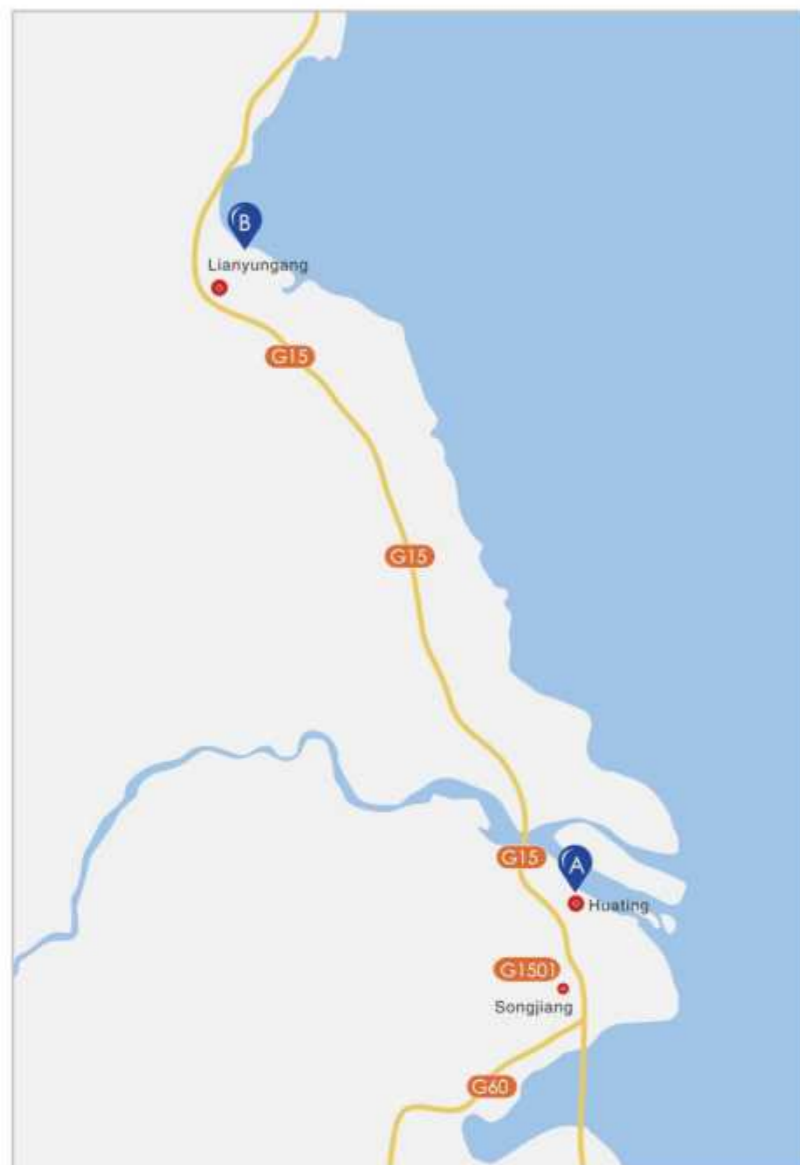


All rivers flow into the sea, Mount Kunlun is top in the sky
Great virtue can carry all things, Truth-seeking and innovative



Bailun Biotechnolog Co.,Ltd

Add: Building 3, 28# Huajia Rd., Songjiang, Shanghai
Tel/wechat: +86-139-17391617
E-mail: sales@fermentertech.com
Web: www.fermentorchina.com

Bailun Biotech (Jiangsu) Co.,Ltd

Add: No.3 Liangang Rd.,Lingang automatic control equipment
industrial zone, Dunshang town, Ganyu district, Lianyungang
Tel/wechat: +86-134-72768136
E-mail: service@fermentertech.com
Web: www.fermentertech.com

2023

BIOREACTOR FERMENTER Laboratory Series



- 2008 Shanghai Bailun Biological Technology Co., Ltd.
- 2009 Lianyungang Bailun Biochemical Technology Co., Ltd.
- 2017 Lianyungang Bailun Bioreactor Technology Co., Ltd.
- 2021 Bailun Biotechnology (Jiangsu) Co., Ltd.
- Current Bailun has more than 20,000 sets of equipment in more than 90 countries and regions around the world stable operation, continue to create value for users!



COMPANY PROFILE

Bailun Biotechnology (Jiangsu) Co., Ltd. is a leading supplier of intelligent data-driven bioreactor systems in China. Products cover all kinds of bioreactors in laboratory, pilot scale and industrial production, including fermenter, animal cell bioreactor, plant cell bioreactor, single-use bioreactor, liquid dispensing system and disposable reactor, etc. Can produce bioreactor of 0.1L-1000KL volume and technical services, and provide intelligent and personalized comprehensive solutions for bioreactors process. Bailun has a large number of experienced fermentation process, biochemical equipment and chemical technical engineers, many famous experts and scholars as the company's technical consultants,. Bailun forever pursuits to create value for customers, and adhere to customer-centric is the core value of Bailun.

In order to optimize and enlarge the production of process products in biological processes, various problems in the process need to be studied, therefore, a variety of research instruments and equipment are designed, and various conclusions are obtained through experiments and used in production practice. This equipment for the study of biological processes can be divided into seed material studies of living cells with the main objective of synthetic biology, and problems arising from changes in the transfer characteristics of process mixing, for which various bioreactor devices have been formed. To this end, the company to the above content as the goal, combined with the actual situation of users organized a series of devices for research products. Among them, there are products for high performance cell line acquisition device, biological reactor products for obtaining bacterial physiological characteristics, experimental equipment for biological process optimization and amplification, bioreactor system for intelligent biological process, as well as a variety of measurement, sterilization or sampling manual operation, data processing software packages, GMP operating characteristics and other components research products for users to choose.

Bailun Spirit:

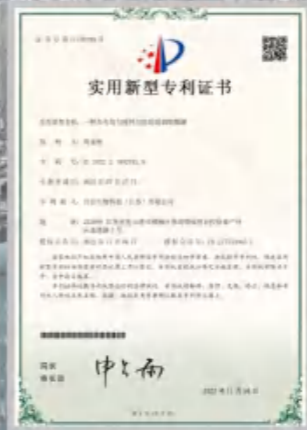
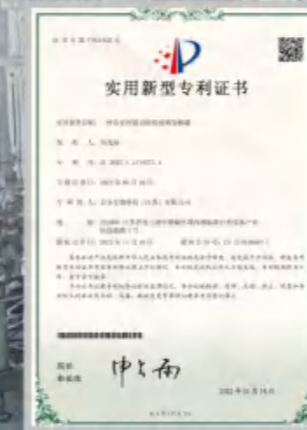
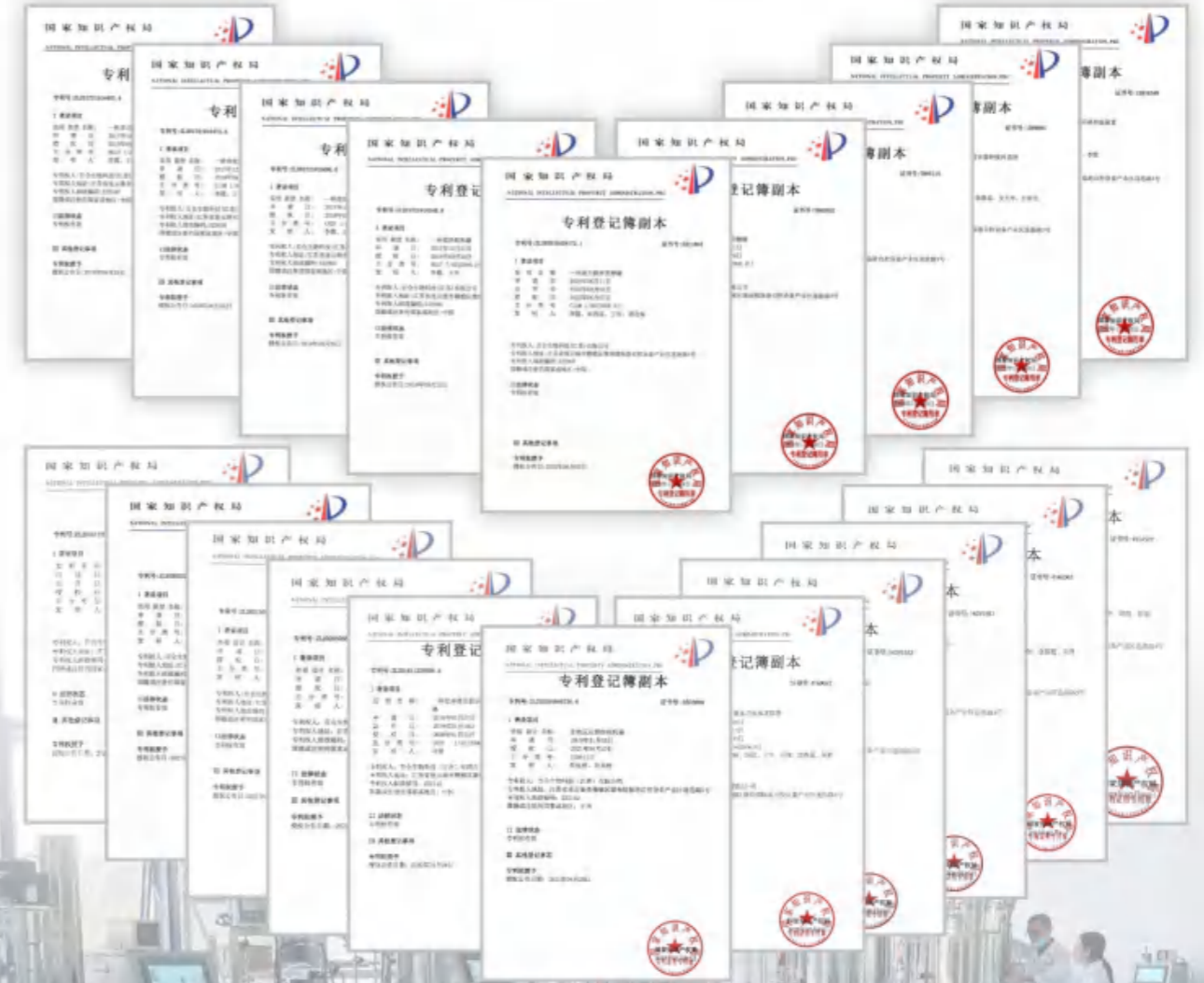
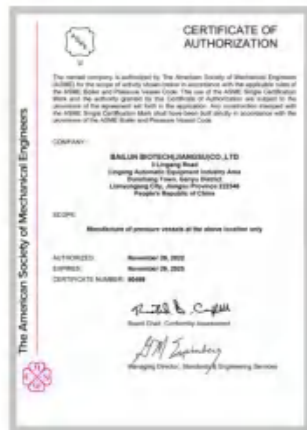
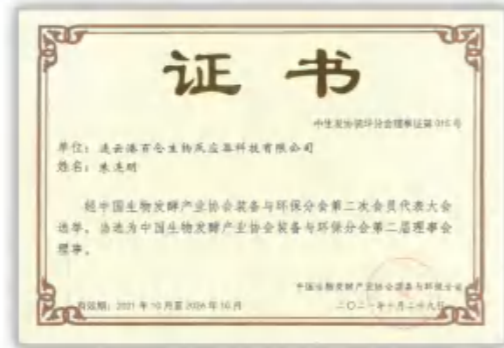
Customer foremost, seeking quality, fairness and honesty, continuous improvement!



BAILUN QUALIFICATION

Honor exists because of customers: because all our efforts are for the satisfaction of customers. Honor is the affirmation, trust and spur, honor is our golden card and pass, honor is our signpost and a journey, Honor represents the past. Bailun people regard honor as an inexhaustible motivation to encourage their own continuous improvement and progress.

First-class quality, from the innovation of technology!



GLASS BIOREACTOR

Off-site sterilization glass fermenter

Suitable for the cultivation of microbial yeast and fungi, ready to use, easy to operate, easy to learn and use, and extremely low failure rate.

- After suitable fittings are installed, it can be suitable for culture of cells of mammals and insects.
- The semi-circular stainless steel jacket bottom, built-in heat exchanger and serial inner heat exchange baffle are conducive to temperature control of hot/cold water and fast heat transfer.
- Tanks working volumes as 1L, 2L, 3L, 5L, 7L, 10L, 15L, 20L, 30L, 40L and 50L are available for selection. Culture tanks are interchangeable.

The bioreactor device for obtaining the physiological characteristics of strains is to obtain the cells obtained from high-performance cell or shake flasks in conventional fermenters (such as only temperature, rotation speed, aeration, pH, DO, etc.) Basic physiological properties.

Full glass tank, good integral structure, safe and reliable, convenient use, easy to learn and to use.

- Tank with working volumes 2L, 3L, 5L, 7L, 10L, 15L and 20L are available for selection, and the culture tanks are interchangeable.
- As for the ventilation optional, it can be equipped with the mass flow meter to reinforce the function and increase the oxygen enrichment bypass function.



BLBIO-5GC Off-site sterilization magnetic driving glass fermenter (magnetic stirring fermenter)

Magnetic driving is suitable for products that have high requirements for biological safety with low culture medium viscosity and long fermentation cycle.



BLBIO-5GJ Off-site sterilization shaft driving glass fermenter (mechanical stirring fermenter)

The shaft driving is suitable for culture of high-density, high-viscosity, and high-oxygen consumption. It has strong universality.



BLBIO-XGJG glass fermenter (single-wall tank)

Single-wall glass fermenter control temperature by external electric heating blanket and inner dipping cooling coil, easy and convenient, low fault rate.

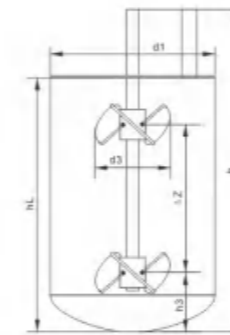


BLBIO-XGJGG glass fermenter (double-wall glass tank)

Temperature control by jacket glass tank, stainless steel water tank and heater, circulating pump forced circulation temperature control, accurate temperature control. The shortage is slightly heavy, the jacket glass is easy broken and easy damaged, And the culture medium sterilization time is slightly long.



BLBIO-5GJ-plus Off-site sterilization shaft driving glass fermenter (mechanical stirring fermenter)



| Specification name | 1L | 2L | 3L | 5L | 7L | 10L | 15L | 20L | 30L | 40L |
|---|------|------|------|------|-------|-----|-------|------|------|-----|
| Total volume (L) | 1L | 2L | 3L | 5L | 7L | 10L | 15L | 20L | 30L | 40L |
| Working volume (L) | 0.7L | 1.4L | 2.1L | 3.5L | 4.9L | 7L | 10.5L | 14L | 21L | 28L |
| Bioreactor diameter d1(mm) | 90 | 120 | 140 | 160 | 190 | 214 | 214 | 256 | 282 | 342 |
| Bioreactor height h(mm) | 155 | 228 | 240 | 265 | 318 | 325 | 423 | 432 | 520 | 454 |
| h/d1 | 1.7 | 1.9 | 2 | 1.65 | 1.67 | 1.5 | 1.97 | 1.68 | 1.84 | 1.3 |
| Filling height hL [mm] Filling liquid volume | 116 | 171 | 180 | 200 | 238.5 | 244 | 317 | 304 | 358 | 323 |
| d2,3 Paddle (mm) | 50 | 60 | 70 | 85 | 95 | 108 | 108 | 128 | 141 | 171 |
| d2,6 Paddle (mm) | / | / | / | / | / | / | / | / | / | / |
| h3(mm) | 40 | 65 | 42 | 62 | 76 | 80 | 80 | 102 | 113 | 137 |
| $\Delta z=1.3 \times d2$, (3-blade segment impeller) (mm) | / | 78 | 91 | 110 | 124 | 140 | 140 | 166 | 183 | 222 |

MULTI-CHANNEL MINI PARALLEL BIOREACTOR

— Obtain high-performance cell reactor device

The strains are transformed by natural mutagenesis, mutation breeding or synthetic biology, and high-throughput screening is used to obtain high-performance cell. High-through put screening generally uses high-throughput microplate screening methods and microreactor studies. We use the multi-channel mini-parallel bioreactor with volume of 0.1-2.4 liters. Due to the smooth characteristics of the microreactor, it is more suitable for industrial production devices and has better results. (The multi-channel here is to obtain a few high-performance cell from a large number of cells)

- Optional working volumes as 0.1, 0.3L, 0.5L, 0.6L, 0.7L, 1L, 2L, and 2.4L are available for selection. Culture tanks are interchangeable.
- Two ways of water temperature control and no water temperature control are available for selection
- Temperature control with water or without water can be selected



BLBIO-0.2GJ-mini 0.2L mechanical mixing glass bioreactor



BLBIO-1GJ-4-mini 1L quadruple multi-channel micro-bioreactor



BLBIO-0.5GJ-4-mini 0.5L quadruple mechanical mixing multi-channel micro-bioreactor



BLBIO-1GJ-4-H-mini 1L quadruple mechanical mixing multi-channel micro-bioreactor



BLBIO-0.5GJ-12-mini 0.5L duodecuple mechanical mixing micro-bioreactor
The best choice for strain screening, quadruple, octuple and duodecuple can be combined arbitrarily, occupying a small space



BLBIO-1GC-5-mini 1L quintuple magnetic multi-channel parallel bioreactor

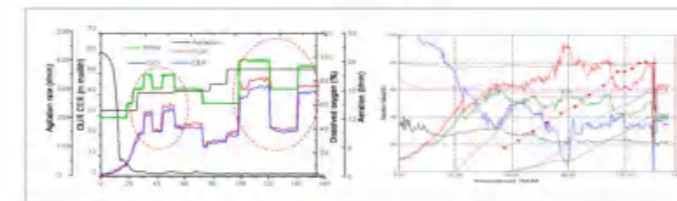
DATA SCIENCE

Data Amplification Analysis Software

Mainly to address the properties of genes, cells and reactors in biological processes, In the process of multi-scale analysis, the restrictive conditions of the process can be distinguished, the influence of the mixed transfer characteristics of the process on cell metabolism can be known, and the process optimization and amplification can be realized.

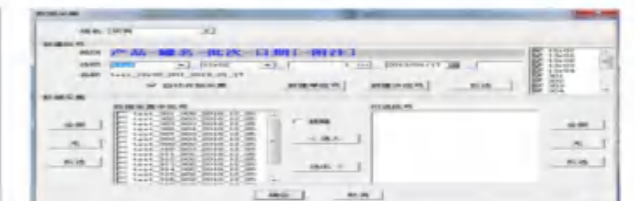
Rapid discovery of key parameters and critical control points in vitamin fermentation.

Such as the discovery of oxygen regulation in vitamin fermentation, accurate process optimization and amplification.

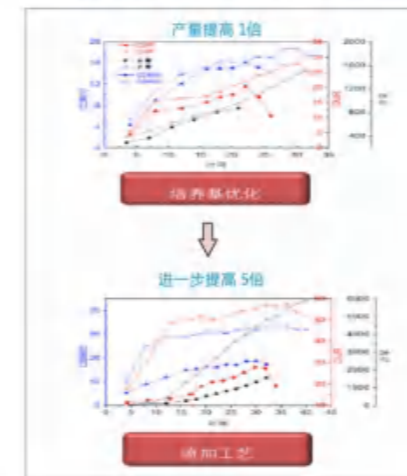


Multi-tanks real-time data collection by group with one key

In one software interface, the batch number data management of multiple fermentation tanks can be realized, and the batch numbers of multiple tanks can be established and real-time data can be collected with only one key.

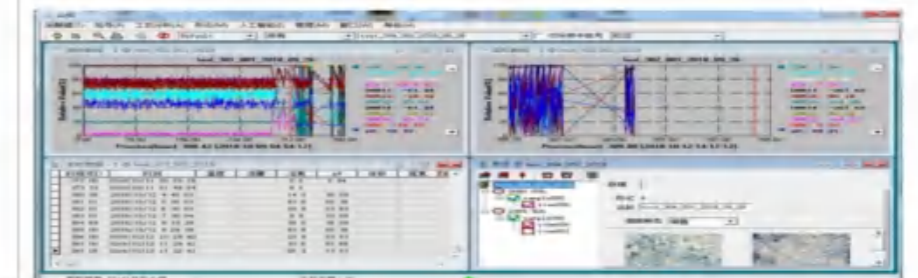


The optimal sugar and nitrogen feeding strategy of antimicrobial peptides

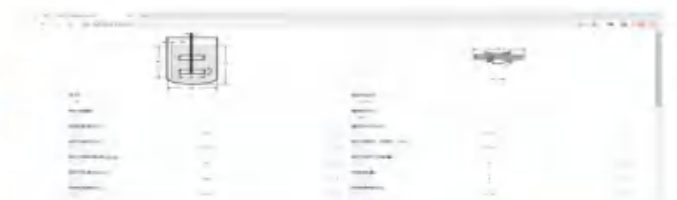
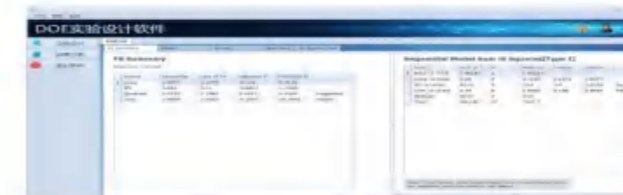


Quick docking of various types of parameters

Manage data such as real-time acquisition, manual measurement, intracellular metabolism, cell morphology and event recording, these data can be used comprehensively to calculate OUR, CER, RQ, K_{la} , cell specific production rate, substrate specific consumption rate and product specific production rate and other parameters that characterize the metabolic state, significantly improves the effectiveness and reliability of process optimization and scale-up.



DOE Experimental Design



MULTI-CHANNEL PARALLEL GLASS BIOREACTOR

We have the following personalized upgrade services (charges apply): Data sharing system, intelligent software package, cloud service-related software, online scale-up design software, CFD fluid simulation, DOE experimental design, combined application of upstream synthetic biology research and fermentation engineering, and industrial scale-up, etc.

Double Parallel Glass Fermenter (desktop)

A standard model of desk type double bioreactors, a preferred product for strain screening and process research and development. High performance-price ratio, small floor space, convenient use, ready to use.



BLBIO-XGJ-2-A Double mechanical mixing glass fermenter (desktop)



BLBIO-XGC-2-A Double magnetic mixing glass fermenter (desktop)



BLBIO-XGJG-2-A Double mechanical mixing single wall glass fermenter (desktop)



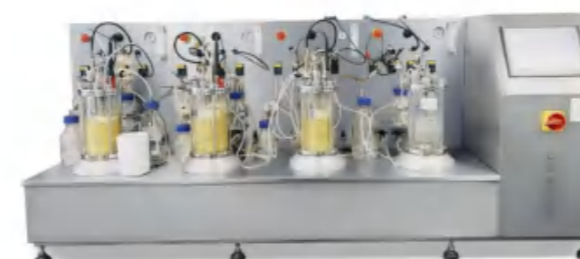
BLBIO-XGJG-2-A Double mechanical mixing double wall glass fermenter (desktop)

| Name | Double magnetic mixing glass fermenter (desktop) | Double mechanical mixing glass fermenter (desktop) | Double mechanical mixing all glass fermenter (desktop) |
|------------------------------------|--|--|--|
| Model | BLBIO-XGC-2-A | BLBIO-XGJ-2-A | BLBIO-XGJG-2-A |
| Total volume (L) | 0.5/0.6/0.7/0.8/1/2/3/5/7/10/15/20 | | |
| Material | Stainless steel + borosilicate glass | | |
| Driving method | Bottom magnetic coupling drives mechanical stirring | Top shaft coupling drive mechanical stirring | Top shaft coupling drive mechanical stirring |
| Sterilization method | Autoclave off-site sterilization | | |
| Base configuration | Temperature, speed, PH, DO, feed, defoaming, air flow (manual), tank pressure (manual) | | |
| Extensible configuration (options) | Liquid level control, feeding weighing system, two-way feeding, online content detection of methanol and ethanol, exhaust O2 and CO2 detection, etc. | | |
| Others | Power 220V 2KW | Dimension (L*W*H mm) 800*600*650 | Net weight (kg)80 |

Quadruple Glass Bioreactor (off-site Sterilization)

It is a model of orthogonal parallel contrast reactor, a sharp tool for screening of medium formula and process optimization.

- Power consumption: 220V 8KW
- Dimensions (L*W*H mm): 1600*730*1750
- Material: 316L stainless steel + borosilicate glass
- Net weight(kg): 150
- Sterilization method: autoclave off-site sterilization
- Total volume: 1/2/3/5/7/10/15L



BLBIO-XGC-4-H Quadruple magnetic mixing glass fermenter (5L)



BLBIO-XGJ-4-H Quadruple mechanical mixing glass fermenter (5L)



BLBIO-XGJG-4-H Quadruple mechanical mixing single wall glass fermenter (5L)



BLBIO-XGJGG-4-H Quadruple mechanical mixing double wall glass fermenter (2L 3L 4L 5L)

MULTI-CHANNEL PARALLEL GLASS BIOREACTOR

Multi-channel parallel bioreactor for Metabolic flow analysis

It is suitable for initial strain screening, which greatly saves time and material costs, and positive and negative cross-parallel comparisons (strain screening).



BLBIO-XGC-4-plus Quadruple mechanical mixing glass fermenter (500ML)



BLBIO-XGC-4-plus Quadruple magnetic mixing glass fermenter (5L)



BLBIO-XGJ-4-plus Quadruple mechanical mixing glass fermenter (5L)



BLBIO-XGJ-11-plus Elevenfold mechanical mixing glass fermenter (5L)

| Name | Quadruple magnetic mixing glass fermenter | Quadruple mechanical mixing glass fermenter | Quadruple mechanical mixing glass fermenter |
|-----------------------|---|--|--|
| Model | BLBIO-XGC-4-plus | BLBIO-XGC-4-plus | BLBIO-XGJ-4-plus |
| Driving method | Bottom magnetic drive mechanical stirring | Top shaft coupling drive mechanical stirring | Top shaft coupling drive mechanical stirring |
| Total volume | 1/2/3/5/7/10/15L | | |
| Base configuration | Temperature, mix speed, pH, DO, feeding, defoaming, air flow (manual), tank pressure (manual) | | |
| Power consumption | 220V 4KW | 220V 5KW | 220V 5KW |
| Dimension (L*W*H)(mm) | 1200*730*1650 | 2000*730*1650 | 2000*730*1650 |
| Weight (kg) | 100 | 200 | 200 |

Multiple Glass Bioreactors (6-12 Units, Off-site Sterilization)

Simple structure, convenient operation, improved efficacy



BLBIO-XGJGG-6 Sextuple double wall glass fermenter (2L)



BLBIO-XGJGG-6 Sextuple double wall glass fermenter (5L)



BLBIO-XGJ-8-H Octuple mechanical mixing glass fermenter (1L)



BLBIO-XGJ-10-H Decuple magnetic mixing glass fermenter (1L)

BIOPROCESS OPTIMIZATION AND SCALE-UP BIOREACTORS

By understanding bacterial physiology and understanding the effects of process mixing transfer properties on cellular metabolism. Disciplines include synthetic biology, chemical engineering and the resulting biochemical engineering. In terms of methods, such as the application of process multi-scale correlation analysis, etc.

Top Mechanical Mixing Stainless Steel Fermenter

Simple structure, convenient operation, low failure rate, classic product of laboratory bioreactor



BLBIO-30SJA 30L Top mechanical mixing stainless steel fermentation system



BLBIO-100SJA 100L Top mechanical mixing stainless steel fermentation system



BLBIO-30SJA-300SJA 30L-300L Top mechanical mixing stainless steel fermentation system

Bottom Mechanical Mixing Stainless Steel Fermenter

Double mechanical sealing, steam sterilization, steam condensate cooling and lubrication



BLBIO-200SJBA 200L Bottom mechanical mixing stainless steel fermentation system



BLBIO-2000SJBA 2000L Bottom mechanical mixing stainless steel fermentation system



BLBIO-300SJBA-3000SJBA 300L-3000L Bottom mechanical mixing stainless steel fermentation system

BIOPROCESS OPTIMIZATION AND SCALE-UP BIOREACTORS

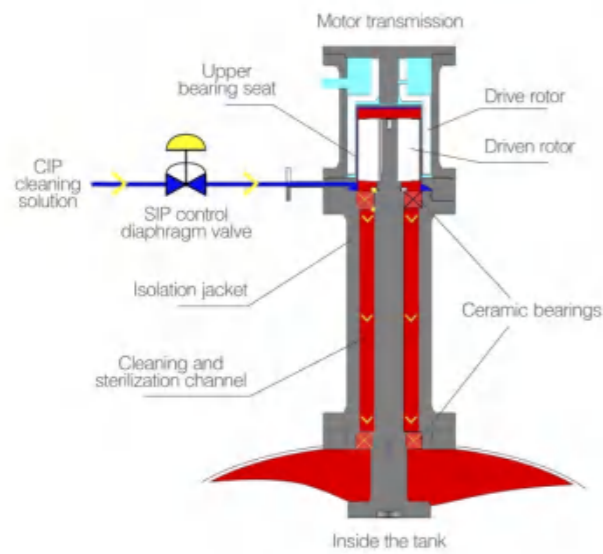
The bioreactor used for process research uses PHA's sensing technology and data analysis to explain the problem of multi-scale concept—which state analysis is the most important.

Top Magnetic Mixing Stainless Steel Fermenter

Without mechanical sealing, internal magnetic and upper and lower bearings can be CIP/SIP, which meets sanitary requirements.

Bottom Magnetic Mixing (upper Suspension) Stainless Steel Fermenter

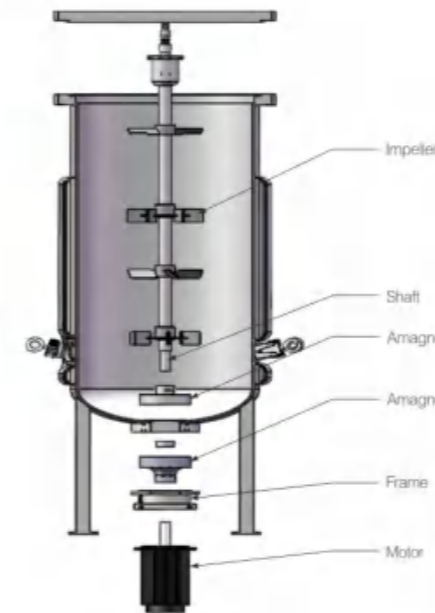
No mechanical seal, easy to disassemble, suitable for long-term and vulnerable bacterial cultivation



CIP/SIP process diagram



Top magnetic mixing cleaning



BLBIO-30SC-150SC 30L, 150L Magnetic mixing secondary fermentation system



70L-1500L Top magnetic mixing bioreactor



50L-800L Top magnetic mixing bioreactor



BLBIO-50SC 50L Bottom magnetic mixing fermentation system



30L Bottom magnetic mixing bioreactor

MULTI-STAGE BIOREACTION SYSTEM

— Bioreactor systems for bioprocess intelligence

The variation of bacterial cells and the influence of changes in environmental conditions on cell metabolism are the main effects of changes in biological processes. Due to our lack of experimental conditions and incomplete understanding, it is impossible to explain the correlation between omics research in synthetic biology and fermentation regulation. Through the design and operation of the reactor, we combine the disciplines of synthetic biology, chemical engineering and biochemical engineering to solve the data sharing problem of the HCPS ternary system, solve the connection between artificial intelligence and biological processes, and form the interaction between human and artificial intelligence, to improve the ability to solve biological process problems. These include the study of cell dynamics in different environments, the resolution of various problems encountered in industrial production, such as the relationship between industrial production raw materials, equipment capabilities and processes, continuous and semi-continuous fermentation, data sharing of different batches, etc. Impact on industrialization through omics research and reverse reasoning research of fermented data silos.



BLBIO-10SJA-100SJA 10L-100L
Secondary Fermentation System



BLBIO-10SJA-10SJA-100SJA 10L-10L-100L
Double secondary fermentation system



BLBIO-5GJ-50SJ 5L-50L
Secondary Fermentation System



BLBIO-10SJA-50SJA 10L-50L
Secondary Fermentation System



BLBIO-10SJD-100SJD-500SJD 10L-100L-500L
Three stage fermentation system



BLBIO-100SJA-100SJA-1000SJA 100L-100L-1000L
Double secondary fermentation system

MULTIPLE BIOREACTOR SYSTEM

Stable, concise, accurate, efficient, and a sharp tool for process research and development

The compact design and flexible configuration of the multi-channel bioreactor are suitable for exploring parameter conditions and optimizing the cultivation process. The control system is easy to operate and enables rapid data analysis. Equipment configurations can be customized, upgraded or expanded to meet the requirements of different applications, thereby improving experimental efficiency.

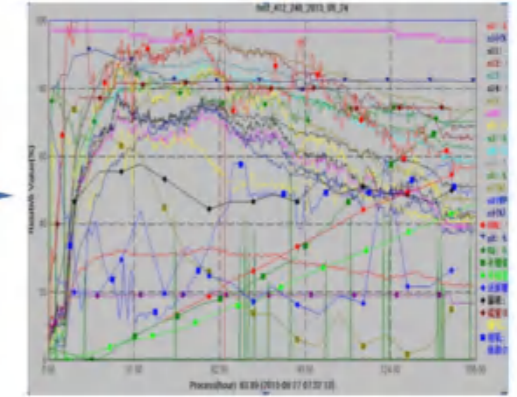


PHA Fermentation process

System Optimization

- Exhaust gas mass spectrometer active
- Cell mass sensor
- Microscopic analyzer
- Electronic olfactory

Test



Dynamic changes in process state



METABOLIC FLUX ADVANCED BIOREACTION SYSTEM

Consistent with the highest configuration in Europe, it reduces the interference of human factors on scientific research, improves the repeatability and accuracy of data, reduces the cost of labor and materials, does not require a special person to be on duty, and can realize computer remote control and wireless monitoring. The tank lid automatic opening system, all parameters can be controlled automatically.

- 50L-100L as seed tank, unify seed standards.
- 4 to 16 units 5-10L tanks with the same geometric size for simultaneous differential culture.
- More than 17 direct parameters and related indirect parameters are measured for data summary and report analysis.



BLBIO-20SJA-FMT 20L
Metabolic flow automatic bioreactor system



BLBIO-30SJA-FMT 30L
Metabolic flow automatic bioreactor system



BLBIO-10SJ-3FMT 10L
Triple metabolic flow automatic bioreactor system



BLBIO-5GJ-4FMT 5L
Quaduple metabolic flow automatic bioreactor system

CONTROL SYSTEM MODULE

System Software

BLBIO-v3.1 biological fermentation control software interface
Independent design and independent intellectual property rights provide accurate theoretical basis for fermentation research

MAMMALIAN CELL BIOREACTOR

Mammalian cell bioreactor (glass vessel - top magnetic mixing, rack and the tank can separated quickly, safe, simple and convenient)

The cell bioreactor adopts the latest mechanical processing and manufacturing technology to meet the needs of users for culturing adherent cells and suspension cells, and meets the requirements of cGMP and FDA. The working volume has five specifications: 2L, 3L, 5L, 7.5L, and 15L. It can be used for batch culture and continuous culture of animal cells, insect cells, and plant cells, suitable for the culture of suspension cells, microcarriers and sheet carriers.



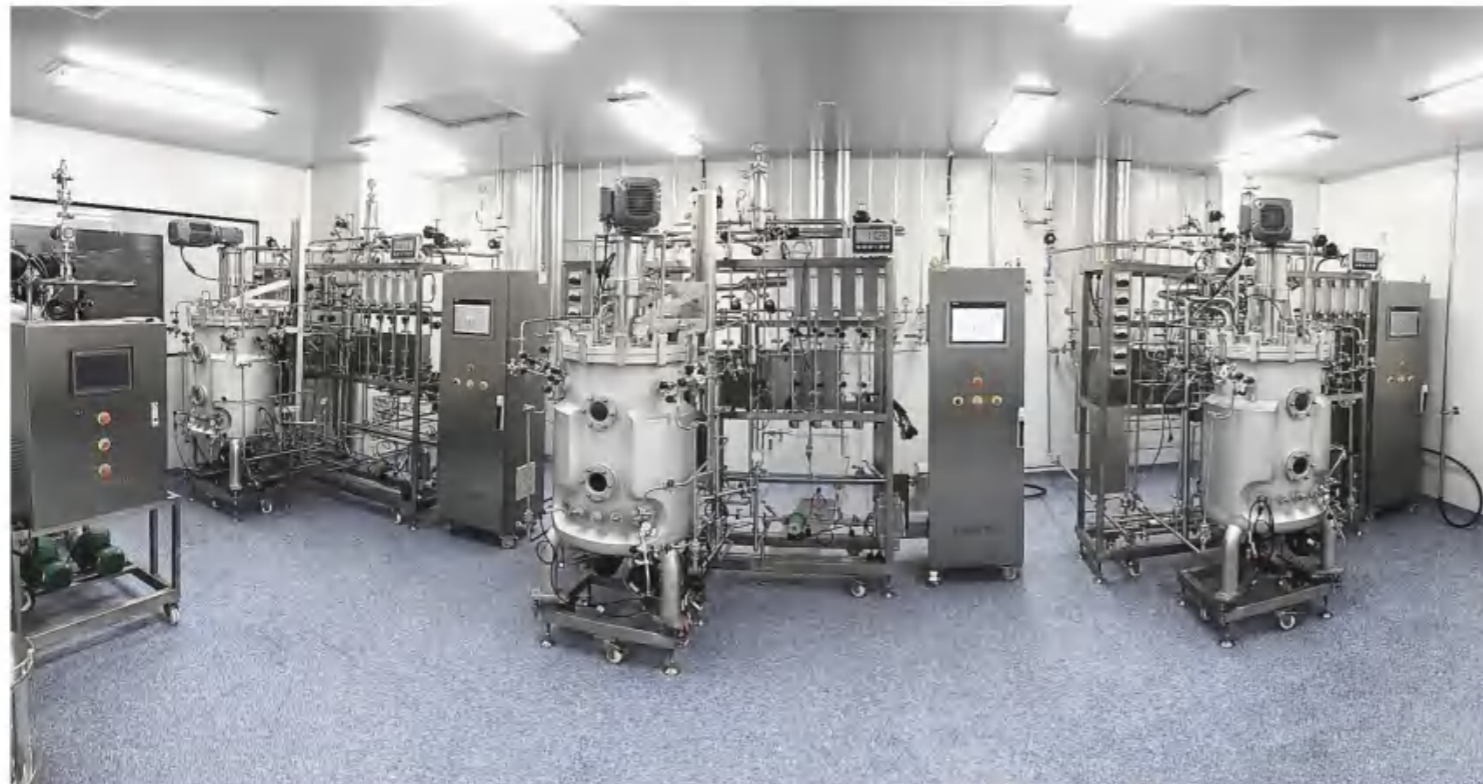
3L double cell bioreactor



10L cell bioreactor



10L cell bioreactor



150L mammalian cell bioreactor

Mammalian cell bioreactor (stainless steel vessel - top magnetic driving, safe and efficient, simple and exquisite)

Modular in design and available in configurations ranging from basic to full-featured, the system offers a complete solution for every budget and need. At the same time, it uses advanced pressure vessel manufacturing technology and integrates many necessary and advanced functions, which can almost meet the various needs of modern biopharmaceutical applications. The culture volume can be from 20L to 5000L, and it has been successfully used in BHK/BSR, VERO, CHO, MDCK293, MARK145 and other cell cultures.

Applications:

Mammalian cells, insect cells, suspension cell culture, microcarrier adherent cell culture, sheet carrier adherent cell culture, vaccine, virus preparation, recombinant protein and antibody process development and medium optimization

Including:

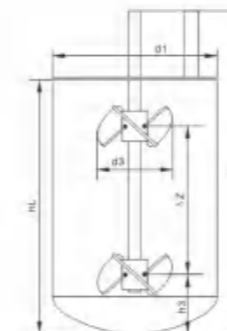
CHO and hybridoma cell culture express monoclonal antibody Vero/MDCK/diploid/primary cell sheet carrier/microcarrier culture of various viruses, HEK293 cell culture adenovirus, insect cell baculovirus system, and CHO/293 transient High-throughput expression of recombinant proteins, cell therapy, etc.



50L-250L Secondary Mammalian Cell Bioreactor



1000L Secondary Mammalian Cell Bioreactor



| Specification | 35L | 50L | 100L | 150L | 200L | 300L | 500L | 1000L | 2000L | 3000L | 5000L |
|--|-------|------|------|-------|------|------|-------|-------|-------|-------|-------|
| Total volume (L) | 47L | 67L | 133L | 200L | 267L | 400L | 680L | 1300L | 2700L | 4020L | 6604L |
| Maximum working volume (L) | 35L | 50L | 100L | 150L | 200L | 300L | 500L | 1000L | 2000L | 3000L | 5000L |
| Fermenter diameter d1 (mm) | 300 | 367 | 500 | 550 | 600 | 700 | 850 | 1000 | 1300 | 1500 | 1700 |
| Fermenter height h (mm) | 470 | 580 | 700 | 750 | 900 | 900 | 1070 | 1500 | 1800 | 2000 | 2600 |
| h/d 1 | 1.56 | 1.58 | 1.4 | 1.36 | 1.5 | 1.29 | 1.26 | 1.5 | 1.4 | 1.3 | 1.5 |
| Filling height hL (mm) Liquid content | 352.5 | 435 | 525 | 523 | 675 | 675 | 803 | 1125 | 1350 | 1500 | 1950 |
| d2.3- Blade (mm) | 150 | 130 | 250 | 275 | 300 | 350 | 425 | 500 | 650 | 750 | 850 |
| d2.6- Blade (mm) | / | / | / | / | / | / | / | / | / | / | / |
| h3(mm) | 120 | 130 | 200 | 220 | 240 | 280 | 340 | 400 | 520 | 600 | 680 |
| $\Delta z=1.3 \times d2$, 3-blade segment impeller | 195 | 104 | 325 | 357.5 | 390 | 455 | 552.5 | 650 | 845 | 975 | 1150 |

AIRLIFT BIOREACTOR SYSTEM

Air-lift stirring fermentation system - suitable for microbial cultivation that requires little shear force

The built-in guide tube forces the medium to convert up and down, and the special air distributor



BLBIO-5GQ 5L
Sterilization-in-situ airlift glass fermentation system



BLBIO-100SQA 100L
Air lift mixing stainless steel fermentation system

SOLID-STATE BIOREACTOR SYSTEM

Solid-state fermenter

The solid fermentation system used in the pharmaceutical, beverage, enzyme preparation, biopesticide and other industries has the advantages of low investment, good sterility, low operating environment, simple maintenance and not easy to pollute the environment, etc. Solid fermentation equipment with volumes ranging from 5L to 50KL.



BLBIO-10SS 10L
Solid Fermentation System



BLBIO-50SS-150SS 50L-150L
Solid Secondary Fermentation System

PLANT CELL BIOREACTOR (LIGHT)



BLBIO-5GCL 5L
Magnetic mixing photobioreactor (off-site sterilization)



BLBIO-1000SJL-1000SJL 1000L
Double stainless steel photobioreactor



BLBIO-20000SS 20L
Solid Fermentation System



BLBIO-50000SS 50L
Solid Fermentation System