



Product Information

EX-CELL® Advanced HD Perfusion Medium Chemically defined cell culture medium

Product description

EX-CELL® Advanced HD Perfusion Medium is a chemically defined cell culture medium designed specifically for intensified perfusion processes with Chinese Hamster Ovary (CHO) cells. This medium was developed to reach and maintain high cell densities at low cell specific perfusion rates (CSPR), while supporting high volumetric productivities of monoclonal antibodies and recombinant proteins in suspension culture. Performance of this medium in perfusion has been validated with different relevant industrial CHO cell lineages (CHOZN® GS, CHO-S, CHO-DG44, CHO-K1) producing a variety of proteins. The formulation is animal-component free and has been formulated without L-Glutamine.

Application

EX-CELL® Advanced HD Perfusion Medium can be used as amplification medium and production medium in perfusion applications.

This product is intended for research or further manufacturing in the bio-manufacturing industry, but not for human or therapeutic use.

Reconstitution method to prepare EX-CELL® Advanced HD Perfusion Medium

Hydration for this medium should follow the instructions below:

- Measure 80% of the final required volume of Milli-Q® or similar cell culture grade water at room temperature.
- Slowly add powder medium at 28.57 g/L, while stirring. Continue stirring for 30 minutes. Product will remain slightly turbid.



- Measure pH and adjust to 4.5 ± 0.1 with 5N NaOH if pH <4.5.
- Add 1.565 g/L sodium bicarbonate to the solution. Stir continuously for 30 minutes.
- Adjust pH between 9.0 and 9.1 with 5N NaOH and stir for 10 minutes or until product is clear.
- Adjust pH to 7.3 ± 0.1 using 5N HCl.
- Add Milli-Q® or similar cell culture grade water to 100% final volume.
- Measure osmolality. Final osmolality should be at 320 – 360 mOsmol/kg.
- Sterile filter using a low protein binding membrane filter with a pore size of 0.22 micron.
- For large volumes a low protein binding 0.45 micron pre-filter is recommended.
- Store product at 2-8° C, protected from light until use. Reconstituted EX-CELL® Advanced HD Perfusion Medium is stable for at least 30 days.

Note: This medium does NOT contain L-glutamine. Aseptic supplement as required prior to use.

Storage

- Dry powder should be stored dry at 2-8°C and protected from light.
- Do not use after expiration date.

Shelf life

- 12 months.

Using EX-CELL® Advanced HD Perfusion Medium in perfusion mode

- Add L-Glutamine to EX-CELL® Advanced HD Perfusion Medium prior to use with non-GS CHO cell lines. Recommended concentrations varied depending on the cell line. A starting concentration of 4-6 mM is suggested.
- Supplementation with a surfactant (e.g. poloxamer) is not required to use this product.
- Cell selection agents should be added as required during the seed train expansion.
- This medium contains <2µM thymidine. While not required, 1x HT supplement can be added prior to use with non-dhfr systems.

Direct medium adaptation

Cell lines may be adapted directly into EX-CELL® Advanced HD Perfusion Medium. Cells should be seeded at $3 - 5 \times 10^5$ cells/mL, then subcultured when densities reach $1 - 2 \times 10^6$ cells/mL and $\geq 80\%$ viability. Adaptation is completed when cells attain a stable doubling time and $\geq 90\%$ viability over at least 2-3 passages.

Cells adapted to EX-CELL® Advanced HD Perfusion Medium can be directly thawed and cultured in EX-CELL® Advanced HD Perfusion Medium.

Sequential medium adaptation

The adaptation guidance provided below relies on regular sub-culturing of cells to maintain cultures in a logarithmic growth phase. This typically means that cells should be passaged every 3 to 4 days. At least two passages at each adaptation step are recommended to ensure that cells appropriately adjust to their new media environment.

Ratio of current media vs. EX-CELL® Advanced HD Perfusion Medium (in %)	Seeding density ($\times 10^5$ cells/mL)	Evaluation of cell growth	Acceptance criteria for next step
75:25	3.0	Cell density, viability in mid-log growth phase	Normal cell doubling time; Viability >80% over at least 2 passages
50:50	3.0	Cell density, viability in mid-log growth phase	Normal cell doubling time; Viability >80% over at least 2 passages
25:75	3.0	Cell density, viability in mid-log growth phase	Normal cell doubling time; Viability >80% over at least 2 passages
10:90	3.0	Cell density, viability in mid-log growth phase	Normal cell doubling time; Viability >80% over at least 2 passages
0:100	3.0	Cell density, viability in mid-log growth phase	Adaptation complete when cells maintain normal doubling time; Viability $\geq 90\%$ over at least 2 passages

Subculturing

1. Pre-warm hydrated EX-CELL® Advanced HD Perfusion Medium to room temperature.
2. Aseptically remove a small volume of cell culture sample from the flask and count by trypan blue exclusion using a hemacytometer or an automated cell counter. Viability should be higher than 90% at all times.
3. Determine the correct volume of cell culture to inoculate a new flask at a starting cell density of $2 - 3 \times 10^5$ viable cells/mL for the targeted working volume.
4. Aseptically add the corresponding amount of fresh media pre-warmed at room temperature to the new flasks followed by the calculated amount of cells.
5. Incubate at 37°C in a humidified atmosphere of 5% CO₂ in air on an orbital shaker platform (19 mm diameter orbit) rotating at 120-140 rpm.
6. Passage cells by repeating the above steps at least twice a week, and always maintaining the cells in exponential growth phase.

Note: When passaging cells, medium carry over should not exceed 25% for the final volume. If carryover exceeds 25% centrifugation is recommended.

Cryopreservation

Adapted cells to EX-CELL® Advanced HD Perfusion Medium may be created.

1. Prepare the desired quantity of cells, harvesting in mid-logarithmic phase of growth with viabilities over 90%.
2. Prepare a freezing medium consisting of 46.5% cold EX-CELL® Advanced HD Perfusion Medium, 46.5% conditioned medium and 7% dimethyl sulfoxide (DMSO).
3. Harvest cells by centrifugation at 200xg for 5 minutes and carefully remove the supernatant.
4. Re-suspend cell pellet in the freezing medium at $10 - 20 \times 10^6$ viable cells/mL.
5. Rapidly transfer 1-2 mL of this suspension to sterile cryovials.
6. Place the vials in a cryobox or a controlled rate freezing apparatus following standard procedures (1°C decrease per minute).
7. For long-term storage, transfer the vials to liquid nitrogen (vapor phase is recommended).

Thawing

1. In a 50 mL centrifuge tube, prepare 10 mL culture medium under the clean bench or the laminar flow hood.
2. Rapidly thaw (<1 minute) a vial of frozen cells in a 37°C water bath. Take out of the vial when ice particles detach from the side of the vial (DMSO at high concentration can have a toxic effect at higher temperature).
3. Transfer the content of the vial the conical tube from step 1 and centrifuge it at 200xg for 5 minutes. After supernatant is discarded, cells can then be re-suspended in 10 mL of medium and transferred to a shake flask containing 20 mL of medium.
 - Alternatively, the entire content of the vial can be transferred aseptically into a 125 mL shake flask containing 28-29 mL pre-warmed complete EX-CELL® Advanced HD Perfusion Medium.
4. Incubate at 37°C in a humidified atmosphere of 5% CO₂ in air on an orbital shaker platform (19 mm diameter orbit) rotating at 120-140 rpm.

Ordering information for EX-CELL® Advanced HD Perfusion Medium

Cat. No.	Product name	Pkg. size	Equivalent
24370C-5L	EX-CELL® Advanced HD Perfusion Medium	0.142 kg	5 liters
24370C-200L	EX-CELL® Advanced HD Perfusion Medium	5.714 kg	200 liters
24370C-500L	EX-CELL® Advanced HD Perfusion Medium	14.285 kg	500 liters
24370C-800L	EX-CELL® Advanced HD Perfusion Medium	22.856 kg	800 liters

Ordering information for cell culture additives

Cat. No.	Product name	Pkg. size
1.37020.5000	Sodium hydroxide pellets suitable for the biopharmaceutical production EMPROVE® bio	5 kg
1.37013.2500	Sodium hydrogen carbonate suitable for biopharmaceutical production EMPROVE® bio Ph Eur, BP, USP, JP	2.5 kg
1.00286.1000	L-Glutamine suitable for use as excipient EMPROVE® exp DAB, USP	1 kg

Ordering information for aseptic filters

Cat. No.	Product name	Pkg. size
GPWP02500	Millipore Express® PLUS Membrane, 0.22 µm, 25 mm	100
GVWP02500	Durapore® Membrane, 0.22 µm, 25 mm	100

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