



User Manual

Disclaimer: Products are intended for research use only

SHENTEK **Biofargo**

🌐 www.biofargo.com
📞 804-529-2296
✉️ contact@biofargo.com

***E.coli* (Protein Expression Strains) HCP
ELISA Kit
User Guide**

PLEASE READ THE DOCUMENT CAREFULLY BEFORE EXPERIMENT

Product No.: 1301301
Version: A/0
For Research Use Only

Biofargo, Inc.

■ Product Name

E.coli (Protein Expression Strains) HCP ELISA Kit

■ Package

96 tests/Kit

■ Intended Use

This kit is intended for use in determining the presence of host cell proteins (HCPs) in products manufactured by expression in *E.coli* originated from BL21, such as interleukin (IL), recombinant human interferon (rhIFN), recombinant human granulocyte-macrophage colony-stimulating factor (rhGM-CSF), recombinant human tumor necrosis factor (rhTNF), growth-promoting factor (EGF/FGF/PDGF), et.al.

The kit is for RESEARCH USE ONLY and not intended for clinical use.

■ Detection Principle

This kit utilizes a solid-phase Enzyme-linked Immunosorbent Assay (ELISA) with a double-antibody sandwich technique to detect residual *E.coli* (Protein expression strains) host cell proteins (HCPs) in the samples. Polyclonal antibody specific to *E.coli* (Protein expression strains) HCPs was employed in the assay to capture any remaining HCPs in the samples. Both the Calibration Standard and test samples were simultaneously added to the microtiter plate coated with affinity purified capture antibody, and followed by incubation and washing. The biotinylated antibody was added to the microtiter plate to bind the HCPs, then reacted with streptavidin labeled with HRP (Horseradish Peroxidase). TMB (3,3',5,5'-tetramethylbenzidine) substrate was added into reaction, HRP catalyzed the oxidation of TMB by H₂O₂ to produce a blue colored product (maximum absorption peak at 655 nm). Then the stop solution was added to terminate the enzymatic reaction, resulting in a yellow colored product (maximum absorption peak at 450 nm). The absorbance values at 450 nm wavelength were positively correlated with the HCPs concentration in the calibration Standard and the samples. The concentration of HCPs in the sample can be calculated using the dose-response curve.

No special treatment is required for the test samples, and its suitability could be verified by the appropriate dilutions with this kit.

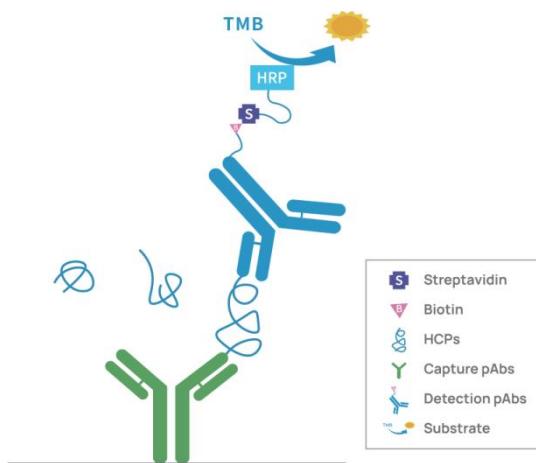


Figure 1. Schematic diagram

■ Kit Contents

Table 1. Kit Components

Reagent	Part No.	Quantity	Note
<i>E.coli</i> HCP-E Calibration Standard	PNB013	2 bottles	Lyophilized powder HCPs lysed by alkaline solution. Dissolve it with 500 μ L Reconstitution Solution, and let it stand for about 5 minutes until transparent. Please refer to the details on the label of the tube.
Anti- <i>E.coli</i> HCP-E Microtiter Strips	PNA003	8 well \times 12 strips	Strips pre-coated with sheep anti- <i>E.coli</i> HCP-E antibody in a vacuumed bag with desiccant. Seal and store immediately after use.
Reconstitution Solution	PNC002	1 \times 1.5 mL	Only used for dissolving <i>E.coli</i> HCP-E Calibration Standard.
Diluent	PNE004	1 \times 25 mL	For dilution of Calibration Standard and the samples.
Wash Buffer Concentrate (10 \times)	PNF001	2 \times 25 mL	For plate washing and dilution of biotinylated antibody and streptavidin-HRP. Easy to be crystallized at low temperature, please incubate at 37°C in water bath before use. Dilute 10 times with freshly prepared ultra-pure water to obtain 1 \times Wash Buffer Solution.

Anti- <i>E.coli</i> HCP-E: Biotinylated Conjugate (100×)	PNG003	1×120 µL	Biotinylated anti- <i>E.coli</i> HCP-E antibody (sheep polyclonal) in a protein matrix with preservative. Dilute 100 times with 1×Wash Buffer before use.
Streptavidin-HRP (100×)	PNH002	1×140 µL	Streptavidin labeled with HRP. Dilute 100 times with 1×Wash Buffer before use.
TMB Substrate	PND002	1×12 mL	3,3',5,5'-tetramethylbenzidine. Sealed and keep away from light. Equilibrate to room temperature (RT) for 20 minutes before use.
Stop Solution	PNI002	1×6 mL	1 M hydrochloric acid. Avoid direct contact with eyes, skin, and clothing. Wear goggles while handling.
Sealing Film	PNK001	3 pieces	Cover the strips with it during incubation to prevent contamination and liquid evaporation.

Note: Room temperature refers to $25 \pm 3^{\circ}\text{C}$.

■ Storage Conditions

Store the kit at 2-8°C. Please check the expiration date on the labels. The opened components should be stored as shown in Table 2.

Table 2. Recommended storage conditions for opened components

Component	Stability
Anti- <i>E.coli</i> HCP-E microtiter strips	Store in the bag with desiccant at 2-8°C for up to 60 days.
Reconstituted <i>E.coli</i> HCP-E Calibration Standard	Store at 2-8°C for up to 30 days.

■ Materials Required But Not Provided

- Sterile centrifuge tubes for dilution
- Absorbent paper for plate drying
- Pipette Tips: 1000 µL, 100 µL and 10 µL
- Multi-channel reagent reservoirs (50 mL)

■ Equipment

- Microplate reader capable of measuring absorbance at 450 nm, with the correction wavelength set at 620 nm to 650 nm.
- Single or multi-channel micropipettes.
- Microplate thermoshaker (For sample incubation. If this equipment is not available, a standing incubation is an option. See the Assay Experiment part for details.)
- Incubator (optional)
- Plate washer (optional)

■ Workflow

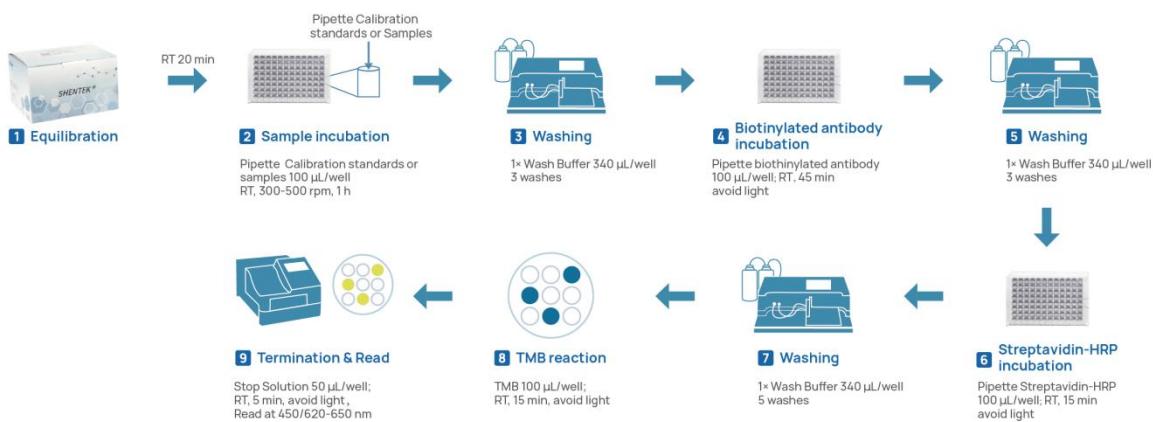


Figure 2. Procedure Flowchart

1. Preparation

(1) Equilibration

- Allow the kit to equilibrate at room temperature for 20 minutes before use. Return to 2-8°C after use.
- Take appropriate amount of strips to a strip holder according to your experimental design. Please store the remaining strips in the bag with desiccant at 2-8°C.

(2) Preparation of Reagents

- *E.coli* HCP-E Calibration Standard Solution: Pipette 500 µL of Reconstitution Solution into the bottle containing *E.coli* HCP-E Calibration Standard. Gently invert 3-5 times to mix well and let it stand for 5 minutes. Save the remaining

solution under the recommended condition.

Note: Do not use any other volumes of Reconstitution Solution to dissolve the Calibration Standard.

- 1×Wash Buffer: Dilute 1 volume of Wash Buffer with 9 volumes of ultra-pure water. For example, add 25 mL Wash Buffer Concentrate (10×) to 225 mL of ultra-pure water to make 250 mL of 1×Wash Buffer. Mix well before use.

Note: If the Wash Buffer Concentrate (10×) or Diluent is cloudy or contains precipitates, heat at 37°C until it clears.

(3) Preparation of Calibration Standard Solutions

- Prepare *E.coli* HCP-E Calibration Standard Solutions as shown in Fig 3 and Table 3.

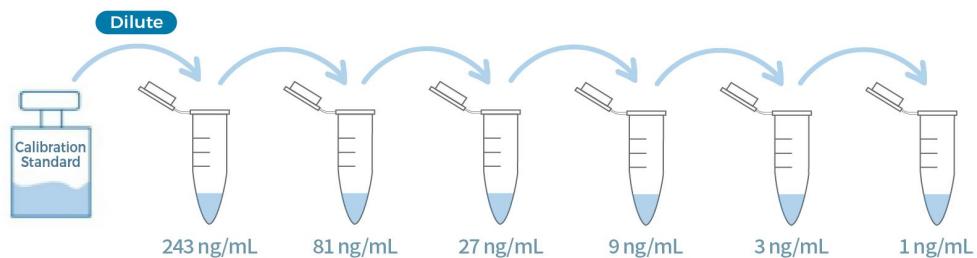


Figure 3. Graphic scheme of *E.coli* HCP-E Calibration Standard Solutions

Table 3. Preparation of *E.coli* HCP-E Calibration Standard Solutions

Tubes	Dilution procedure	Conc. (ng/mL)
ST1	Dilute the reconstituted <i>E.coli</i> HCP-E Calibration Standard to ST1 with Diluent	243
ST2	300 µL ST1 + 600 µL Diluent	81
ST3	300 µL ST2 + 600 µL Diluent	27
ST4	300 µL ST3 + 600 µL Diluent	9
ST5	300 µL ST4 + 600 µL Diluent	3
ST6	300 µL ST5 + 600 µL Diluent	1
NCS	Diluent	0

(4) Sample Preparation

- Test samples: In-process samples, harvested bulk, drug substance and drug product. Make sure samples are clear and transparent, and insoluble substances need to be removed by centrifugation or filtration.

- Conduct sample stability studies to prevent degradation or denaturation during the experiment. Avoid repeated freeze-thaw cycles. Long-term storage at -70°C or below is recommended to avoid degradation.
- Dilute the samples with a suitable diluent to achieve a proper range of HCP concentration within the calibration curve.
- For the first use, a method validation is recommended to verify sample suitability before the subsequent routine test. This will help to set up appropriate sample dilution series.

Note: Please contact us for support of validation protocol.

2. Assay Experiment

(1) Sample Incubation

- Pipette 100 µL of Calibration Standards, controls and samples into each designated well according to the experimental design. Avoid foaming bubbles during pipetting. We recommend to prepare 2-3 replicates for each sample.
- Seal the plate and incubate on microplate thermoshaker at 300-500 rpm for 1 hour at room temperature. It is possible to incubate the plate without shaking for 2 hours if such a device is not available.

Table4. Example of 96-well microplate layout

	1	2	3	4	5	6	7	8	9	10	11	12
A	NCS	NCS	NCS		S1	S1	S1					
B					S2	S2	S2					
C	ST6	ST6	ST6		S3	S3	S3					
D	ST5	ST5	ST5		S1+SRC	S1+SRC	S1+SRC					
E	ST4	ST4	ST4		S2+SRC	S2+SRC	S2+SRC					
F	ST3	ST3	ST3		S3+SRC	S3+SRC	S3+SRC					
G	ST2	ST2	ST2									
H	ST1	ST1	ST1									

- ❖ “ST1-ST6” indicate 6 concentration gradients, “NCS” as negative control, “S1-S3” as test samples, and “S1+SRC-S3+SRC” as the spiked recovery controls for each sample.
- ❖ The number of replicates and the spiked samples can be determined by method validation.

(2) Biotinylated Antibody Reagent Preparation and Incubation

- 1×Anti-*E.coli* HCP-E:Biotinylated Conjugate: Prepare the 1×Anti-*E.coli* HCP-E:Biotinylated Conjugate by diluting the Anti-*E.coli* HCP-E:Biotinylated Conjugate (100×) with 1×Wash Buffer in a sterile centrifuge tube. Prepare 1×Anti-*E.coli* HCP-E:Biotinylated Conjugate fresh, mix gently and use immediately.
- Wash the plate with 340 μ L of 1×Wash Buffer per well. Wipe off any liquid from the bottom outside of the plate. Repeat washing for 3 times. Do not allow the wells to be completely dried before adding the next solution.
- Pipette 100 μ L of 1×Anti-*E.coli* HCP-E:Biotinylated Conjugate into the corresponding wells as indicated earlier.
- Seal the plate and incubate for 45 min at room temperature, and protect from light.

(3) Streptavidin-HRP Preparation and Incubation

- 1×Streptavidin-HRP: Prepare the 1×Streptavidin-HRP by diluting the Streptavidin-HRP (100×) with 1×Wash Buffer in a sterile centrifuge tube. Prepare 1×Streptavidin-HRP fresh, mix gently and use it immediately.
- Wash the plate with 340 μ L of 1×Wash Buffer per well. Wipe off any liquid from the bottom outside of the plate. Repeat washing for 3 times. Do not allow the wells to be completely dried before adding the next solution.
- Pipette 100 μ L of 1×Streptavidin-HRP into the corresponding wells.
- Seal the plate and incubate for 15 min at room temperature, and protect from light.

(4) TMB Reaction

- Equilibrate the TMB substrate for 20 min at room temperature.
- Wash the plate with 340 μ L of 1×Wash Buffer per well. Wipe off any liquid from the bottom outside of the plate. Repeat washing for 5 times. Do not allow the wells to be completely dry before adding the substrate.
- Add 100 μ L of TMB Substrate into the wells, and incubate at room temperature for 15 min, and protect from light.

Note: Do not use sealing film during this step.

(5) Termination

- Add 50 μ L of Stop Solution into each well.

Note: The order of adding Stop Solution should be the same as the order of adding the TMB solution. While adding samples, suspend the tips above the liquid to prevent contact with the solution in the wells and minimize the risk of bubble formation.

- Incubate at room temperature for 5 minutes, and protect from light.

(6) Read

- Read absorbance at 450 nm/620-650 nm.

3. Calculation and Analysis

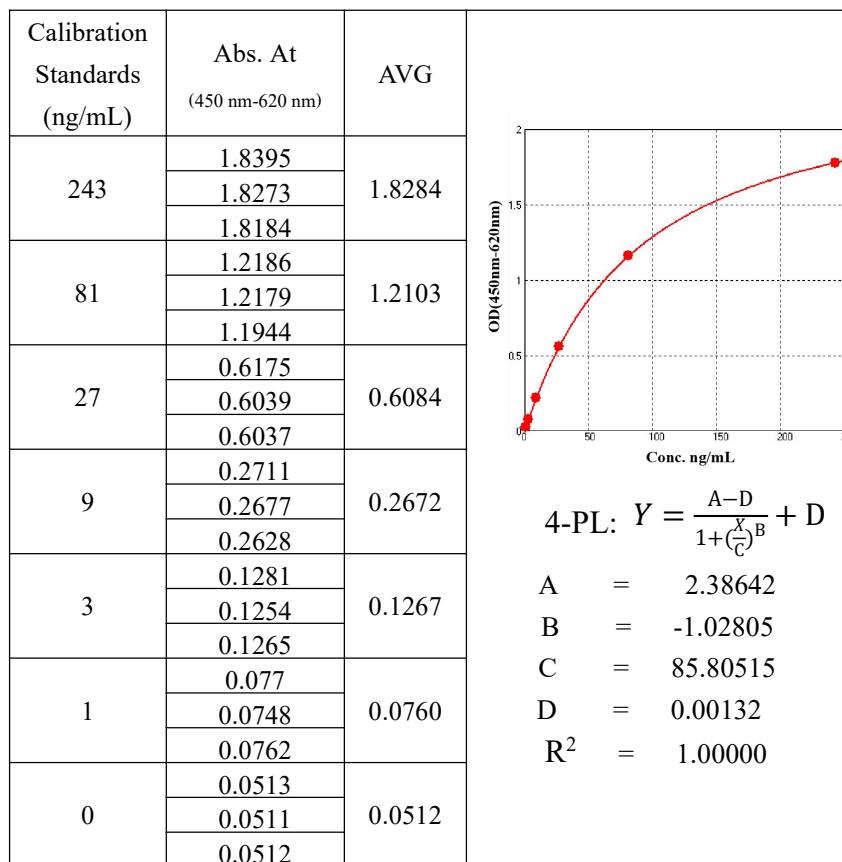
- The OD value of each well should be calculated by the difference between OD450 nm and their respective long wavelength. If the microplate reader is not equipped with long wavelength measurement, this step can be omitted.
- Subtract the OD value of the NCS from each calibration point and samples, and record the mean of the replicate wells.
- Perform a 4-parameter logistic regression model using the Calibration Standard concentration values and OD values to obtain the calibration curve equation. Substitute the average OD value of the samples into the equation to calculate the sample concentration, which should be multiplied by the dilution factor to obtain the actual samples concentration.
- The software for data analysis of the standard curve could be the one that comes with the microplate reader. If not, we recommend to use professional standard curve software such as Curve Expert, ELISA Calc, and so on.
- For samples with absorbance values above the Calibration Standard ST1, a pilot study should be performed to determine an appropriate dilution before retesting. The HCP concentration in the samples are calculated from the test value multiplied by its corresponding dilution factor. If the spiked samples are simultaneously set at this dilution level and the recovery rate should meet the requirements of the corresponding regulations.

■ Limitations

- For research purposes only, not intended for clinical use.
- Specifically designed for detecting residual protein content in products manufactured by expression in BL21 of *E.coli*. A method validation is required in other types of *E.coli* protein expressing strains.
- This kit is not suitable for *E.coli* cloning strains or samples disintegrated by alkaline lysis. Please contact us for support of the related kits and services.
- The samples pH should be between 6.5 and 8.5. Beyond this range may cause abnormal results.

■ Assay Performance

- Linearity& Range: 1 - 243 ng/mL, $R^2 \geq 0.990$
- LLOQ: 1.5 ng/mL
- Typical calibration curve for reference:



- Specificity: No cross-reactivity with CHO, Vero, HEK293T, and Hansenula polymorpha.

■ Additional Information

- ✧ This kit is intended for use by qualified technicians only.
- ✧ Consumables, for example sterile disposable tips, tubes and reservoirs are only allowed for single use. It is recommended to wipe with 75% ethanol before and after each use. Follow the specified pipetting procedure carefully.
- ✧ Users should validate the assay before testing their samples.
- ✧ Dilution should be gentle and thorough to avoid excessive foaming.
- ✧ Stop Solution is 1M HCl. Avoid direct contact with eyes, skin, and clothing.
- ✧ Do not mix the kit reagents from different lot numbers .
- ✧ Use fresh sterile water or ultra-pure water, and ensure the water temperature does not exceed 37°C.
- ✧ Seal or cover the microplate immediately after sample loading to avoid liquid evaporation.
- ✧ Avoid drying the wells before substrate incubation.
- ✧ Store unused microtiter strips in a sealed bag with desiccant to prevent contamination.
- ✧ Centrifuge Anti-*E.coli* HCP-E:Biotinylated Conjugate (100×) and Streptavidin-HRP (100×) before use to avoid any loss of the reagent.
- ✧ To avoid pipetting errors, pipette or sampling accurately for dilution of Standard and samples, for example, a minimum volume of 5 μ L is recommended.
- ✧ *E.coli* HCP-E Calibration Standard solutions, Biotinylated Antibody solution and Streptavidin-HRP solution are recommended for single use due to stability issue. Prepare freshly before each experiment.
- ✧ TMB Substrate should be colorless. If not, discard it and contact us for assistance.
- ✧ Pipette carefully to avoid any bubbles, and gently shake the plate for thorough mixing. Bubbles can influence optical density values and detection results.
- ✧ Plate reading should be completed within 30 minutes after termination.
- ✧ Avoid the samples containing sodium azide (NaN₃), which will deactivate the HRP and lead to the underestimation of HCP levels.

■ Troubleshooting

Problem	Possible Cause	Solution
High background signal (OD)	Cross-contamination of reagents, including distilled water	Freshly prepared prior to experiment.
	Cross-contamination of equipment, including micropipettes and centrifuge	Clean the equipment with 75% ethanol before experiment.
	Environment contamination	Separate the working bench to avoid contamination.
	Insufficient washing	Increase the wash buffer volume or wash times, and remove any remaining liquid before proceeding to the next step.
Abnormal values	Improper washing	Swiftly and completely shake off any excess liquid, and avoid reusing paper towels to minimize contamination.
	Improper sampling	Add the samples to the bottom of the wells using micropipettes, and avoid splashing to the neighboring wells.
	Plate sealing	Promptly cover the plate with the sealing film and remove it carefully to prevent splashing.

If you have any other questions, please contact us for technical support.

■ References

- ICH. M10 Bioanalytical Method Validation And Study Sample Analysis
- FDA. Bioanalytical Method Validation Guidance for Industry
- USP<1132> Residual Host Cell Protein Measurement in Biopharmaceuticals
- EP< 2.6.34>HOST-CELL PROTEIN ASSAYS
- ChP<9012>Guidance of Quantitative Method Validation for Biological Samples
- ChP<3412>Determination of Residual *E.coli* Proteins

Effective date: 29 May 2024

Support & Contact

SHENTEK

Biofargo, Inc.
www.biofargo.com

Address: 1716 E Parham Rd Richmond, Va, 23228, USA
E-mail: contact@biofargo.com
Phone: 804-529-2296