bacteria for our applications in the isolation of membrane proteins. It is a very effective instrument much more versatile and accurate than the traditional French press system and the more classical disruption systems by sonication"*

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About Constant Systems

Why choose Constant Systems Ltd?

Founded in 1989, Constant Systems Limited is now 30 years old and entering into our fourth decade of operations we are still very much dedicated to the design, manufacturing and maintenance of our high pressure cell disruption equipment which has built a reputation on reliability, reproducibility, efficacy and consistency.

Holding ISO 9001:2015, UL 61010-1:2004 and CSA C22.2#61010-1-04:2004 accreditations our dedication to supply and support our client base is second to none.



With continued research into client requirements and implementing these into safe and efficient means of cell lysis processes we have progressively grown and maintained a worldwide client base and see ourselves as a front runner for Cell Disruption equipment. We have over 1,300 pieces of equipment around the globe in the areas of drug discovery, protein characterisation and functional studies of cellular processes and to date have directly contributed to research published in over 2,000 peer reviewed papers across a range of academic journals, including Nature and the Journal of Biological Chemistry

What's on offer?

Several equipment suppliers use high pressure for cell lysis processes and our equipment benefits from the use of high pressure but also our unique hydraulic design and control system which guarantees a consistent process throughout. This unique design and control is utilised throughout our range of Cell Disruption equipment ensuring that your process is both upward and downwardly scalable.

Due to this combination of high pressure and consistent control typically 99% of your sample will be processed at the target pressure which ensures a maximum return and in most cases a single pass or process is adequate therefore multiple passes are not required.



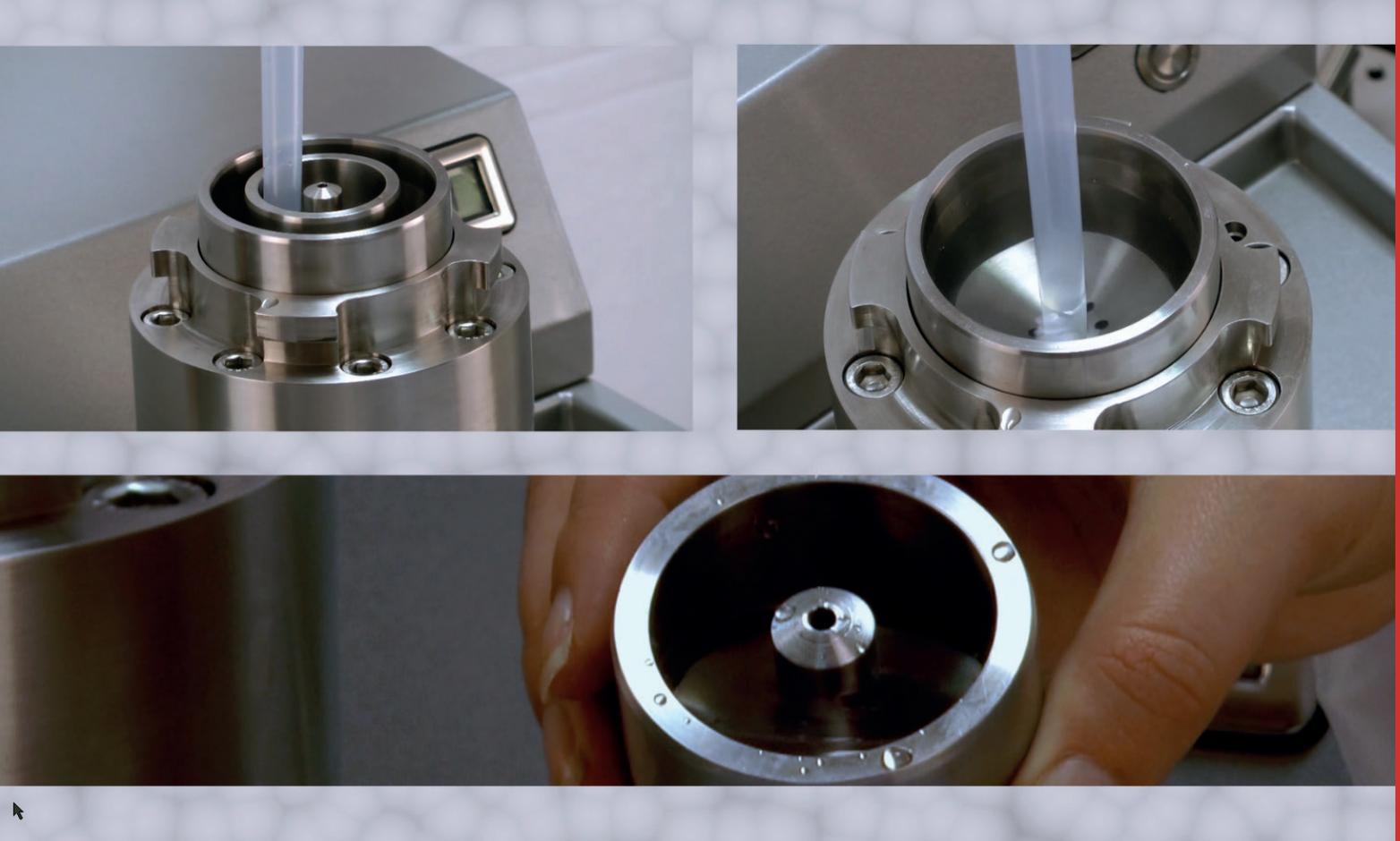
Our product range offers a complete and scalable solution for highly efficient cell lysis from 0.5mL single sample processing through to 150L/hour continuous fluid processing. Our equipment is utilised by academic, research and industrial facilities worldwide to process common expression systems such as *E. coli* and *S. cerevisiae* through to widely considered tough to break organisms *P. pastoris*, *S. aureus* and *L. lactis*, to see a more comprehensive listing of sample types processed on our equipment then please follow the QR code below.

Technology

So what happens?

Our unique process which is based on precise and consistent control of high pressure ensures that our equipment range produces efficient cell lysis across a range of expression systems and material types including bacteria, yeast, algae, and plant/tissue. There are several conditions (steps) that affect the cells within your sample, these are detailed below

1. Instantaneous high pressure - the sample is momentarily trapped in the high pressure cylinder and acting pressures instantly move from ambient to the set pressure.
2. Shear stresses - the sample rushes across the fixed orifice geometry and starts to enter the fixed orifice.
3. Acceleration - the sample is accelerated through the orifice up to speeds of 650 metres per second.
4. Depressurisation – once the sample has left the orifice acting pressures instantly return to ambient.
5. Impact - the sample now collides with the cooled heat exchange surface (which can be as low as -15 degree Celsius) in less than one second of the process beginning.



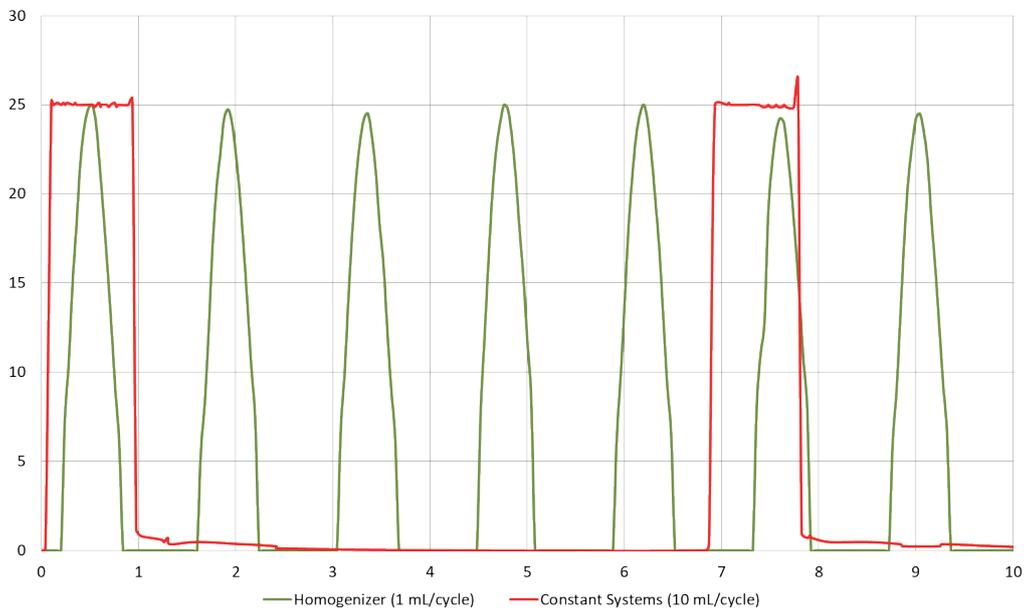
How do we control all these effects?

Simple, we very accurately control the process pressure.

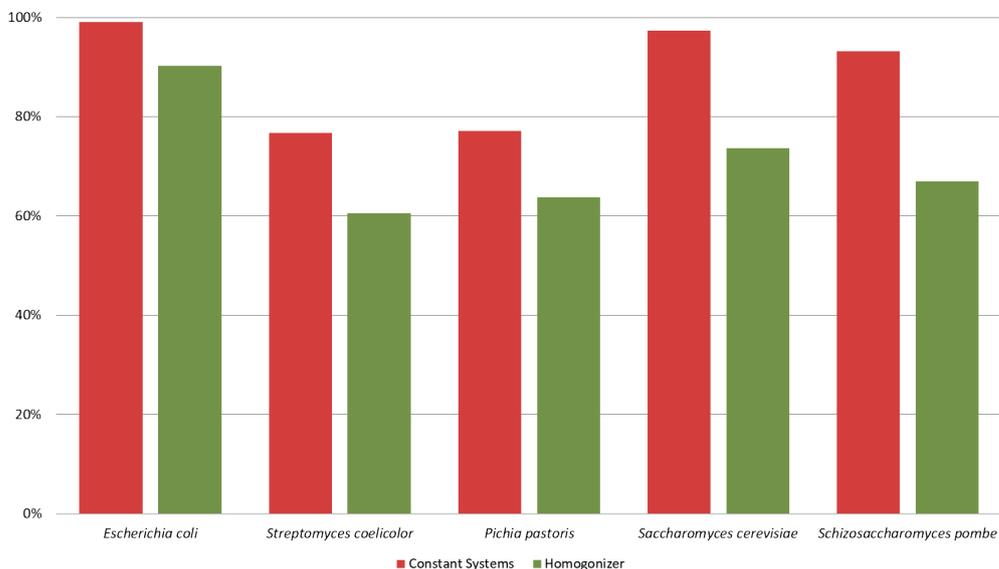
Several equipment suppliers offer high pressure processing but how accurate and consistent is the pressure that is applied to the sample? The data chart below shows recent testing of a well-known high pressure homogenizer, we found that the homogenizer processed <30% of the sample within 10% of the set pressure so in simple terms that's over two thirds of your sample being processed outwith 10% of the target pressure. The same testing indicated that our unique hydraulic design and fixed orifice geometry meant that 99% of the sample was processed within 1% of the set pressure. This ensures that the exact same conditions are applied to the sample throughout the process, so whether it's a 0.5mL single sample or 150L per hour continuous flow processing we give you the control and accuracy that guarantees repeatable, scalable highly efficient cell lysis.

The data charts below show pressure profiles and lysis performance of Constant Systems Equipment and a well known high pressure homogenizer.

Process Pressure Profile at 25,000 psi (1,723 bar)



Efficacy of Constant Systems Equipment in Comparison to Competitor Homogenizer



Equipment

Constant Systems Cell Disruption Equipment is offered via five models which enable the client to process between 0.5mL in a single process through to 150L/hour continuous fluid processing. All Constant Systems equipment are manufactured using industry standard materials. These are shown on the table below as an over view and further detailed on the following pages

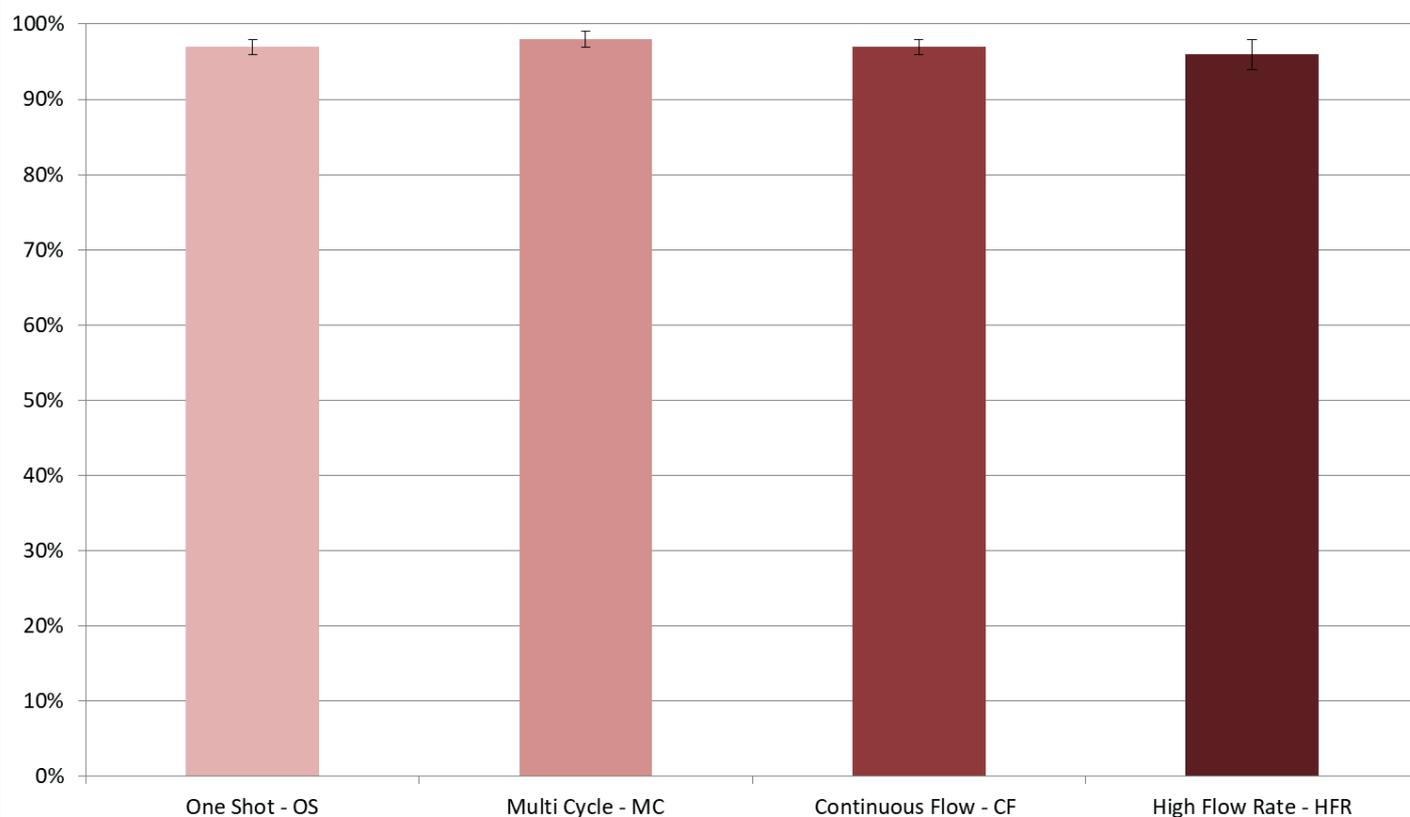


Equipment Type	Recommended Minimum Volume	Recommended Maximum Volume	Able to process Sample States	Dead Loss Volume
OS	0.5mL	24mL	Fluid Re-suspended Tissue Frozen	<0.1mL
MC	0.5mL	80mL	Fluid Re-suspended Tissue Frozen	<0.1mL
CF1	15mL	10L	Fluid Re-suspended	2mL
CF2	15mL	100L	Fluid Re-suspended	2mL
HFR	5L	1000L	Fluid Re-suspended	2.5L

Lyophilised Baker's Yeast (*Saccharomyces cerevisiae*) was used to inoculate 200 mL sterile YMB (Yeast Mold Broth: Peptone 5 g/L, Dextrose 10 g/L, Maltose 3 g/L, Yeast Extract 3g/L) in 1 L flasks which were then incubated at 30°C with shaking at approximately 100 rpm for 24 hours until a cell count of approximately 10⁹ cells/mL was reached.

A sample of this culture was then diluted by a factor of 10 with sterile YM. The resulting culture was then processed individually by four available equipment models, all of which were operated at 40,000psi process pressure. Samples of lysate were taken and cells were counted using a hemocytometer. A sample of unlysed cells from the same culture was used as a control, from which the complete lysis percentage was calculated.

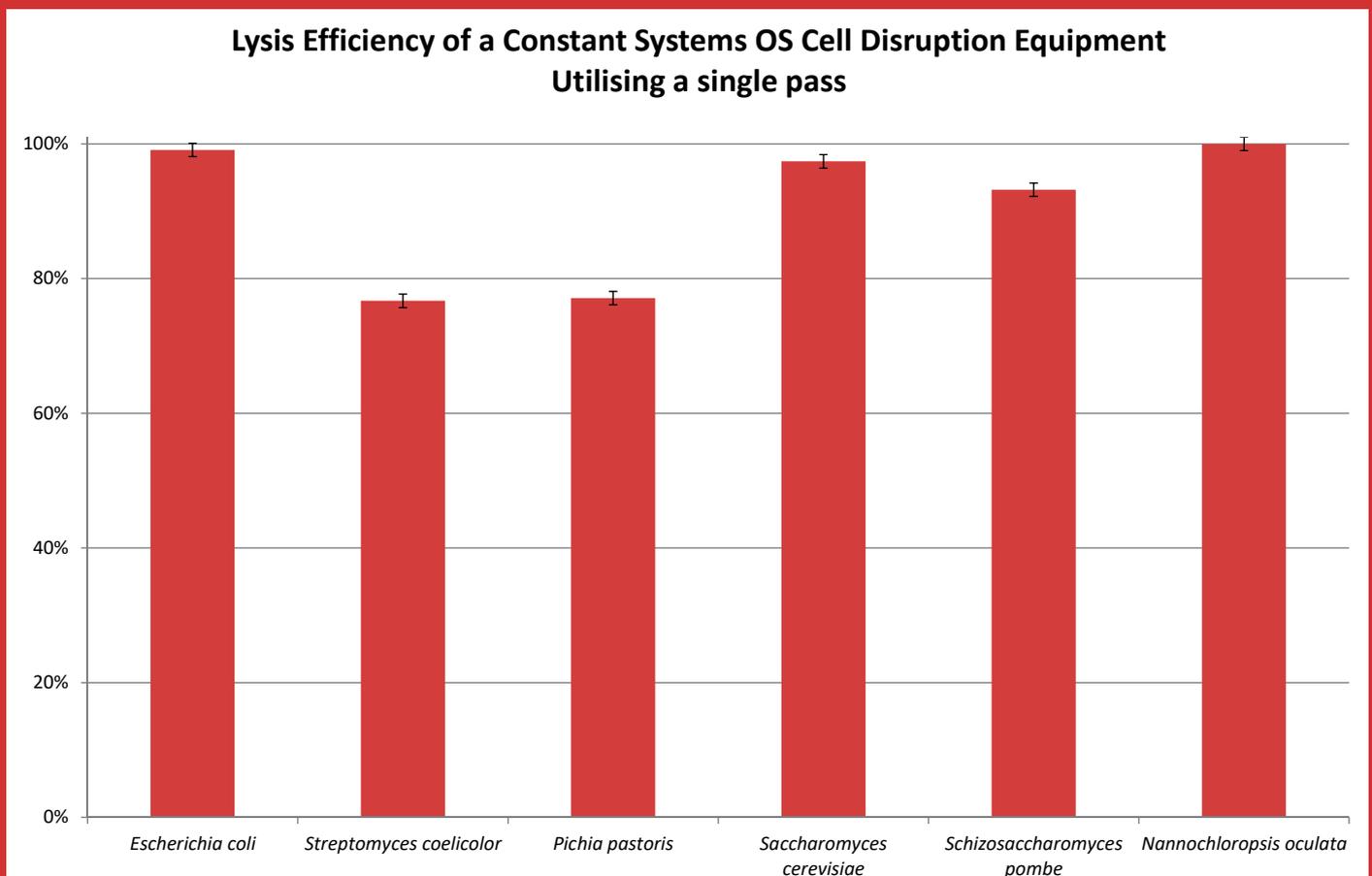
Lysis Efficiency When Processing *Saccharomyces cerevisiae* (10⁹ cells/mL) on Constant Systems Range of Cell Disruptors



OS

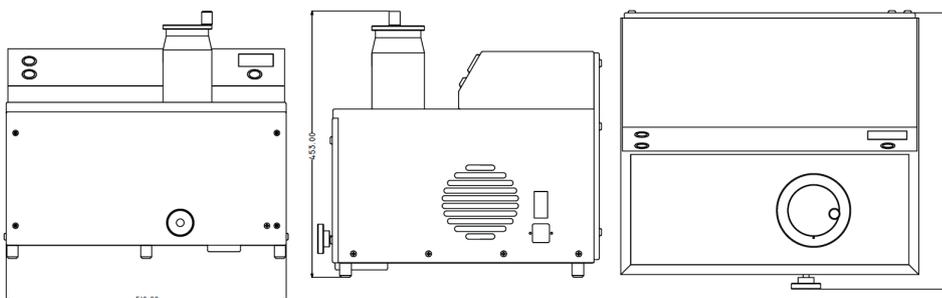
The OS Cell Disrupter is the smallest offering in the Constant Systems Cell Disruption range of products. At approximately 500mm² the OS sits very comfortably on the benchtop but is best suited when used on its tailor made trolley. The OS trolley ensures that the equipment is situated at its optimum working height and is mounted on full swivel and lockable casters that enables safe and free movement of the equipment when needed. The OS is capable of processing volumes from 0.5mL to 8mL per process with a dead loss volume of <0.1mL per process.

The OS is recommended for total volumes of up to 24mL which is ideal for those users who wish to upgrade from small bench-top techniques such as bead beating and sonication. The OS takes advantage of Constant Systems precise and consistent hydraulic control which is fully scalable through the whole product range from 0.5mL single preparation processing to large volume processing at 150L per hour. This precise control ensures that the entire sample is processed at the operators set pressure to ensure accurate and consistent results and in most cases a single process or pass is adequate therefore multiple passes are not required. The OS model can be utilised for processing fluid, re-suspended, viscous, tissue, plant and frozen sample types.



Specifications

- Simple, quick and easy to use
- No need for compressed air or bottled gas, standard electrical supply required only
- No need to prime or purge the equipment prior to use. Any air in the system is simply processed at no detrimental effect to the sample or the equipment
- Design incorporates a stainless steel tray to capture accidental spillages
- Disruption pressure displayed digitally and is easily and accurately set between 1-40 kpsi
- Ability to process fluid, re-suspended, viscous, tissue, plant and frozen sample types
- Collection cups provided can be transferred to and from ice or freezer to aid temperature control of sample
- Constant Systems precise and consistent hydraulic control ensures that consistency is maintained during each and every process giving you confidence in repeatability with 99% of the sample being processed at the set pressure
- Fully contained during the process
- Utilising industry standard media such as Ethanol (70%), Sodium Hydroxide (1 molar) and detergents such as Virkon (1%) the OS models can be easily cleaned using the following methods:
- Process flow cleaning - simply process cleaning media through the equipment as you would your sample
- Manual cleaning - All product path components can easily be dismantled for autoclaving or manual cleaning
- Product path materials are industry standard Stainless Steel 316L and F51 duplex or equivalent, EPDM, GLFPTFE & PEEK 450G ensuring that all sample types and industry standard cleaning media can be processed as standard
- Unit Dimensions: 475x510x455 mm (DxWxH)
- Unit Weight: 110 kg
- Electrical connections - country specific plug type and standard single phase supply via C15 or C20 connection



MC

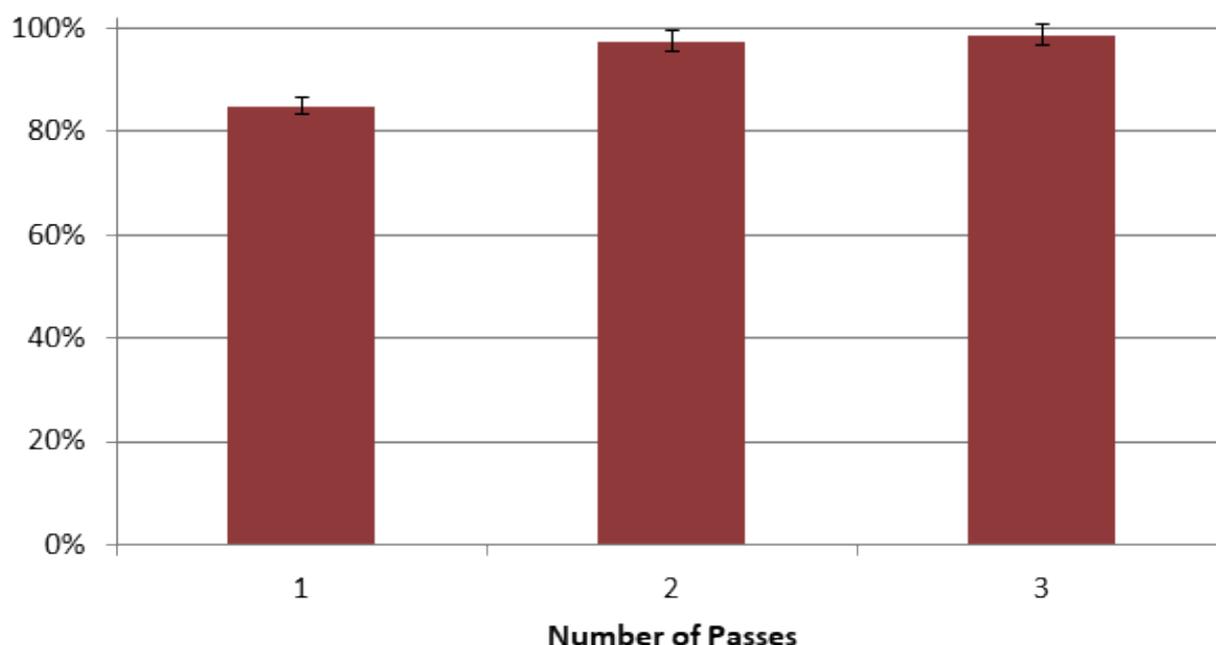
The MC Cell Disrupter is the most versatile model for small volume processing offered by Constant Systems Limited. At approximately 500mm² the MC sits very comfortable on the benchtop but is best suited when used on its tailor made trolley. The MC trolley ensures that the equipment is situated at its optimum working height and is mounted on full swivel and lockable casters that enables safe and free movement of the equipment when needed. The MC is capable of processing volumes from 0.5mL to 40mL per process and is recommended for volumes up to 80mL which makes the MC ideal for those users who wish to upgrade from small bench-top techniques such as bead beating and sonication. The MC takes advantage of Constant Systems precise and consistent hydraulic control which is fully scaleable through the whole product range from 0.5mL single preparation processing to large volume processing at 150L per hour. This precise control ensures that the entire sample is processed at the operators set pressure to ensure accurate and consistent results and in most cases a single process or pass is adequate therefore multiple passes are not required. The MC model can be utilised in three modes, these being Single Cycle (SC), Multi Cycle (MC) and Re Cycle (RC) for processing fluid, viscous, tissue, plant and frozen sample types.

SC Mode is simply a single cycle process and can be utilised to process 0.5mL - 8mL volumes of all sample types whether fluid, solid, frozen, tissue or plant.

MC Mode can be utilised to process greater than 8mL volumes up to 40mL in each process and recommended for a total volume no greater than 80mL. In MC mode all sample types that are fluid and re-suspended can be processed.

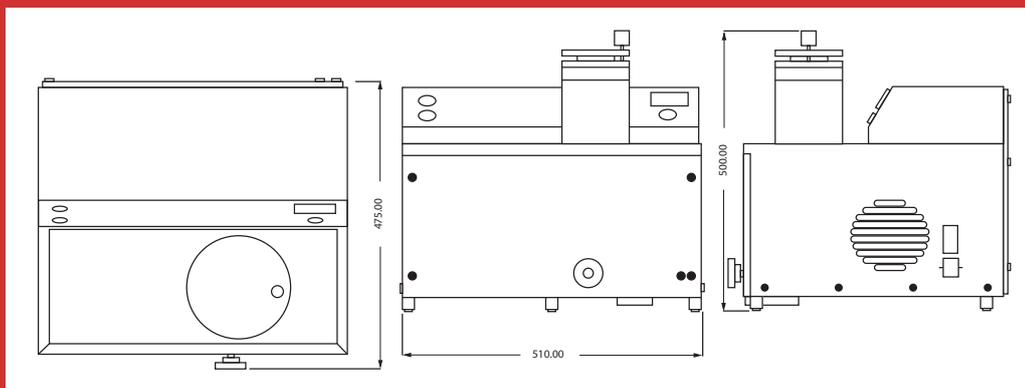
RC Mode enables the user to conduct multiple passes of the same sample (fluid or re-suspended) without collecting and reintroducing the sample time and time again. RC mode is best utilised for very tough sample types such as Gram Positive Bacteria and some Fungi and Algae types. In RC mode a maximum sample volume of up to 80mL can be processed.

Lysis of *Pichia pastoris* (2.8×10^9 Cells/mL) Utilising a Constant Systems MC equipment model



Specifications

- Simple, quick and easy to use
- No need for compressed air or bottled gas, standard electrical supply required only
- No need to prime or purge the equipment prior to use. Any air in the system is simply processed at no detrimental effect to the sample or the equipment
- Design incorporates a stainless steel tray to capture accidental spillages
- Disruption pressure displayed digitally and is easily and accurately set between 1-40 kpsi
- Ability to process fluid, re-suspended, viscous, tissue, plant and frozen sample types
- Collection cups provided can be transferred to and from ice or freezer to aid temperature control of sample
- Constant Systems precise and consistent hydraulic control ensures that consistency is maintained during each and every process giving you confidence in repeatability with 99% of the sample being processed at the set pressure
- Fully contained during the process
- Utilising industry standard media such as Ethanol (70%), Sodium Hydroxide (1 molar) and detergents such as Virkon (1%) the MC models can be easily cleaned using the following methods:
 - Process flow cleaning - simply process cleaning media through the equipment as you would your sample
 - Manual cleaning - All product path components can easily be dismantled for autoclaving or manual cleaning
- Product path materials are industry standard Stainless Steel 316L and F51 duplex or equivalent, EPDM, GLFPTFE & PEEK 450G ensuring that all sample types and industry standard cleaning media can be processed as standard
- Unit Dimensions: 475x510x500 mm (DxWxH)
- Unit Weight: 110 kg
- Electrical connections - country specific plug type and standard single phase supply via C15 or C20 connection



Scan here to see a video on the use of the MC Cell Disrupter

CF – Continuous Flow Processing

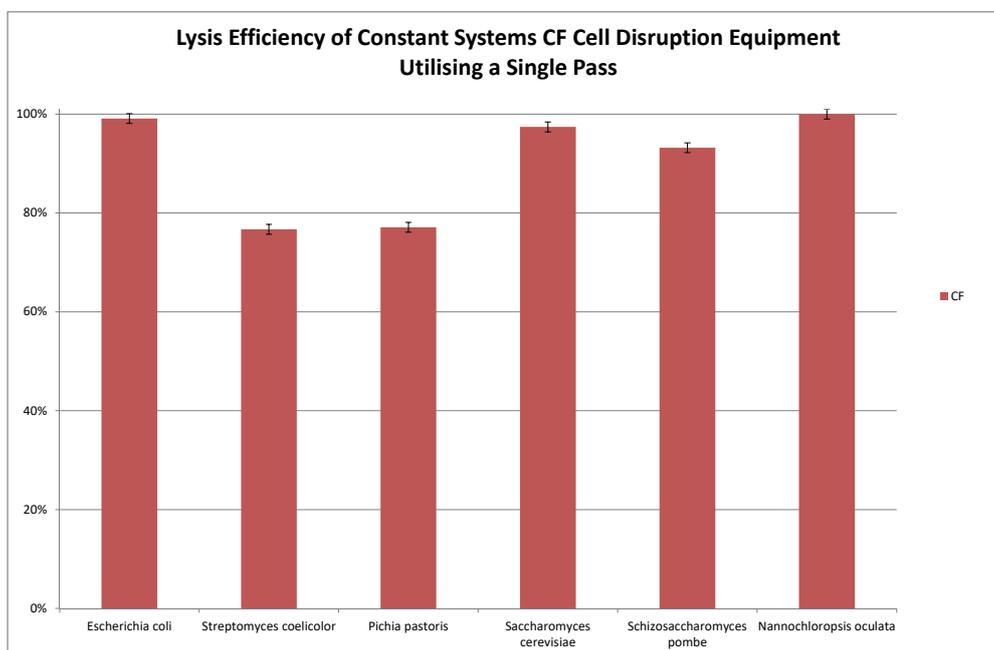
The CF Cell Disrupter offers Continuous Flow Processing with two models, the CF1 and CF2. Both models offer the same process and differ only by process speed, the CF1 offers up to 6L per hour and the CF2 offers up to 24L per hour processing rates. Both models benefit from a HMI control, a maximum process pressure of 40kpsi (2700 bar), integrated sample cooling jacket, 200mL inlet reservoir (hopper), auto shut down feature for when the process is complete and both models take advantage of Constant Systems precise and consistent hydraulic control which is fully scale-able through the whole product range from 0.5mL single preparation processing to large volume processing at 150L per hour. This precise control ensures that the entire sample is processed at the operators set pressure to ensure accurate and consistent results and in most cases a single process or pass is adequate meaning multiple passes are not required. Both models are capable of processing fluid or re-suspended sample types and are utilised for many sample types such as bacteria, yeast and algae.

CF1 Model

At approximately 700mm² the CF1 is small enough to bench mount if required but is best suited when used on its tailor made trolley. The CF1 trolley ensures that the equipment is situated at its optimum working height and is mounted on full swivel and lockable casters that enables safe and free movement of the equipment when needed. The CF1 is recommended for process volumes in the range of 15mL through to 10L. For those processing larger volumes in this range then the CF1 can be offered with an integrated peristaltic pump fully controlled through the HMI which will ensure that the inlet reservoir is continually fed whilst recirculating the sample to help avoid any settling until the entire sample is processed.

CF2 Model

With a footprint of approx. 700mm² the CF2 is a floor standing model that is recommended for process volumes from 15mL through to 100L. The CF2 is offered with an integrated peristaltic pump as standard. The CF2 and is mounted on full swivel and lockable castors that enables safe and free movement of the equipment when needed.



Specifications

- Simple, quick and easy to use
- No need for compressed air or bottled gas, standard electrical supply required only
- No need to prime or purge the equipment prior to use. Any air in the system is simply processed at no detrimental effect to the sample or the equipment
- Design incorporates a stainless steel top tray to capture accidental spillages
- Disruption pressure displayed digitally and is easily and accurately set between 1- 40 kpsi
- Integrated sample cooling jacket ensures that the sample is kept at optimum temperatures throughout the process
- Constant Systems precise and consistent hydraulic control ensures that consistency is maintained during each and every process giving you confidence in repeatability with 99% of the sample being processed at the set pressure
- Utilising industry standard media such as Ethanol (70%), Sodium Hydroxide (1 molar) and detergents such as Virkon (1%) the CF models can be easily cleaned using the following methods
- Process flow cleaning - simply process cleaning media through the equipment as you would your sample
- Reverse flow cleaning and full soak - utilising the peristaltic pump your cleaning media can be pumped backwards through the equipment until the inlet reservoir is filled enabling a full soak if required
- Manual cleaning - All product path components can easily be dismantled for autoclaving or manual cleaning
- Product path materials are industry standard Stainless Steel 316L and F51 duplex or equivalent, WC, EPDM, GLFPTFE & PEEK 450G ensuring that all sample types and industry standard cleaning media can be processed as standard
- Automatic shut down once the sample has been fully processed
- IQ, OQ and PQ available upon request
- 1PH electrical connections - country specific plug type and standard single phase supply via C15 or C20 connection

- CF1

Unit Dimensions: 605x700x740 mm (DxWxH)
Unit Weight: 130 kg
Electrical Supply: 1 Ph electricity as standard,
Americas some areas require 3PH

- CF2

Unit Dimensions: 720x700x1340 mm (DxWxH)
Unit Weight: 240 kg
Electrical Supply: 3Ph electricity



Scan here to see a video on the use of the CF1 Cell Disrupter

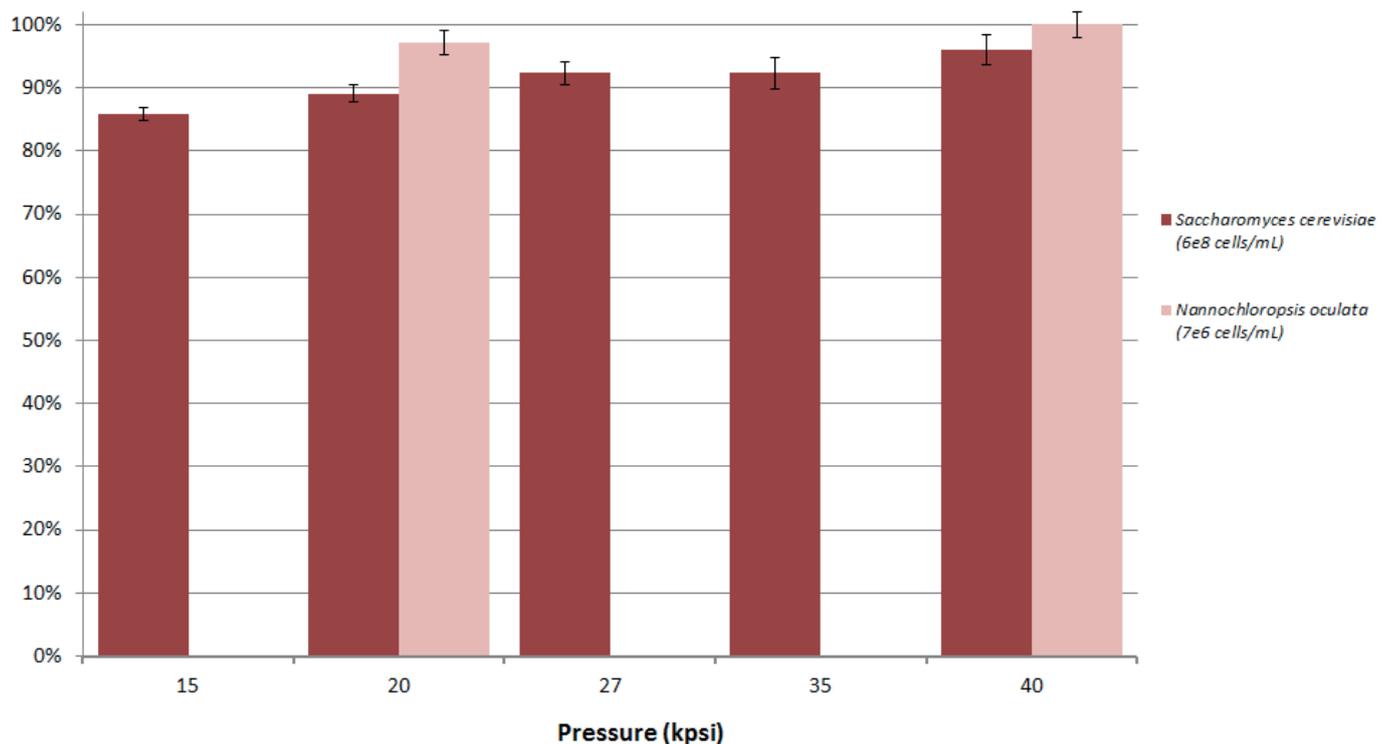
HFR

The HFR is the ideal production model and offers the same lysis efficiency as the standard CSL systems across the full range of processing pressures yet can provide a vastly superior flow rate.

With lysis efficiencies of up to 95% or more and flow rates of up to 150 L/hr, this system can make short work of processing the entire contents of a production scale fermenter or bioreactor, even without prior pelleting and re-suspending.

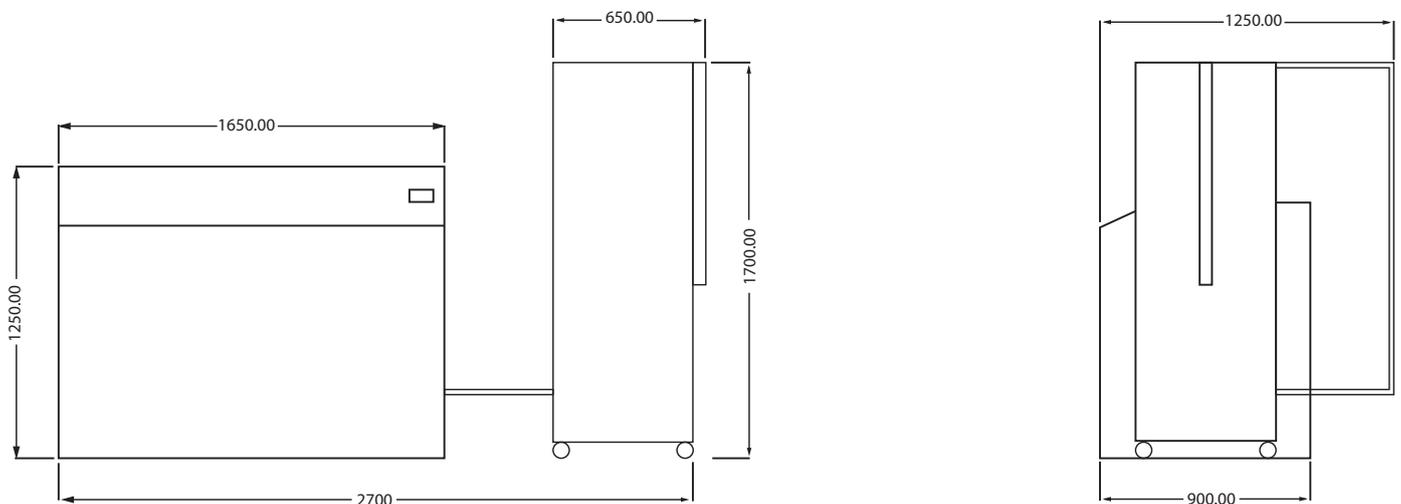
The intuitive user interface offers complete control of the flow rate while the flow path accumulator ensures that the entire sample is processed smoothly and efficiently. This machine has been shown to give the same lysis results as the CF Range when processing tough to break cells types such as *S. cerevisiae* and *N. oculata* and the innovative heat exchange system ensures that the processed sample is completely chilled upon recovery when fitted with a circulating chiller.

Lysis Efficiency of Yeast and Algae by Constant Systems HFR Cell Disruptor in Standard Configuration



Specifications

- Incorporates our unique disruption mechanism and precise hydraulic operating control system
- Disruption pressure easily and accurately set and displayed digitally with a range of up to 40 Kpsi as standard
- Flow rate up to 150 L/hr at maximum pressure
- Automatic shut down when process is complete
- Various flow rates are available depending on desired maximum pressure
- Pressure consistent and stable during the disruption cycle
- Various configurations available for inlet and outlet, allowing direct connections to upstream and downstream equipment
- Performance comparable to existing range of Constant Systems Ltd cell disruptors
- Materials in contact with sample - 316 L and F51 duplex stainless steel or equivalent, EPDM
- IQ/OQ available on request
- Machine Dimensions - 1650 x 900 x 1250 (LxWxH)
- Machine Weight - 875 kg
- Accumulator Dimension - 650 x 1700
- Accumulator Weight - 210 kg



Client Support

We take pride in providing the highest level of service to the client and our support starts at the initial enquiry stage. All enquiries are detailed and documented, the client is taken through the enquiry process so that all relevant information is captured ensuring that the best fit equipment is recommended via a personalised Cell Disruption Solutions Proposal.

Following a successful sale all Constant Systems equipment along with the client are supported post sale either directly by our service team or through our distributor network meaning our service and technical teams are ready to assist whether it be a question on spare parts, technical assistance, request new user training or renewing a maintenance agreement.

Maintenance Agreement

We recommend a maintenance agreement on all our Cell Disruption models where our engineers will carry out a point check and ensure the equipment is within calibration and running at optimum levels. During the visit the engineer will also take time to review the users log book and liaise with the client to discuss any requirements from the client side and make recommendations regarding usage, training, cleaning and spare parts.

Our excellent service department pride themselves on the level of customer care and support we deliver to all our direct clients in the UK, Europe and those a little further away in South Africa, Australia and New Zealand who over the 12 months running up to June 2019 rated our client support as a whole at 95/100

For more information

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ADJUST PRESSURE

5.0C



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FS 67550



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