Miltenyi Biotec

PepTivator® SARS-CoV-2 MHC-I Select – research grade

6 nmol/peptide 130-130-629
60 nmol/peptide 130-130-632

Contents

1. Description

This product is for research use only.

Components	**6 nmol/peptide PepTivator SARS-CoV-2 MHC-I Select – research grade** or **60 nmol/peptide PepTivator SARS-CoV-2 MHC-I Select – research grade** Pool of 173 lyophilized MHC class I–restricted peptides derived from the whole proteome of SARS-CoV-2 (GenBank MN908947.3) without the surface or spike glycoprotein ("S").
Capacity	6 nmol (approximately 10 µg) per peptide for stimulation of up to 10^8 total cells or 60 nmol (approximately 100 µg) per peptide for stimulation of up to 10^9 total cells.
Product format	Lyophilized peptides containing stabilizer.
Purity	Average purity of peptides >70% (HPLC).
Storage	Store lyophilized product at –20 °C. The expiration date is indicated on the vial label.

This product contains no preservatives; always handle under aseptic conditions.

1.1 Background information

SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) was first detected in December 2019 in Wuhan, China. Investigations of the cellular immune response revealed the crucial role of virus-reactive T cells after natural infection and vaccination. Analysis of antigen-specific $CD8^+$ T cells has, however, proven challenging for certain individuals due to low T cell frequencies.[1-3] To efficiently stimulate SARS-CoV-2 reactive $CD8^+$ T cells, PepTivator SARS-CoV-2 MHC-I Select was designed. It consists of 173 MHC class I–restricted peptides of 8–11 aa length. Sequences are derived from the following structural and non-structural SARS-CoV-2 proteins: envelope protein, membrane protein, nucleoprotein, ORF1ab, ORF3a, ORF7a, ORF8 and ORF10 (GenBank MN908947.3)

The peptides are restricted to the following HLA-molecules: HLA-A*01, A*02, A*03, A*11, A*24, A*26, A*29, A*30, A*31, A*33, A*68,B*07, B*08, B*13, B*15, B*27, B*35, B*39, B*40, B*44, B*51, B*54, B*57, B*58, C*07.

Epitopes from the SARS-CoV-2 surface or spike glycoprotein ("S") are covered by a separate product: PepTivator SARS-CoV-2 MHC-I Select Prot_S. Comparison of T cell reactivity towards the spike protein and other SARS-CoV-2 proteins allows to distinguish vaccine-induced from natural T cell immunity.

The PepTivator SARS-CoV-2 MHC-I Select can be

- applied alone to analyze $CD8^+$ T cells reactive to the whole SARS-CoV-2 proteome (without the spike protein),
- used together with PepTivator SARS-CoV-2 MHC-I Select Prot_S to analyze $CD8^+$ T cells reactive to the whole SARS-CoV-2 proteome (including the spike protein), or
- used to supplement other PepTivators to boost the $CD8^+$ T cell response and analyze $CD4^+$ as well as $CD8^+$ T cells.

1.2 Applications

- Detection and analysis of antigen-specific $CD8^+$ effector/ memory T cells, for example, in peripheral blood mononuclear cells (PBMCs), by MACS® Cytokine Secretion Assays, intracellular cytokine staining, or other technologies.
- Isolation of viable antigen-specific $CD8^+$ T cells using MACS Cytokine Secretion Assay – Cell Enrichment and Detection Kits or the CD137 MicroBead Kit, human for *in vitro* generation of T cell lines/clones.
- Generation of antigen-specific $CD8^+$ effector/ memory T cells from naive T cell populations for research on immunotherapy and vaccination.
- Pulsing of antigen-presenting cells for research on dendritic cell vaccination.

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2. Recommendations for *in vitro* restimulation of antigen-specific T cells with PepTivator Peptide Pools

2.1 Cell preparation

For induction of cytokine secretion by antigen-specific T cells, best results are achieved by stimulation of fresh PBMCs, whole blood, or other leukocyte-containing single-cell preparations from tissues or cell lines. Alternatively, frozen cell preparations can be used.

▲ **Note:** Remove platelets after density gradient separation. Resuspend cell pellet, fill tube with buffer, and mix. Centrifuge at 200×g for 10–15 minutes at 20 °C. Carefully remove supernatant.

▲ **Note:** PBMCs may be stored overnight. The cells should be resuspended and incubated in culture medium as described in 2.4, steps 1–3, but without addition of antigen. The antigen is then added to the culture on the next day.

For details about cell preparation refer to the protocols section at www.miltenyibiotec.com/protocols.

2.2 Reagent requirements

- Culture medium, e.g., TexMACS™ Medium (# 130-097-196) or RPMI 1640 containing 5% human serum, e.g., autologous or AB serum.

  ▲ **Note:** Do not use bovine serum albumin (BSA) or fetal bovine serum (FBS) because of non-specific stimulation.

- (Optional) Kits for the isolation and/or detection of cytokine-secreting T cells, e.g., IFN-γ Secretion Assay – Cell Enrichment and Detection Kit (PE), human (# 130-054-201) or TNF-α Secretion Assay – Cell Enrichment and Detection Kit (PE), human (# 130-091-269).
- (Optional) Antibodies or kits for intracellular cytokine staining, e.g., IFN-γ Antibody, anti-human, PE. For more information about antibodies refer to www.miltenyibiotec.com/antibodies.
- (Optional) CD154 MicroBead Kit, human (# 130-092-658) or CD137 MicroBead Kit, human (# 130-093-476).
- (Optional) CytoStim™ (# 130-092-172, # 130-092-173) for restimulation of human T cells.
- (Optional) PepTivator CEF MHC Class I Plus – premium grade (# 130-098-426) as a peptide-specific positive control.

2.3 Recommendations for reconstitution of PepTivator® Peptide Pools

1. For reconstitution of the lyophilized peptide pool take the vial from –20 °C and warm-up to room temperature.

   ▲ **Note:** Do not open the vial by removing the rubber plug.

2. To dissolve the 6 nmol PepTivator Peptide Pool fill a sterile syringe (0.5 mL) with 200 µL of sterile water. To dissolve the 60 nmol PepTivator Peptide Pool fill a sterile syringe (5 mL) with 2 mL of sterile water.
3. Slowly inject the water with a sterile needle through the center of the rubber plug into the vial containing the lyophilized peptide pool.
4. Vortex the solution to completely dissolve the lyophilized peptide pool. The concentration of the stock solution of PepTivator Peptides is 30 nmol (approximately 50 µg) of each peptide per mL.
5. Remove the rubber plug and aspirate the stock solution with a pipette.
6. To avoid repeated freeze-thaw cycles prepare working aliquots from the stock solution.
7. Store the working aliquots at –80 °C.

2.4 Recommendations for *in vitro* restimulation of antigen-specific T cells

▲ SARS-CoV-2-specific T cells are expected to be present only in certain individuals. Their frequency may be low compared to T cells with other specificities. The given protocol for *in vitro* T cell stimulation thus may only serve as a guideline.

▲ Magnetic enrichment of stimulated antigen-specific T cells according to cytokine secretion, e.g. IL-17, using the MACS® Secretion Assay technology or according to expression of activation markers, e.g. CD154, will enhance the sensitivity to detect rare cells.

▲ Always include a negative control (without antigen) in the experiment. As a positive control, a sample stimulated with, e.g., PepTivator CEF MHC Class I Plus or CytoStim may also be included.

1. Wash cells by adding medium, centrifuge at 300×g for 10 minutes. Aspirate supernatant.
2. Resuspend cells in culture medium at 10^7 cells per mL. Plate cells in dishes at a density of 5×10^6 cells/cm² (refer to 4. Appendix: Flask and dish sizes for *in vitro* T cell stimulation).
3. Mix the reconstituted PepTivator thoroughly. Add 20 µL of PepTivator stock solution per mL cell suspension. Mix carefully and incubate cells at 37 °C and 5% CO_2.

   The final concentration of PepTivator in the cell suspension is 0.6 nmol (approximately 1 µg) of each peptide/mL.

   Cytokine Secretion Assay: Incubate cells for 3–6 hours.

   CD154 MicroBead Kit: Incubate cells for 4–16 hours.

   CD137 MicroBead Kit: Incubate cells for 16–24 hours.

   Intracellular cytokine staining with antibodies or kits: Incubate cells for 2 hours, then add 1 µg/mL brefeldin A, and incubate for further 4 hours.

4. Collect cells carefully by using a cell scraper, or by pipetting up and down when working with smaller volumes. Rinse the dish with cold buffer. Check microscopically for any remaining cells, if necessary, rinse the dish again.

   To proceed with the Cytokine Secretion Assay, the CD154 or CD137 MicroBead Kits, or intracellular cytokine staining, please refer to the respective data sheet.

   ▲ **Note:** When preparing cells for **intracellular cytokine staining,** fixed cells may be stored at 2–8 °C for up to 1 week.

3. References

1. J. R. Habel *et al.* (2020) Suboptimal SARS-CoV-2–specific $CD8^+$ T cell response associated with the prominent HLA-A*02:01 phenotype. PNAS 117(39): 24384–24391.
2. J. Mateus *et al.* (2021) Low-dose mRNA-1273 COVID-19 vaccine generates durable memory enhanced by cross-reactive T cells. Science 374(6566): eabj9853
3. L. A. Jackson *et al.* (2020) An mRNA Vaccine against SARS-CoV-2 - Preliminary Report. N. Engl. J. Med. 383(20): 1920–1931.

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4. Appendix: Flask and dish sizes for *in vitro* T cell stimulation

For *in vitro* T cell stimulation (refer to 2.4) the cells should be resuspended in culture medium, containing 5% of human serum, at a dilution of 10^7 cells/mL. The cells should be plated at a density of 5×10^6 cells/cm². Both the dilution and the cell density are important to assure optimal stimulation.

The following table lists culture plate, dish and flask sizes suitable for different cell numbers. It also indicates the appropriate amount of medium to add.

Total cell number	Medium volume to add	Culture plate	Well diameter
0.15×10^7	0.15 mL	96 well	0.64 cm
0.50×10^7	0.50 mL	48 well	1.13 cm
1.00×10^7	1.00 mL	24 well	1.60 cm
2.00×10^7	2.00 mL	12 well	2.26 cm
5.00×10^7	5.00 mL	6 well	3.50 cm
Total cell number	**Medium volume to add**	**Culture dish**	**Dish diameter**
4.5×10^7	4.5 mL	small	3.5 cm
10.0×10^7	10.0 mL	medium	6 cm
25.0×10^7	25.0 mL	large	10 cm
50.0×10^7	50.0 mL	extra large	15 cm
Total cell number	**Medium volume to add**	**Culture flask**	**Growth area**
12×10^7	12 mL	50 mL	25 cm²
40×10^7	40 mL	250 mL	75 cm²
80×10^7	80 mL	720 mL	162 cm²
120×10^7	120 mL	900 mL	225 cm²

Refer to **www.miltenyibiotec.com** for all data sheets and protocols. Miltenyi Biotec provides technical support worldwide. Visit www.miltenyibiotec.com for local Miltenyi Biotec Technical Support contact information.

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