

## Human CD40 Sandwich ELISA Kit Datasheet

Please read it entirely before use

**Catalogue Number:** KE00342

**Size:** 96T

**Sensitivity:** 3.5 pg/mL

**Range:** 78.1-5000 pg/mL

**Usage:** For the quantitative detection of human CD40 concentrations in serum, plasma, urine, saliva and human milk.

This product is for research use only and not for use in human or animal therapeutic or diagnostic.

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## 1. Background

CD40, also named as TNFRSF5 and Bp50, is a type I transmembrane protein that belongs to the tumor necrosis factor receptor (TNFR) family. CD40 is expressed on B cells, dendritic cells (DCs), monocytes, platelets, and macrophages as well as by non-hematopoietic cells such as myofibroblasts, fibroblasts, epithelial, and endothelial cells. It is a receptor for TNFSF5/CD40L. CD40L/CD40 interactions are essential for immunoglobulin (Ig) isotype switching, germinal center formation and the development of B cell memory.

## 2. Principle



### Sandwich ELISA structure (Detection antibody labeled with HRP)

A capture antibody is pre-coated onto the bottom of wells which binds to analyte of interest. A detection antibody labeled with HRP also binds to the analyte. TMB acts as the HRP substrate and the solution color will change from colorless to blue. A stop solution containing sulfuric acid turns solution yellow. The color intensity is proportional to the quantity of bound protein which is measurable at 450 nm with the correction wavelength set at 630 nm.

## 3. Required Materials

- 3.1 A microplate reader capable of measuring absorbance at 450 nm with the correction wavelength set at 630 nm.
- 3.2 Calibrated, adjustable precision pipettes and disposable plastic tips. A manifold multi-channel pipette is recommended for large assays.
- 3.3 Plate washer: automated or manual.
- 3.4 Absorbent paper towels.
- 3.5 Glass or plastic tubes to prepare standard and sample dilutions.
- 3.6 Beakers and graduated cylinders.
- 3.7 Log-log or semi-log graph paper or computer and software for ELISA data analysis. A four-parameter logistic (4-PL) curve-fit is recommended.

## 4. Kit Components and Storage

<b>Microplate</b> - antibody coated 96-well microplate (8 well × 12 strips)	1 plate	<b>Unopened Kit:</b> Store at 2-8°C for 6 months or -20°C for 12 months. <b>Opened Kit:</b> All reagents stored at 2-8°C for 7 days. <b>Please use a new standard for each assay.</b>
<b>Protein standard</b> - 10000 pg/bottle; lyophilized	2 bottles	
<b>Detection antibody, HRP-conjugated (100×)</b> - 120 µL/vial*	1 vial	
<b>Sample Diluent PT 4B1</b> - 30 mL/bottle. For human serum, plasma, urine and human milk	1 bottle	
<b>Sample Diluent PT 1</b> - 30 mL/bottle. For saliva	1 bottle	
<b>Detection Diluent</b> - 30 mL/bottle	1 bottle	
<b>Wash Buffer Concentrate (20×)</b> - 30 mL/bottle	1 bottle	
<b>Tetramethylbenzidine Substrate (TMB)</b> - 12 mL/bottle	1 bottle	
<b>Stop Solution</b> - 12 mL/bottle	1 bottle	
<b>Plate Cover Seals</b>	4 pieces	

\* Centrifugation immediately before use

## 5. Safety Notes

- 5.1 Avoid any skin and eye contact with Stop Solution and TMB. In case of contact, wash thoroughly with water.
- 5.2 Do not use the kit after the expiration date.
- 5.3 Do not mix or substitute reagents or materials from other kit lots or other sources.
- 5.4 Be sure to wear protective equipment such as gloves, masks and goggles during the experiment.
- 5.5 When using an automated plate washer, adding a 30 second soak period following the addition of Wash Buffer to improve assay precision

## 6. Sample Collection and Storage

- 6.1 Serum: Allow blood samples to clot for 30 minutes, followed by centrifugation for 15 minutes at 1000xg. Clear serum can be assayed immediately or aliquoted and stored at -20°C. Avoid repeated freeze-thaw cycles.
- 6.2 Plasma: Use EDTA, heparin, or citrate as an anticoagulant for plasma collection. Centrifuge for 15 minutes at 1000xg within 30 minutes of collection. The plasma can be assayed immediately or aliquoted and stored at -20°C. Avoid repeated freeze-thaw cycles.
- 6.3 Urine: Collect urine samples and centrifuge for 20 minutes at 1000xg. Collect the aqueous layer, assay immediately or aliquot and store samples at ≤ -20°C. Avoid repeated freeze-thaw cycles.
- 6.4 Saliva: Collect saliva samples and centrifuge for 5 minutes at 10,000xg. Collect the aqueous layer, assay immediately or aliquot and store samples at ≤ -20°C. Avoid repeated freeze-thaw cycles.
- 6.5 Human Milk: Collect milk samples and Centrifuge for 15 minutes at 1000xg at 2-8°C. Collect the aqueous fraction and repeat this process a total of 3 times. Assay immediately.

## 7. Regent Preparation

**7.1 Wash Buffer (1X):** If crystals have formed in the concentrate, warm to room temperature and mix gently until the crystals have completely dissolved. Add 30 mL of Wash Buffer Concentrate (20X) to 570 mL deionized or distilled water to prepare 1X Wash Buffer.

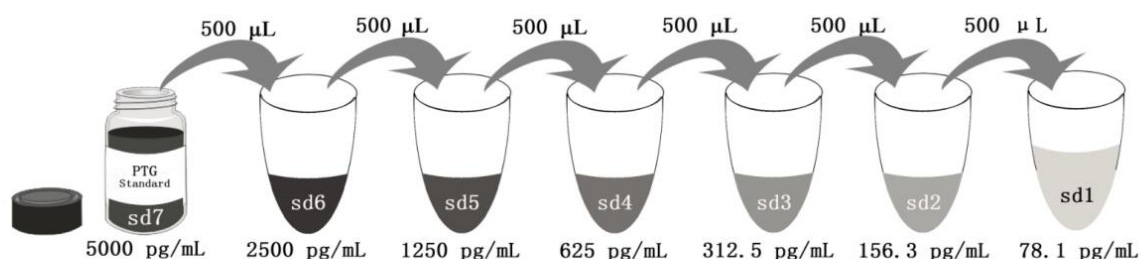
**7.2 Detection Antibody, HRP-conjugated(1X):** Dilute 100X Detection Antibody, HRP-conjugated 1:100 using Detection Diluent prior to assay. Suggested 1:100 dilution: 10  $\mu$ L 100X Detection Antibody, HRP-conjugated + 990  $\mu$ L Detection Diluent (Centrifuge the 100X Detection Antibody solution, HRP-conjugated for a few seconds prior to use)

**7.3 Sample Dilution:** Different samples should be diluted with corresponding Sample Diluent, samples may require further dilution if the readout values are higher than the highest standard OD reading. Variations in sample collection, processing and storage may affect the results of the measurement.

Recommended Dilution for different sample types: 1:2 is recommended for human serum and plasma; 1:2 or 1:4 is recommended for urine; 1:2 or 1:4 is recommended for saliva; 1:2 is recommended for human milk.

### 7.4 Standard Serial Dilution:

For human serum, plasma, urine and human milk, add 2 mL Sample Diluent PT 4B1 in protein standard. For saliva, add 2 mL Sample Diluent PT 1 in protein standard.



Add # $\mu$ L of Standard diluted in the previous step	—	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L
# $\mu$ L of Sample Diluent PT 4B1 or PT 1	2000 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L	500 $\mu$ L
	"sd7"	"sd6"	"sd5"	"sd4"	"sd3"	"sd2"	"sd1"

## 8. Assay Procedure Summary

Bring all reagents to room temperature before use (Detection antibody, HRP-conjugated can be used immediately). To avoid cross-contamination, change pipette tips between additions of each standard level, between sample additions, and between reagent additions. Also, use separate reservoirs for each reagent.

8.1 Take out the required number of microplate strips and return excess strips to the foil pouch containing the drying reagent pack and reseal; store at 4°C immediately. Microplate strips should be used in one week.

8.2 Preset the layout of the microplate, including control group, standard group and sample group, add 100 µL of each standard and sample to the appropriate wells. (Make sure sample addition is uninterrupted and completed within 5 to 10 minutes, It is recommended to assay all standards, controls, and samples in duplicate).

8.3 Seal plate with cover seal, pressing it firmly onto top of microwells. Incubate the plate for 2 hours at 37°C.

### 8.4 Wash

1) Gently remove the cover seal. Discard the liquid from wells by aspirating or decanting. Remove any residual solution by tapping the plate a few times on fresh paper towels.

2) Wash 4 times with 1X Wash Buffer, using at least 350-400 µL per well. Following the last wash, firmly tap plates on fresh towels 10 times to remove residual Wash Buffer. Avoid getting any towel fibers in the wells or wells drying out completely.

8.5 Add 100 µL of 1X Detection antibody, HRP-conjugated solution (refer to Reagent Preparation 7.2) to each well. Seal plate with cover seal and incubate for 40 minutes at 37°C.

8.6 Repeat wash step in 8.4.

8.7 Signal development: Add 100 µL of TMB substrate solution to each well, protected from light. Incubate for 15 to 20 minutes. Substrate Solution should remain colorless until added to the plate.

8.8 Quenching color development: Add 100 µL of Stop Solution to each well in the same order as addition of the TMB substrate. Mix by tapping the side of the plate gently. NB: Avoid skin and eye contact with the Stop solution.

8.9 Read results: Immediately after adding Stop solution read the absorbance on a microplate reader at a wavelength of 450 nm. If possible, perform a double wavelength readout (450 nm and 630 nm).

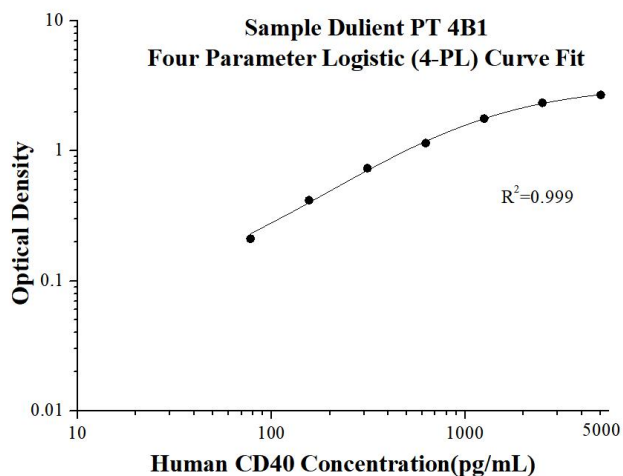
8.10 Data analysis: Calculate the average of the duplicate readings (OD value) for each standard and sample, and subtract the average of the zero standard absorbance. Construct a standard curve by plotting the mean absorbance for each standard on the y-axis against the concentration on the x-axis, use four-parameter logistic curve-fit (4-PL) analysis to do this. If the samples have been diluted, the OD readout from the standard curve must be multiplied by the dilution factor used.

Step	Reagent	Volume	Incubation	Wash	Notes
1	Standard and Samples	100 µL	120 min	4 times	Cover Wells incubate at 37°C
2	Diluent Detection antibody, HRP-conjugated Solution	100 µL	40 min	4 times	Cover Wells incubate at 37°C
3	TMB Substrate	100 µL	15-20 min	Do not wash	Incubate in the dark at 37°C
4	Stop Solution	100 µL	0 min	Do not wash	-
5	Read plate at 450 nm and 630 nm immediately after adding Stop solution. DO NOT exceed 5 minutes.				

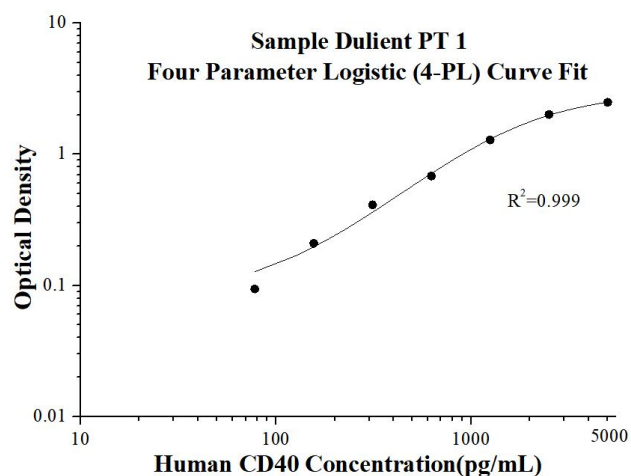
## 9. Validation Data

### 9.1 Standard curve

These standard curves are provided for demonstration only. A standard curve should be generated for each set of samples assayed.



(pg/mL)	O.D	Average	Corrected
0	0.0379 0.0362	0.03705	-
78.1	0.2542 0.2419	0.24805	0.211
156.3	0.4653 0.4437	0.4545	0.41745
312.5	0.7708 0.7756	0.7732	0.73615
625	1.172 1.2001	1.18605	1.149
1250	1.8236 1.7973	1.81045	1.7734
2500	2.3974 2.3685	2.38295	2.3459
5000	2.7705 2.7054	2.73795	2.7009



(pg/mL)	O.D	Average	Corrected
0	0.0262 0.0297	0.02795	-
78.1	0.1238 0.1205	0.12215	0.0942
156.3	0.2403 0.2359	0.2381	0.21015
312.5	0.4415 0.4391	0.4403	0.41235
625	0.7341 0.6878	0.71095	0.683
1250	1.328 1.3044	1.3162	1.28825
2500	2.0225 2.0578	2.04015	2.0122
5000	2.5225 2.509	2.51575	2.4878

## 9.2 Precision

**Intra-assay Precision** (Precision within an assay) Three samples of known concentration were tested 20 times on one plate to assess intra-assay precision.

**Inter-assay Precision** (Precision between assays) Three samples of known concentration were tested in 24 separate assays to assess inter-assay precision.

Intra-assay Precision					Inter-assay Precision				
Sample	n	Mean (pg/mL)	SD	CV%	Sample	n	Mean (pg/mL)	SD	CV%
1	20	3,213.3	248.1	7.7	1	24	2,085.6	202.4	9.7
2	20	595.9	34.6	5.8	2	24	681.4	60.1	8.8
3	20	153.4	8.4	5.5	3	24	175.8	13.8	7.9

## 9.3 Recovery

The recovery of human CD40 spiked to three different levels throughout the range of the assay in various matrices was evaluated.

Sample Type		Average% of Expected	Range (%)
Human plasma	1:2	98	80-115
	1:4	113	102-122
Urine	1:2	87	80-97
	1:4	98	87-116
Saliva	1:2	108	88-121
	1:4	110	90-121
Human Milk	1:2	101	79-114
	1:4	110	100-119

## 9.4 Sample values

**Human plasma/Urine/Saliva/Human milk** - Human plasma, urine, saliva and human milk samples were evaluated for the presence of human CD40 in this assay.

Sample Type	Mean (pg/mL)	Range (pg/mL)
Human plasma (n=15)	89.6	39.1-155.7
Urine (n=8)	1,053.4	79.9-2,169.7
Saliva (n=6)	684.6	349.9-1,498.5
Human Milk (n=6)	53.4	29.8-104.3



## 9.5 Sensitivity

The minimum detectable dose of human CD40 is 3.5 pg/mL. This was determined by adding two standard deviations to the concentration corresponding to the mean O.D. of 20 zero standard replicates.

## 9.6 Linearity

To assess the linearity of the assay, human plasma and human milk samples were spiked with high concentrations of human CD40 in various matrices and diluted with the appropriate **Sample Diluent PT 4B1** to produce samples with values within the dynamic range of the assay. Urine samples were diluted with the appropriate **Sample Diluent PT 4B1** to produce samples with values within the dynamic range of the assay. Saliva samples were diluted with the appropriate **Sample Diluent PT 1** to produce samples with values within the dynamic range of the assay.

		Human plasma (Sample Diluent PT 4B1)	Urine (Sample Diluent PT 4B1)	Saliva (Sample Diluent PT 1)	Human Milk (Sample Diluent PT 4B1)
1:2	Average% of Expected	88	100	100	87
	Range (%)	87-88	-	-	81-92
1:4	Average% of Expected	97	111	109	87
	Range (%)	90-102	106-115	90-123	84-90
1:8	Average% of Expected	107	113	91	113
	Range (%)	101-112	110-119	76-106	112-114
1:16	Average% of Expected	112	107	104	120
	Range (%)	111-112	87-120	91-117	118-123

## 9.7 Specificity

This assay recognizes natural and recombinant human CD40.

The following factors prepared at 50 ng/mL were assayed and exhibited no cross-reactivity or interference.

Recombinant human:	Recombinant mouse:
BAFF R	CD40
CD27	CD40 Ligand
CD30	Fas
CD40 Ligand	
Fas	

## 10. References

1. T M Foy, et al. (1994) J Exp Med. 180(1):157-63.
2. C van Kooten, et al. (2000) J Leukoc Biol. 67(1):2-17.
3. S Ferrari, et al. (2001) Proc Natl Acad Sci U S A. 98(22):12614-9.
4. Raul Elgueta, et al. (2009) Immunol Rev. 229(1):152-72.