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# **HPV Type 45 In Vitro Potency Evaluation Kit**

## **Manual**

**Cat#17-0120**

**This kit is used to detect the content of HPV45-L1 antigen in samples.**

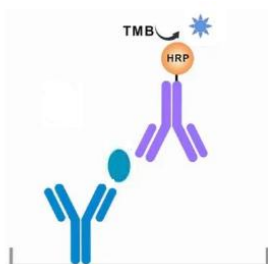
**research use only and not for diagnostic purposes.**

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## 1. Experimental Principle

This product uses the principle of a sandwich ELISA with a monoclonal neutralizing antibody against HPV45-L1 coated on the ELISA plate. After the addition of the sample and reaction, unbound materials are washed away. Another HRP-labeled monoclonal neutralizing antibody against HPV45-L1 is added, forming a complex of coated antibody-antigen-HRP antibody. The degree of TMB color development indicates the content of active HPV45-L1 antigen in the intermediate products of vaccine production, drug substance, and 9-valent HPV vaccine mixture (before adjuvant addition).



## 2. Instructions for Use

Please read this manual carefully before starting the experiment.

- Follow good laboratory practices: Wear gloves, lab coats, and safety goggles at all times. Do not eat, drink, or smoke in the laboratory area.
- All biological materials should be treated as potentially hazardous and disposed of according to established safety procedures.
- Do not mix or substitute reagents or materials from other kit batches or suppliers; performance cannot be guaranteed if substituted.

## 3. Materials and Reagents Provided

Components of the kit	Quantity	Storage Conditions
Pre-coated plate	8 wells × 12 strips	2~8°C
Detection antibody (500×)	50μL × 1 tube	-15 ~ -25°C
Single component color development solution II	11mL × 1 bottle	2~8°C
Termination solution	7mL × 1 bottle	2~8°C
BSA	3g/bag × 2 bags	2~8°C
Detection antibody diluent	12mL × 1 bottle	2~8°C
20×PBST	50mL × 1 bottle	2~8°C
Sealing membrane	2 sheets	2~8°C/Room temperature
Manual	1 copy	2~8°C/Room temperature

## 4. Materials Required for the Experiment but Not Provide

These materials are not included in the kit but are needed for the test:

- 1) HPV45 antigen reference solution
- 2) HPV45 antigen enterprise reference solution

3) 9-valent HPV mixture enterprise reference solution (optional)

- Microplate reader, deionized water, multi-channel and single-channel pipettes, dilution tubes, shaker incubator.

## **5. Storage Conditions and Shelf Life**

- Detection antibody (500×), store at -15 ~ -25°C, other components at 2~8°C away from light.  
- Validity period of 12 months.

## **6. Operational Tips**

- Avoid creating bubbles when preparing solutions or adding samples.  
- Replace tips promptly to avoid cross-contamination of samples or reagents.  
- Ensure the ELISA plate is covered with a sealing membrane during incubation.  
- All samples should be thoroughly and gently mixed.  
- Incubate the ELISA plate on a shaker incubator during all incubation steps.

## **7. Reagent Preparation**

- Equilibration: Bring the required reagents to room temperature (18 ~ 25°C) and equilibrate for 30 minutes.  
- 20×PBST may contain precipitates, which is normal. If the precipitate does not dissolve by gentle stirring, it can be heated in a 37°C oven to dissolve the precipitate before use.

### **7.1 Preparation of 1×PBST**

Take 1 bottle of 20×PBST and dilute with deionized water to 1000mL, mix well and set aside for use. The amount of solution can be adjusted according to the experimental needs, prepare as needed.

### **7.2 Preparation of 5% BSA diluent**

Accurately weigh 5.0g of BSA and completely dissolve it in 100mL of 1×PBST, mix well and set aside for use as 5% BSA diluent.

The amount of solution can be adjusted according to the experimental needs, prepare as needed.

### **7.3 Preparation of enzyme conjugate-detection antibody working solution**

Calculate the volume of working solution needed for the experiment, take an appropriate amount of enzyme conjugate (500×) and dilute with detection antibody diluent 100 times, then further dilute 5 times, mix well and set aside for use.

## **8. Reference and Sample Preparation**

- Prepare different concentrations of reference solutions (2-fold gradient dilution) with 5% BSA diluent: 4000ng/mL, 2000ng/mL, 1000ng/mL, 500ng/mL, 250ng/mL, 125ng/mL, 62.5ng/mL, 31.25ng/mL, 15.625ng/mL, 7.8125ng/mL, 3.9ng/mL, 0ng/mL (5% BSA diluent).  
- Dilute the test samples with 5% BSA diluent to the linear range of the standard curve for detection. If the concentration of the test sample is unknown, it can be diluted 10 times, 30 times, 100 times, 300 times, and 1000 times, and then tested to select the OD value within the standard curve range to back-calculate the sample concentration (ng/mL). Finally, the sample concentration should be multiplied by the sample dilution factor to obtain the measured value.

- Prepare new reference and sample solutions each time, and discard used reference and sample solutions.

## **9. Flowchart**

- 9.1 Prepare all reagents, samples, and reference standards according to the manual.
- 9.2 Add reference standards or samples (100µL) into the wells of the microplate, incubate at 37°C with shaking for 60 minutes.
- 9.3 Wash with 1x PBST three times.
- 9.4 Add the enzyme-labeled reagent (100µL), and incubate at 37°C for 60 minutes.
- 9.5 Wash with 1x PBST three times.
- 9.6 Add the color development solution (100µL), and let it react at room temperature in the dark for 10 minutes.
- 9.7 Add 50µL of the stopping solution to all wells, and read the OD values.

## **10. Operating Procedures**

- Prepare all reagents, references, and samples according to the requirements of the previous sections.
- The ELISA plate is ready to use at any time, and it is not necessary to rinse before use.

### **10.1 Sample Addition**

Add all references and samples to the ELISA plate, mark them, add 100µL of sample per well (set up duplicate wells), seal the plate with a sealing membrane, and place it in a 37°C constant temperature shaker incubator, 300rpm, incubate for 60 minutes.

### **10.2 Washing**

Discard the liquid in each well, add 350µL of 1×PBST to each well, let it stand for 30 seconds, discard the liquid, and repeat 3 times. After the last wash, gently blot dry on a paper towel.

### **10.3 Addition of Enzyme Conjugate**

Add 100µL of enzyme conjugate working solution to each well, seal the plate with a new sealing membrane, and place it in a 37°C constant temperature shaker incubator, 300rpm, incubate for 60 minutes.

### **10.4 Washing**

Repeat step 10.2.

### **10.5 Color Development**

Add 100 µL of single component color development solution to each well, gently mix and incubate in the dark at 25°C for 10 minutes.

### **10.6 Termination**

Add 50µL of termination solution to each well, gently mix.

### **10.7 Reading**

Select the main wavelength of the microplate reader at 450nm, reference wavelength at 630nm, and measure the absorbance value (OD value=OD450-OD630) of each well.

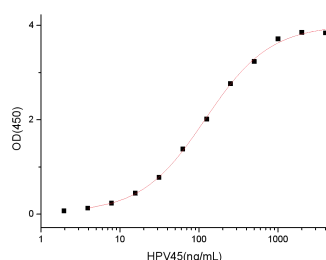
## **11. Result Processing**

### **11.1 Standard Curve**

Calculate the average OD value of the reference (see example below, for illustration only, specific to actual measurement):

Standard Curve ng/mL	OD1	OD2	Average OD
4000	3.720	3.96	3.840
2000	3.881	3.823	3.852
1000	3.628	3.799	3.714
500	3.338	3.133	3.236
250	2.759	2.770	2.765
125	2.057	1.972	2.015
62.5	1.338	1.421	1.380
31.25	0.765	0.795	0.780
15.625	0.447	0.442	0.445
7.8125	0.243	0.231	0.237
3.90625	0.125	0.131	0.128
NC	0.016	0.012	0.014

Fit the standard curve concentration and corresponding average OD values using a four-parameter fitting method to obtain the standard curve, as shown in the figure below. The four-parameter fitting equation is:  $y = 4.00641 - 3.98098 / [1 + (x/120.55552)^{1.06357}]$ .



Four-parameter fitting standard curve (linear correlation coefficient  $R^2=0.99909$ )

## 11.2 Calculation of Sample Concentration

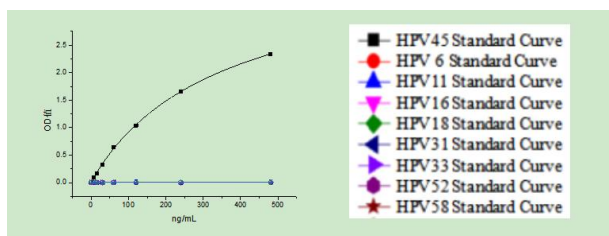
Select the OD value within the standard curve range to back-calculate the sample concentration, which is the measured value (ng/mL). Multiply the measured value by the sample dilution factor to obtain the sample concentration.

## 12. Product Performance Indicators

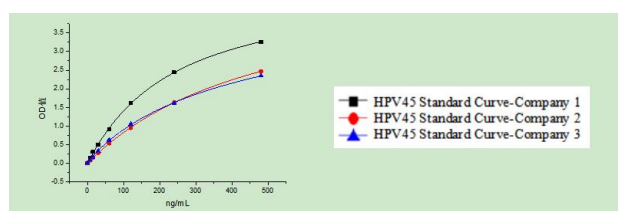
- Linear range: 3.9 ~ 4000ng/mL
- Sensitivity: <3.9ng/mL.
- Accuracy and precision: The recovery rate of high, medium, and low concentration quality control points is within the range of 80% ~ 120%, which meets the requirements; CV (%) ≤ 10%, which meets the requirements.

Accuracy/Precision	Accuracy (Recovery Rate %)			Precision (CV %)		
	1	2	3	1	2	3
HQC-400ng/mL	101%	98%	90%	2.84%	2.02%	3.36%
MQC-100ng/mL	105%	100%	102%	1.27%	3.48%	2.34%
LQC-20ng/mL	94%	106%	105%	3.93%	3.01%	2.41%

- HOOK effect: Using HPV45 reference solution higher than 4000ng/mL for testing, the signal value did not decrease, no HOOK effect.
- Dilution linearity: Select reference solutions higher than 4000ng/mL diluted to the linear range of the standard curve (400ng/mL, 100ng/mL, 20ng/mL), calculate accuracy, and the deviation is within the range of 80% ~ 120%.
- Specificity: No significant cross-reactivity with other 8 HPV subtypes such as HPV6, 11, 18, 31, 16, 33, 52, 58.



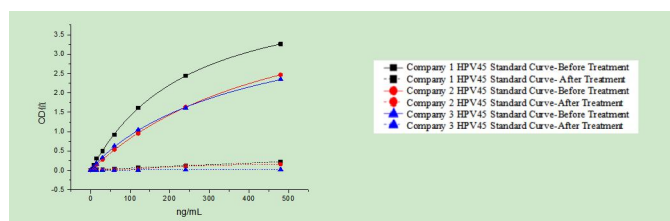
- Broad-spectrum Activity: It shows binding affinity with HPV45 from more than three different companies with varying expression systems.



- Applicability: Suitable for detecting the content of active HPV45 antigen in both HPV45 monovalent solutions and 9-valent HPV mixtures (before adjuvant addition). There is no cross-reactivity with other eight HPV subtypes in vaccines other than HPV45, with a total cross-reactivity rate of 0%. The OD values detected for HPV45 in the 9-valent mixture are close to those detected for the monovalent, with the standard curves essentially overlapping, making it suitable for the detection of HPV45 in 9-valent HPV vaccines.

Sample	HPV45				8 mix-HPV 6、31、18、33、52、16、11、58				9 mix-HPV6、11、31、33、45、52、16、18、58			
Standard ng/mL	OD1	OD2	OD 均值	P/N	OD1	OD2	OD 均值	P/N	OD1	OD2	OD 均值	P/N
480	3.742	415.72	0.238	19.04	3.694	3.763	3.729	392.47	3.742	415.72	0.238	19.04
240	3.245	360.50	0.147	11.72	3.182	3.099	3.141	330.58	3.245	360.50	0.147	11.72
120	2.310	256.67	0.085	6.76	2.312	2.308	2.310	243.16	2.310	256.67	0.085	6.76
60	1.613	179.17	0.052	4.12	1.584	1.597	1.591	167.42	1.613	179.17	0.052	4.12
30	0.961	106.78	0.031	2.48	1.004	1.022	1.013	106.63	0.961	106.78	0.031	2.48
15	0.585	64.94	0.020	1.60	0.558	0.535	0.547	57.53	0.585	64.94	0.020	1.60
7.5	0.310	34.39	0.015	1.20	0.282	0.292	0.287	30.21	0.310	34.39	0.015	1.20
NC	0.009	1.00	0.013	1.00	0.009	0.010	0.010	1.00	0.009	1.00	0.013	1.00

- **Vaccine Inactivation Treatment:** After treatment at 56°C for 30 minutes, the HPV45 antigen solutions from three different companies showed a decrease in signal compared to untreated samples, indicating that this kit can reflect whether the HPV antigen solution has been inactivated.



- **Vaccine Testing:**
  - Recommended desorption method is as follows:
    - ◆ Preparation of Desorption Agent: 60mM sodium dihydrogen phosphate, 0.1M sodium citrate, 1M sodium chloride, 0.8% Tween-80 (pH 6.7-6.8).
    - ◆ Desorption Treatment of Finished Vaccine: Mix the desorption agent with the finished vaccine in a 1:1 ratio, then stir overnight at room temperature to react.
    - ◆ Desorption Efficiency (Measured Value/Theoretical Value):

QCs, ng/mL	Desorption Efficiency%
100	73%
50	70%
20	71%

- **Good Reproducibility:** After desorption of the finished vaccine, the coefficient of variation (CV) of the optical density (OD) values for each point on the standard curve is within 10%, and the CV of the OD values for quality controls (QCs) is also within 10%, indicating stable repeatability of the test.

Operation	Standard -9-valent mixed bulk solution						After desorption treatment of the finished vaccine							
HPV45 standard g/mL	OD1	OD2	Ave OD	QCs, ng/mL	OD	Ave OD	OD1	OD2	Ave OD	QCs, ng/mL	OD	Ave OD	ng/mL	Desorption Efficiency%
500	3.914	3.986	3.95	100	2.367	2.359	3.888	4.032	3.96	100	2.133	2.101	73.251	73%
250	3.45	3.507	3.479		2.379		3.443	3.44	3.442		2.052			
125	2.748	2.638	2.693		2.33		2.478	2.464	2.471		2.118			
62.5	1.974	1.888	1.931	50	1.519	1.533	1.634	1.615	1.625	50	1.326	1.316	35.092	70%
31.25	1.247	1.145	1.196		1.5		0.947	0.943	0.945		1.309			
15.625	0.728	0.696	0.712		1.579		0.552	0.537	0.545		1.314			
7.8125	0.399	0.382	0.391	20	0.8	0.789	0.295	0.297	0.296	20	0.646	0.645	14.157	71%
NC	0.015	0.015	0.015		0.791		0.015	0.015	0.015		0.648			
					0.777						0.641			



### 13. Problems and Solutions

Problem	Cause	Solution
Poor standard curve linearity	Improper dilution of the standard curve	Check the pipette, use a calibrated pipette, standardize operations, and redilute.
Low signal value	Insufficient incubation time	Ensure adequate incubation time.
	Insufficient reagent amount or improper dilution	Check the pipette, ensure correct and sufficient reagent preparation
	Prolonged exposure of color development solution	The color development solution should be stored away from light, replace with a new color development solution.
High CV value	Inadequate washing	Follow the washing steps strictly.
	Contaminated washing solution	Replace with a new washing solution.
Insufficient sensitivity	Improper storage of the ELISA kit	Store according to the manual instructions
Precipitation in the diluent	Precipitation and/or coagulation of components in the diluent	Heat the diluent to 37°C to completely dissolve the precipitate.