

# **ab46508 – Human Thrombomodulin ELISA Kit (CD141)**

## Instructions for Use

For the quantitative measurement of Human Thrombomodulin (CD141) in serum, plasma, buffered solutions and cell culture media.

This product is for research use only and is not intended for diagnostic use.

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## **1. BACKGROUND**

Abcam's Thrombomodulin (CD141) Human *in vitro* ELISA (Enzyme-Linked Immunosorbent Assay) kit is designed for the quantitative measurement of Thrombomodulin (CD141) in serum, plasma, buffered solutions and supernatants.

A monoclonal antibody specific for Thrombomodulin has been coated onto the wells of the microtiter strips provided. Samples, including standards of known Thrombomodulin concentrations, control specimens or unknowns are pipetted into these wells. During the first incubation, the standards or samples and a biotinylated monoclonal antibody specific for Thrombomodulin are simultaneously incubated. After washing, the enzyme Streptavidin-HRP, that binds the biotinylated antibody is added, incubated and washed. A TMB substrate solution is added which acts on the bound enzyme to induce a colored reaction product. The intensity of this colored product is directly proportional to the concentration of Thrombomodulin present in the samples.

This kit will recognize both endogenous and recombinant Human Thrombomodulin.

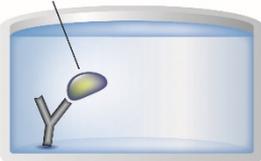
## 2. ASSAY SUMMARY

Primary Capture Antibody



Remove appropriate number of antibody coated well strips. Equilibrate all reagents to room temperature. Prepare all the reagents, samples, and standards as instructed.

Sample



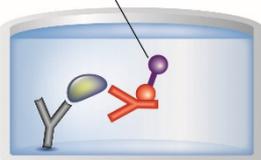
Add standard or sample to each well used.

Biotinylated Antibody



Add prepared Biotinylated labeled detector antibody. Incubate at room temperature

Streptavidin-HRP



Aspirate and wash each well. Add prepared Streptavidin-HRP mix to each well. Incubate at room temperature

Substrate Colored Product



Aspirate and wash each well. Add the TMB Solution to each well until color develops and then add the Stop Solution. Immediately begin recording the color development

## 3. PRECAUTIONS

Please read these instructions carefully prior to beginning the assay.

All kit components have been formulated and quality control tested to function successfully as a kit. Modifications to the kit components or procedures may result in loss of performance.

## 4. STORAGE AND STABILITY

Store kit at +2-8°C immediately upon receipt.

Refer to list of materials supplied for storage conditions of individual components. Observe the storage conditions for individual prepared components in section 9. Reagent Preparation.

## 5. MATERIALS SUPPLIED

Item	Quantity		Storage Condition (Before Preparation)
	1 x 96 tests	2 x 96 tests	
Thrombomodulin Microplate (12 x 8 well strips)	96 wells	2 x 96 wells	+2-8°C
Thrombomodulin Standard (Lyophilized)	2 vials	4 vials	+2-8°C
10X Standard Diluent Buffer	25 mL	25 mL	+2-8°C
Control	2 vials	4 vials	+2-8°C
Biotinylated anti-Thrombomodulin	400 µL	2 x 400 µL	+2-8°C
Biotinylated Antibody Diluent	7 mL	13 mL	+2-8°C
Streptavidin-HRP	2 x 5 µL	4 x 5 µL	+2-8°C
HRP Diluent	12 mL	23 mL	+2-8°C
200X Wash Buffer	10 mL	2 x 10 mL	+2-8°C
Chromogen TMB Substrate Solution	11 mL	24 mL	+2-8°C
Stop Reagent	11 mL	2 x 11 mL	+2-8°C

**Note:** This ELISA kit will soon contain the “Easy View” colored reagents. The Standard diluent buffer will now be red, and the Streptavidin-HRP Diluent will be green. Please note that while stock lasts you may still receive colorless diluents. This change does not impact the results provided by the kit or the assay procedure.

### **6. MATERIALS REQUIRED, NOT SUPPLIED**

These materials are not included in the kit, but will be required to successfully utilize this assay:

- Microplate reader capable of measuring absorbance at 450 nm.
- Precision pipettes to deliver 2  $\mu$ L to 1 mL volumes.
- Adjustable 1-25 mL pipettes for reagent preparation.
- 100 mL and 1 liter graduated cylinders.
- Absorbent paper.
- Distilled or deionized water.
- Tubes to prepare standard or sample dilutions.
- Log-log graph paper or computer and software for ELISA data analysis.

### **7. LIMITATIONS**

- Do not mix or substitute reagents or materials from other kit lots or vendors. Kits are QC tested as a set of components and performance cannot be guaranteed if utilized separately or substituted.
- Since exact conditions may vary from assay to assay, a standard curve must be established for every assay performed.
- Bacterial or fungal contamination of either samples or reagents or cross-contamination between reagents may cause erroneous results.

- Disposable pipette tips, flasks or glassware are preferred, reusable glassware must be washed and thoroughly rinsed of all detergents before use.
- Improper or insufficient washing at any stage of the procedure will result in either false positive or false negative results. Completely empty wells before dispensing fresh 1X Wash Buffer. Do not allow wells to sit uncovered or dry for extended periods.

### 8. TECHNICAL HINTS

- Kit components should be stored as indicated. All the reagents should be equilibrated to room temperature before use. Reconstituted standards should be discarded after use.
- Once the desired number of strips has been removed, immediately reseal the bag to protect the remaining strips from degradation.
- Use a clean disposable plastic pipette tip for each reagent, standard, or specimen addition in order to avoid cross-contamination; for the dispensing of the Stop Solution and substrate solution, avoid pipettes with metal parts.
- Thoroughly mix the reagents and samples before use by agitation or swirling.
- All residual washing liquid must be drained from the wells by efficient aspiration or by decantation followed by tapping the plate forcefully on absorbent paper. Never insert absorbent paper directly into the wells.
- The TMB solution is light sensitive. Avoid prolonged exposure to light. Also, avoid contact of the TMB solution with metal to prevent color development. Warning TMB is toxic avoid direct contact with hands. Dispose off properly.
- If a dark blue color develops within a few minutes after preparation, this indicates that the TMB solution has been contaminated and must be discarded. Read absorbances within 1 hour after completion of the assay.

## GENERAL INFORMATION

- When pipetting reagents, maintain a consistent order of addition from well-to-well. This will ensure equal incubation times for all wells.
- Dispense the TMB solution within 15 minutes following the washing of the microtiter plate.
- **This kit is sold based on number of tests. A ‘test’ simply refers to a single assay well. The number of wells that contain sample, control or standard will vary by product. Review the protocol completely to confirm this kit meets your requirements. Please contact our Technical Support staff with any questions.**

## 9. REAGENT PREPARATION

Equilibrate all reagents and samples to room temperature (18-25°C) prior to use.

### 9.1 1X Standard Diluent Buffer

Dilute the 10X Standard Diluent Buffer 10-fold in distilled water before use.

### 9.2 1X Wash Buffer

Dilute the 200X Wash Buffer Concentrate 200-fold in distilled water before use. Mix gently to avoid foaming. The 1X Wash Buffer can be prepared as needed according to the following table:

Number of well strips used	Volume of 200X Wash Buffer Concentrate (mL)	Volume of distilled water (mL)
1-6	5	995
1-12	10	1,990

### 9.3 1X Control Solution

Control vials must be reconstituted with the volume of 1X Standard Diluent Buffer that is indicated on the vial. Reconstitution of the lyophilized material with the indicated volume will yield a solution for which the Thrombomodulin concentration is stated on the vial. Allow the reconstituted 1X Control Solution to stand for 5 minutes with gentle swirling prior to use in the assay procedure. **Do not store the 1X Control Solution after reconstitution.**

## 9.4 1X Biotinylated anti-Thrombomodulin

Prepare the 1X Biotinylated anti-Thrombomodulin immediately prior to use. According to the table below, dilute the Biotinylated anti-Thrombomodulin with the Biotinylated Antibody Diluent based on the number of wells being used in the assay procedure:

Number of well strips used	Volume of Biotinylated anti-Thrombomodulin ( $\mu\text{L}$ )	Volume of Biotinylated Antibody Diluent ( $\mu\text{L}$ )
2	40	1,060
3	60	1,590
4	80	2,120
6	120	3,180
12	240	6,360

## 9.5 1X Streptavidin-HRP Solution

Add 500  $\mu\text{L}$  of HRP-Diluent to the Streptavidin-HRP vial prior to use to create a Streptavidin-HRP Concentrate. Do not keep this solution for further experiments.

Subsequently, prior to use in the assay procedure, prepare the 1X Streptavidin-HRP Solution by further diluting the Streptavidin-HRP Concentrate with HRP-Diluent. Use the table below to determine the volumes of each solution required to prepare the final 1X Streptavidin-HRP Solution:

Number of well strips used	Volume of Streptavidin-HRP ( $\mu\text{L}$ )	Volume of HRP-Diluent (mL)
2	30	2
3	45	3
4	60	4
6	75	5
12	150	10

## 10. STANDARD PREPARATION

Prepare serially diluted standards immediately prior to use. Always prepare a fresh set of standards for every use.

- 10.1 Prepare a 20 ng/mL **Standard #1** by reconstituting with the volume indicated on the vial using the 1X Standard Diluent Buffer.
- 10.2 Label tubes #2-6 and add 300  $\mu$ L of 1X Standard Diluent Buffer into each tube.
- 10.3 Prepare **Standard #2** by adding 300  $\mu$ L of Standard #1 to tube #2 and mix thoroughly.
- 10.4 Prepare **Standard #3** by adding 300  $\mu$ L of Standard #2 to tube #3 and mix thoroughly.
- 10.5 Using the table below as a guide, prepare further serial dilutions.
- 10.6 1X Standard Diluent Buffer serves as the zero standard (0 pg/mL).

# ASSAY PREPARATION

## Standard Dilution Preparation Table

Standard #	Volume to Dilute ( $\mu\text{L}$ )	Diluent ( $\mu\text{L}$ )	Total Volume ( $\mu\text{L}$ )	Starting Conc. (ng/mL)	Final Conc. (ng/mL)
1	-	-	-	20	20
2	300	300	600	20	10
3	300	300	600	10	5
4	300	300	600	5	2.5
5	300	300	600	2.5	1.25
6	300	300	600	1.25	0.625



## 11. SAMPLE PREPARATION AND STORAGE

- **Preparation of Plasma Samples**

Collect plasma using citrate, EDTA or heparin. Centrifuge samples at 1,000 x *g* for 30 minutes. Dilute samples 1:2 into 1X Standard Diluent Buffer and assay. Store un-diluted plasma samples at -20°C or below for up to 3 months. Avoid repeated freeze-thaw cycles.

- **Preparation of Serum Samples**

Samples should be collected into a serum separator tube. After clot formation, centrifuge samples at 1,000 x *g* for 10 minutes and collect serum. Dilute samples 1:2 into 1X Standard Diluent Buffer and assay. Store un-diluted serum at -20°C or below. Avoid repeated freeze-thaw cycles.

- **Preparation of Cell culture Supernatants**

Centrifuge cell culture media at 1,000 x *g* for 10 minutes to remove debris. Collect supernatants and assay. Store samples at -20°C or below. Avoid repeated freeze-thaw cycles.

- **Storage**

Aliquots of two serum samples (spiked) were stored at -20°C, 2-8°C, room temperature (RT) and at 37°C, and the Thrombomodulin levels determined after 24 hours. There is no significant loss of Thrombomodulin immunoreactivity during storage at 2-8°C and RT, but there is a significant loss of immunoreactivity when the sample is stored at 37°C.

- **Thawing of samples**

Three Aliquots of 2 samples (spiked) were stored at -20°C and thawed up to 4 times, and the Thrombomodulin levels determined. There was no significant loss of Thrombomodulin after 5 cycles of freezing and thawing.

## 12. PLATE PREPARATION

- The 96 well plate strips included with this kit is supplied ready to use. It is not necessary to rinse the plate prior to adding reagents.
- Unused well strips should be returned to the plate packet and stored at 4°C.
- For statistical reasons, we recommend each sample should be assayed with a minimum of two replicates (duplicates).
- Well effects have not been observed with this assay. Contents of each well can be recorded on the template sheet included in the Resources section.

## **13. ASSAY PROCEDURE**

- **Equilibrate all materials and prepared reagents to room temperature prior to use.**
  - **It is recommended to assay all standards, controls and samples in duplicate.**
- 13.1 Prior to use, mix all reagents thoroughly taking care not to create any foam within the vials.
  - 13.2 Determine the number of microplate strips required to test the desired number of samples, plus appropriate number of wells needed for controls and standards. Remove sufficient microplate strips from the pouch.
  - 13.3 Add 100  $\mu$ L of each standard (see Section 10), including blank controls to the appropriate wells.
  - 13.4 Add 100  $\mu$ L of sample and 1X Control Solution to the appropriate wells.
  - 13.5 Add 50  $\mu$ L of 1X Biotinylated anti-Thrombomodulin to all wells (see Section 9).
  - 13.6 Cover and incubate for 1 hours at room temperature (18-25°C).
  - 13.7 Remove the cover and wash the plate as follows:
    - 13.7.1 Aspirate the liquid from each well.
    - 13.7.2 Add 300  $\mu$ L of 1X Wash Buffer into each well
    - 13.7.3 Aspirate the liquid from each well.
    - 13.7.4 Repeat for a total of 3 washes.
  - 13.8 Add 100  $\mu$ L of 1X Streptavidin-HRP solution into all wells, including the blank wells. Re-cover and incubate at room temperature for 30 minutes.
  - 13.9 Wash as described in Step 13.7.
  - 13.10 Add 100  $\mu$ L of Chromogen TMB substrate solution into each well and incubate in the dark for 10-15 minutes at room temperature. Avoid direct exposure to light by wrapping the plate in aluminum foil.

*Note:* Incubation time of the substrate solution is usually determined by the microplate reader performances: many microplate readers record absorbance only up to 2.0 O.D. The O.D. values of the plate should be monitored and the substrate reaction stopped before positive wells are no longer accurately readable (maximum ~20 minutes).

- 13.11 Add 100  $\mu$ L of Stop Reagent into each well. Results must be taken immediately after the addition of Stop Reagent, or within one hour, if the microplate is stored at 2-8°C in the dark.
- 13.12 Read absorbance of each well on a spectrophotometer using 450 nm as the primary wavelength and optionally 620 nm (610 nm to 650 nm is acceptable) as the reference wavelength.

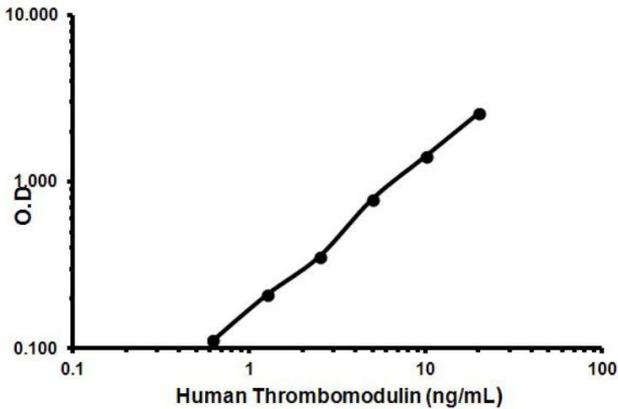
### **14. CALCULATIONS**

Calculate the mean absorbance for each set of duplicate standards, controls and samples, and subtract the average zero standard optical density. Plot the standard curve on log-log graph paper, with standard concentration on the x-axis and absorbance on the y-axis. Draw the best-fit straight line through the standard points.

For samples that have been diluted, the concentration read from the standard curve has to be multiplied by the dilution factor to determine the actual concentration of the target protein present.

## 15. TYPICAL DATA

**TYPICAL STANDARD CURVE** - Data provided for demonstration purposes only. A new standard curve must be generated for each assay performed.



Conc. (ng/mL)	O.D.
20	2.545
10	1.408
5	0.782
2.5	0.354
1.25	0.208
0.62	0.111
0	0.051

## 16. TYPICAL SAMPLE VALUES

### EXPECTED SERUM VALUES

Sample Matrix	Number of samples evaluated	Range (ng/mL)	Mean (ng/mL)	Standard deviation (ng/mL)
Serum	40	1.9 – 11.2	7.1	2.5
Plasma	40	2.9 – 7.6	5.1	1.5

### SENSITIVITY -

The sensitivity or minimum detectable dose of Thrombomodulin using this Abcam Thrombomodulin ELISA kit was found to be 0.31 ng/mL. This was determined by adding 2 standard deviations to the mean OD obtained when the zero standard was assayed in 6 independent experiments.

### PRECISION -Serum

	Intra-Assay	Inter-Assay
n=	6	6
CV (%)	3.9	9.8

### DILUTION PARALLELISM -

Three spiked Human serum samples with different levels of Thrombomodulin were analysed at different serial two fold dilutions (1:2 To 1:32) with two replicates each. Recoveries ranged from 70 to 141% with an overall mean recovery of 109%.

### SPIKE RECOVERY -

The spike recovery was evaluated by spiking in Human serum and culture medium samples different concentrations of Thrombomodulin in 3 separate experiments. Recoveries ranged from 72 to 105% with an overall mean recovery of 89%.

### **17. ASSAY SPECIFICITY**

The assay recognizes both natural and recombinant Human Thrombomodulin. To define the specificity of this ELISA several proteins were tested for cross reactivity. There was no cross reactivity observed for any protein tested (IL-1 $\alpha$ , IL-1 $\beta$ , IL-2, IL-17FA, IL-17F, IFN $\gamma$ , CD116, CD54, CD138, and ICAM-2).

## 18. TROUBLESHOOTING

Problem	Cause	Solution
Poor standard curve	Inaccurate pipetting	Check pipettes
	Improper standards dilution	Prior to opening, briefly spin the stock standard tube and dissolve the powder thoroughly by gentle mixing
Low Signal	Incubation times too brief	Ensure sufficient incubation times; change to overnight standard/sample incubation
	Inadequate reagent volumes or improper dilution	Check pipettes and ensure correct preparation
Large CV	Plate is insufficiently washed	Review manual for proper wash technique. If using a plate washer, check all ports for obstructions
	Contaminated wash buffer	Prepare fresh wash buffer
Low sensitivity	Improper storage of the ELISA kit	Store the reconstituted protein at -80°C, all other assay components 4°C. Keep substrate solution protected from light.

19. NOTES





**For all technical and commercial enquires please go to:**

[www.abcam.com/contactus](http://www.abcam.com/contactus)

[www.abcam.cn/contactus](http://www.abcam.cn/contactus) (China)

[www.abcam.co.jp/contactus](http://www.abcam.co.jp/contactus) (Japan)