ESCO
LIFESCIENCES

CelCradle X®
Automated Cell Harvesting System

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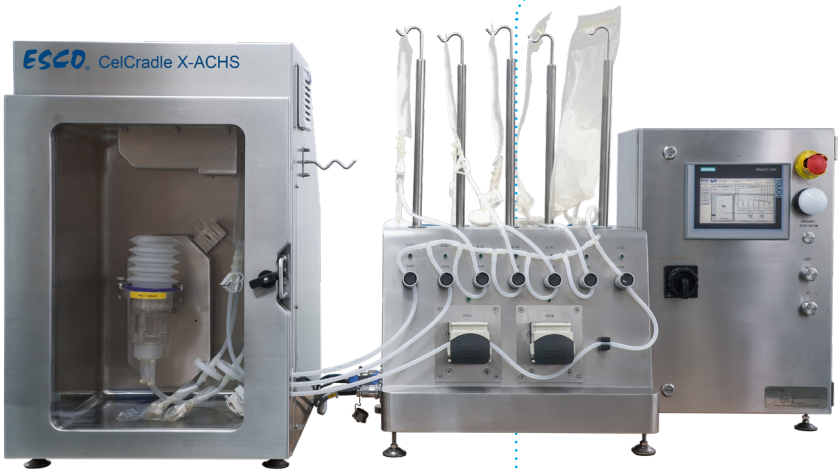
Bridging the Gap to Scalable Cell Therapy with Automated Harvesting

The demand for manufacturing adherent mammalian cells such as Mesenchymal Stem Cells/Mesenchymal Stromal Cells/Medicinal Signalling Cells (MSCs), induced pluripotent stem cells (iPSCs), embryonic stem cells (ESCs), differentiated cells from pluripotent cells, fibroblast cells and others. This transition requires a shift from small-scale lab work to pilot-scale production and beyond accelerating as cell therapies rapidly advance toward commercial approval.

To achieve this essential increase in volume, automation is required across the entire workflow. However, most available solutions focus narrowly on upstream expansion, leaving a significant bottleneck in the downstream process, especially cell harvest. The **CelCradle® X -Automated Cell Harvesting System (CelCradle X® ACHS)** was designed to close this gap in cell manufacturing. Built for agility, ACHS provides a closed, automated solution that compatibly integrates with **CelCradle®X** and **CelCradle®** and capable of interfacing with various existing upstream platforms. It replaces inconsistent and labour-intensive manual methods with a standardized, closed, and efficient process.

The **CelCradle X® ACHS** is optimized to ensure gentle and efficient cell recovery from the TideMotion bioreactors, maximizing your yield and ensuring the viability of your final product.

Beyond Tide Motion bioreactors, the patented cell harvesting system can also be configured for adherent microcarriers in suspension bioreactors or potentially other packed bed bioreactors and cultureware working with Esco Aster Manufacturing Science and Technology department to perform the bio engineering and process development and validation.



Features:

- Single-use harvest assembly kit for closed, automated harvesting
- Harvest viable cells within 1-3 hours
- Heating incubator for harvest procedures that requires 20°C to 40°C
- Achieve >90% harvesting efficiency

Note: Harvesting efficiency will be dependent on the cell line used, media or enzyme used, process, etc.

Applications:

The **CelCradle X® ACHS** supports a wide range of applications across research, development, and industrial manufacturing, including:

- **Adherent Cell Therapy Manufacturing** – Automated harvesting of autologous and allogeneic MSCs and other adherent cell types ; harvesting adherent cells for cell derivatives such as cell derived nanovesicles, mitochondria, etc.
- **Seed Train Expansion** – Biomass production for larger packed-bed or suspension bioreactors.
- **Process Development and Scale-Up** – Ideal for optimizing harvest parameters, reducing variability, and validating GMP-ready processes.
- **Ability to be configured for harvesting cells from microcarriers**

The **CelCradle X® ACHS** leverages automation, flexibility, and process integrity to **streamline downstream workflows**. This reduces manual labour and provides a faster, more reliable path to **commercial biomanufacturing scale**.

How Does It Work?

CCX-ACHS - Shaking Incubator Chamber

CCX Single-Use Cell Harvest Assembly

Includes the bag that will hold the rinse solution, enzyme, media, inhibitor, harvest, and waste, inhibitor bags into place

**the size of the bags will vary based on packed-bed volume used.*

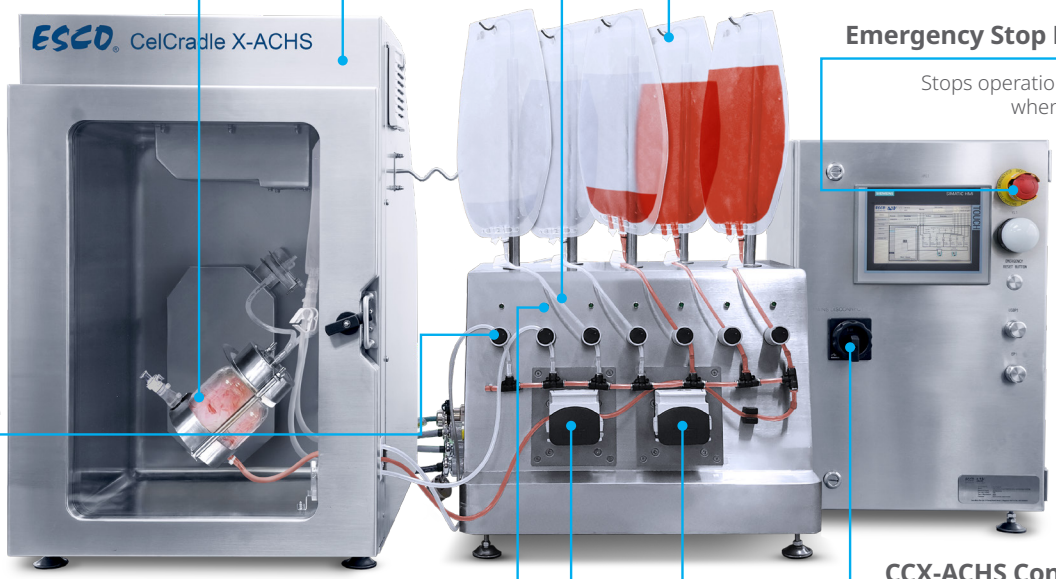
CCX Matrix Vessel

Placed within the incubator in a horizontal manner for efficient shaking during cell detachment step

Bag Hanger Rod

Emergency Stop Button

Stops operation at once when pressed



**design and specifications subject to change*

Pinch Valve

CCX-ACHS Controller

Controls parameters for the CCX-ACHS harvest run

Pinch Light Valve Indicator

Peristaltic Pump

Responsible for pumping media into and out of the bags as tubes are connected into a manifold to the CCX matrix vessel

Auxiliary Peristaltic Pump

(additional pump for back-up)

Workflow:

1. Set the harvesting conditions (e.g., chamber temperature).
2. Configure the harvesting recipe (washing, enzyme incubation, shaking, harvest,etc.)
3. Prepare reagents and buffers and fill them into single-use bags.
4. Install the consumables kit onto the system.
5. Place the **CelCradle®** or **CelCradle X®** vessel onto the holder.
6. Start the automated harvesting process.

Harvesting Recipe:

1. **Removal of Culture Medium/Waste**
   - Existing medium or waste is pumped out of the vessel to initiate the harvest process.
2. **Washing**
   - Add phosphate-buffered saline (PBS) or ethylenediaminetetraacetic acid (EDTA).
   - The shaking motor generates a gentle vertical oscillation on the bottle.
   - The wash solution is then pumped out.
3. **Enzyme Incubation**
   - A dissociating reagent is pumped into the vessel.
   - The rotating mechanism distributes it evenly.
   - Incubation time is set according to optimized conditions.
   - Common enzymes include recombinant trypsin, collagenase, accutase, papain, etc.
4. **Inhibitor Addition (Optional)**
   - An enzyme inhibitor may be pumped into the vessel if required.
5. **Mechanical Shaking**
   - The system automatically performs vertical shaking of the vessel to further detach cells from the carriers.
6. **Medium Addition**
   - Culture medium containing serum or trypsin inhibitor is pumped in to flush the cells.
7. **Collection**
   - The suspension containing cells is collected into the harvest bag.
8. **Repetition**
   - Steps 5–6 are repeated approximately five times to maximize yield.
   - Cells are fully harvested from carriers then obtained via centrifuge.

Note: *Users are responsible for ensuring all reagents and liquids are sterile and must follow proper aseptic connection procedures.*

Scale Up Strategy For Manufacturing

3D expansion in **BioMESH®** carriers in **CelCradle X®**

3D cell seeding in **BioNOC II®** or **BioMESH®** carriers in **MiniTide®**

2D cell culture inT-flasks

TideCell / TideXcell®

Tide 2 mm/s: 3,000-5,000 L (stainless steel tanks)

Tide 6 mm/s: 55,000 L

TideCell / TideXcell®
100-300 L

Large-scale production in **TideXcell®** (2L-300L) bioreactor

Small Scale Production

CelCradle X® Automated Cell Harvesting System (CCX-ACHS)

Closed harvesting system for:

- ✓ Biomass Expansion
- ✓ Autologous/ Allogenic Cell Therapy
- ✓ Intracellular Virus

Large Scale Production

TideXcell® Automated Cell Harvesting System (TXC-ACHS)

Closed harvesting system for:

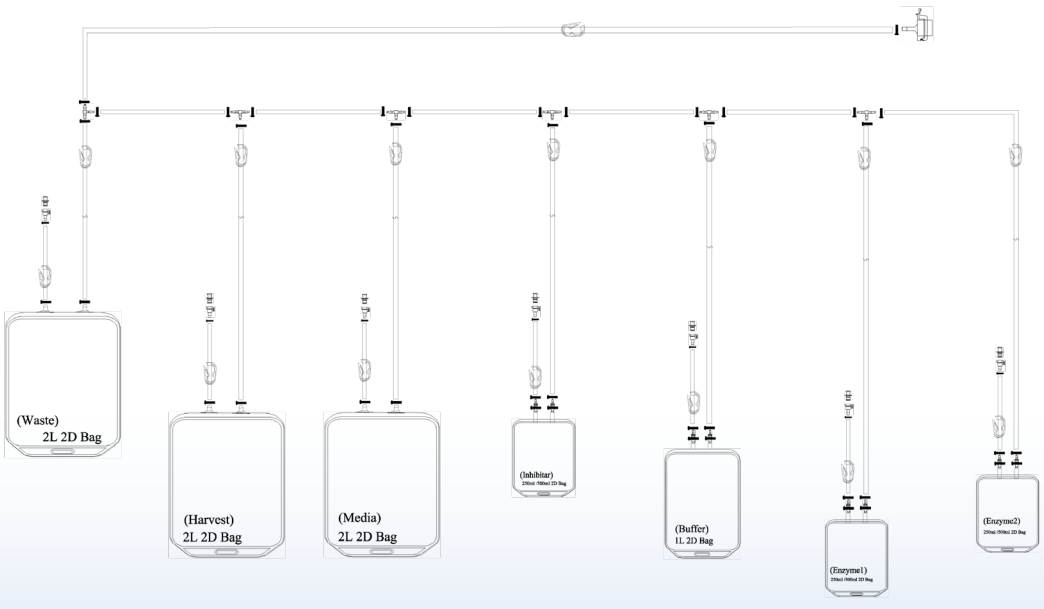
- ✓ Biomass Expansion
- ✓ Autologous/ Allogenic Cell Therapy
- ✓ Intracellular Virus

Technical Specifications

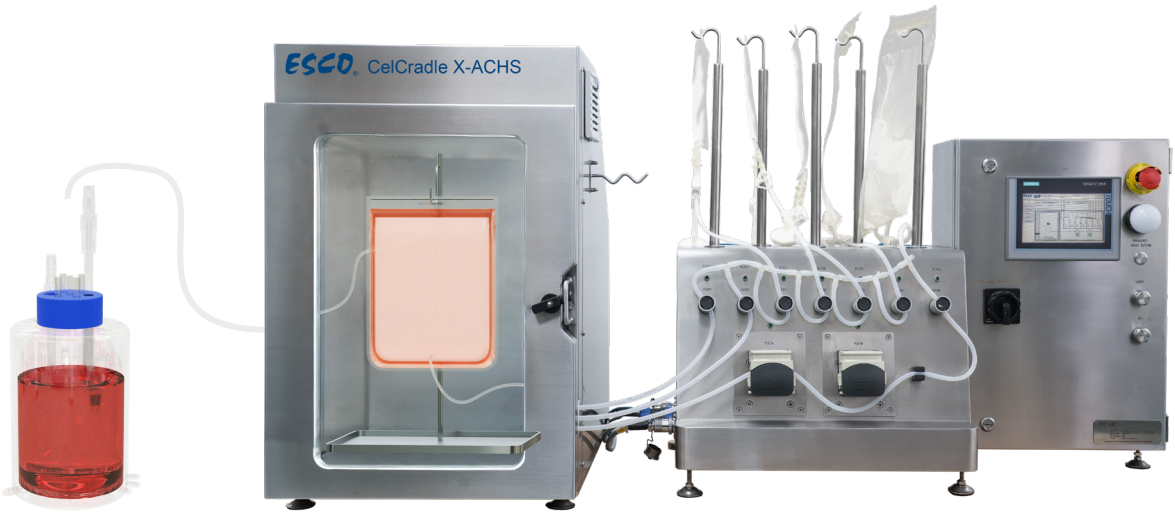
Item	Specification
Whole System	
Weight	200 kg
Dimension	1. Incubation Chamber 50.0(W) x 64.6(D) x 76.9(H) cm 2. Harvester pumping set and HMI Box: 92.8(W) x 38.2(D) x 82.2(H) cm
Power Requirement	Single phase, AC, 220-240 V, 50/60 Hz
Material	SS316 and SS304 all with full welding
Incubation Chamber	
Shaking Motor	50 – 200 rpm
Incubator temperature	Range: 20°C – 40°C At room temperature 18°C to 25°C Accuracy: ±0.5°C.
Capacity	1 CelCradle X® Matrix vessel, plastic and glass material, design for single use. Or 1 single -used CelCradle Matrix vessel
Control Panel Box	
Touchscreen	Input interface: Siemens 7′ color HMI Operating module: Siemens PLC
Data Record	Data: datalogs, alarmlogs, audit trail
Post Data Processing	csv file
Peristaltic pump	One main pump and one spare pump
Pump speed	0 – 300 rpm
Tubing	3/16′ silicone tubing

CCX Single-Use Cell Harvest Assembly

Note: *Standard connector types (male, female, and genderless) and tubing sizes are supported. Other connection types (male, female, genderless, AQG, welding) and tubing sizes can also be customized upon request*



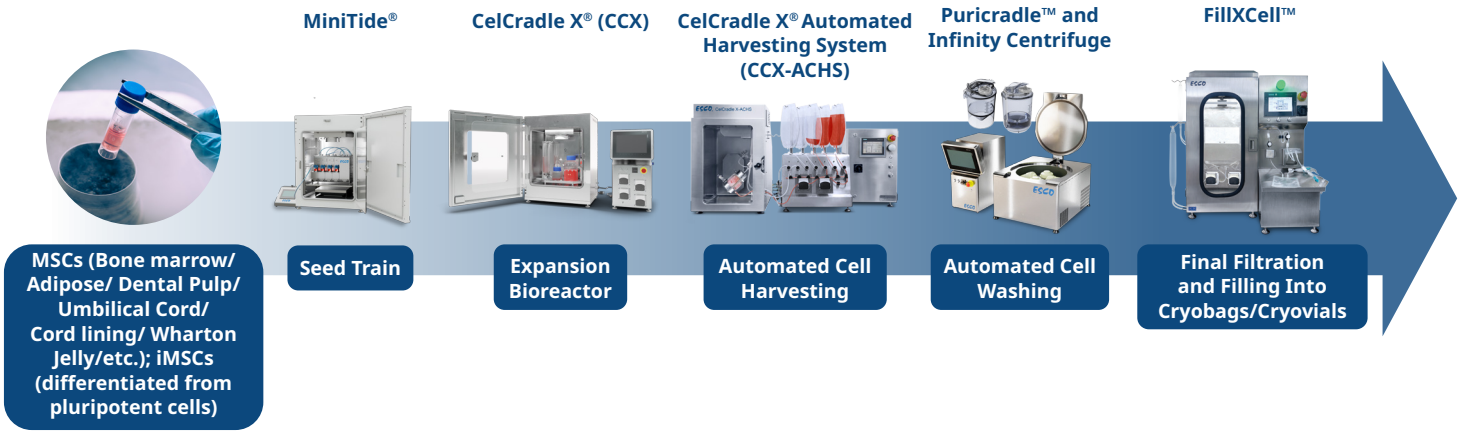
Cell harvest from microcarrier culture in suspension bioreactors such as stirred or others



Features:

- Ability to be configured for harvesting cells from microcarriers
- Supports batch, or continuous harvest modes
- Adaptable to different vessel sizes and process scales
- Closed, Automated system to maintain GMP compliance and prevent contamination.

Production of Mesenchymal Stromal/Stem cells and other adherent cell therapy (E.g. Fibroblasts/Trophoblasts, etc..)

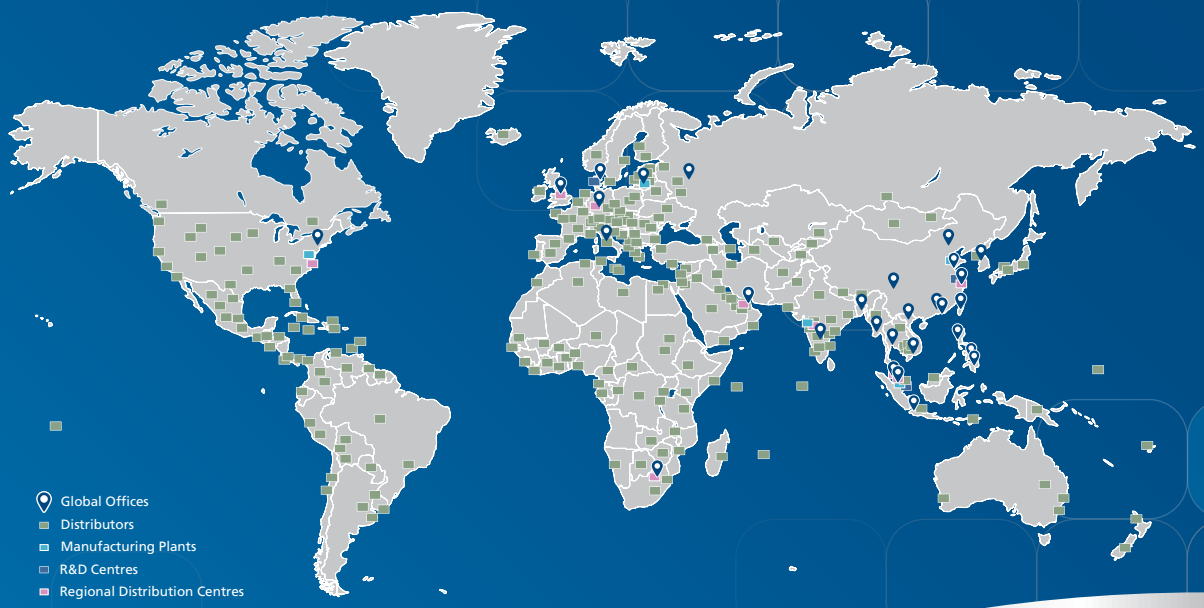


Ordering Information

Item Code	Description	Unit
2231033	CelCradle X Automatic Cell Harvesting System (ACHS)	Set
5690000	CelCradle X Automated Cell Harvesting System Consumable Kit	Set

ESCO GLOBAL NETWORK

42 Locations in 24 Countries All Over the World



Air Shower
Aseptic Containment Isolator (ACTI)
Ceiling Laminar Airflow Units
Cleanroom Transfer Hatch
Containment Barrier Isolator (CBI)
Downflow Booth (DFB)
Dynamic Floor Laminar Hatch
Dynamic Pass Box
Evidence Drying Cabinet
Garment Storage Cabinet
General Processing Platform Isolator (GPPI)
Laminar Flow Horizontal Trolley
Laminar Flow Straddle Units, Single and Double
Laminar Flow Vertical Trolley
Pass Box
Soft Wall Cleanroom
Sputum Booth
Ventilated Balance Enclosure (VBE)
Weighing and Dispensing Containment Isolator (WDCI)

Since 1978, Esco has emerged as a leader in the development of controlled environment, laboratory and pharmaceutical equipment solutions. Products sold in more than 100 countries include biological safety cabinets, fume hoods, ductless fume hoods, laminar flow clean benches, animal containment workstations, cytotoxic cabinets, hospital pharmacy isolators, and PCR cabinets and instrumentation. With the most extensive product line in the industry, Esco has passed more tests, in more languages, for more certifications, throughout more countries than any biosafety cabinet manufacturer in the world. Esco remains dedicated to delivering innovative solutions for the clinical, life science, research and industrial laboratory community.

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Esco Micro Pte. Ltd.
19 Changi South Street 1,
Singapore 486779
Tel: +65 65420833
Email: mail@vaccixcell.com

Esco Technologies, Inc.
2512 Metropolitan Drive, Suite 120 B
Feasterville- Trevose, PA 19053-6738
Tel: +1 215 322 2155
Email: eti.pharma@escolifesciences.com

Esco GB Ltd
Unit 2 R-evolution @ Gateway 36, Kestrel Way, Barnsley, S70 5SZ
Tel: +44 (0) 1226 360 799
Email: egb.info@escolifesciences.co

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