

## COVID-19 S-Protein (S1RBD) ELISA Kit

**Catalog Number:** ELV-COVID19S1

User Manual

Last Revised: January 22, 2024



Protocol Video

*Please read entire manual carefully before starting experiment.*

### Introduction

The spike protein (S-protein) and nucleocapsid protein (N-protein) are encoded by all coronaviruses, including the coronavirus (COVID-19). The spike protein (S-protein) performs two primary tasks that aid in host infection: 1) mediates the attachment between the virus and host cell surface receptors, and 2) facilitates viral entry into the host cell by assisting in the fusion of the viral and host cell membranes.

The RayBio® COVID-19 S-Protein (S1RBD) ELISA (Enzyme-Linked Immunosorbent Assay) kit is an in vitro enzyme-linked immunosorbent assay for the quantitative measurement of COVID-19 S-Protein (S1RBD) in serum (plasma is not recommended in this assay) and cell culture supernatants. This assay employs an antibody specific for COVID-19 S-Protein (S1RBD) coated on a 96-well plate. Standards and samples are pipetted into the wells and COVID-19 S-Protein (S1RBD) present in a sample is bound to the wells by the immobilized antibody. The wells are washed and biotinylated anti-COVID-19 S-Protein (S1RBD) antibody is added. After washing away unbound biotinylated antibody, HRP-conjugated streptavidin is pipetted to the wells. The wells are again washed, a TMB substrate solution is added to the wells and color develops in proportion to the amount of COVID-19 S-Protein (S1RBD) bound. The Stop Solution changes the color from blue to yellow, and the intensity of the color is measured at 450 nm.

**Short on sample, or need higher sensitivity?** Check out the [IQELISA® Immuno-PCR assay platform](#) and our [Simoa® Single Molecule Protein Detection Services](#).

### Storage

The entire kit may be stored at -20°C for up to 1 year from the date of shipment. Avoid repeated freeze-thaw cycles. The kit may be stored at 4°C for up to 6 months. For extended storage, it is recommended to store at -80°C. For prepared reagent storage, see table below.

## Reagents

Component	Size / Description	Storage / Stability After Preparation
SARS-CoV-2 S-Protein (S1RBD) Microplate	96 wells (12 strips x 8 wells) coated with anti-SARS-CoV-2 S-Protein (S1RBD).	1 month at 4°C*
SARS-CoV-2 S-Protein (S1RBD) Standard Protein	2 vials of SARS-CoV-2 S-Protein (S1RBD). 1 vial is enough to run each standard in duplicate.	1 week at -80°C
SARS-CoV-2 S-Protein (S1RBD) Detection Antibody	2 vials of biotinylated anti-SARS-CoV-2 S-Protein (S1RBD). Each vial is enough to assay half the microplate.	5 days at 4°C
Wash Buffer	25 ml of 20X concentrated solution.	1 month at 4°C
HRP-Streptavidin	200 µl 200X concentrated HRP-conjugated streptavidin.	Do not store and reuse.
TMB One-Step Substrate Reagent	12 ml of 3,3,5,5'-tetramethylbenzidine (TMB) in buffer solution.	N/A
Stop Solution	8 ml of 0.2 M sulfuric acid.	N/A
Assay Diluent A	30 ml of diluent buffer, 0.09% sodium azide as preservative.	N/A
Assay Diluent B	15 ml of 5X concentrated buffer.	1 month at 4°C

\*Return unused wells to the pouch containing desiccant pack, reseal along entire edge.

## Additional Materials Required

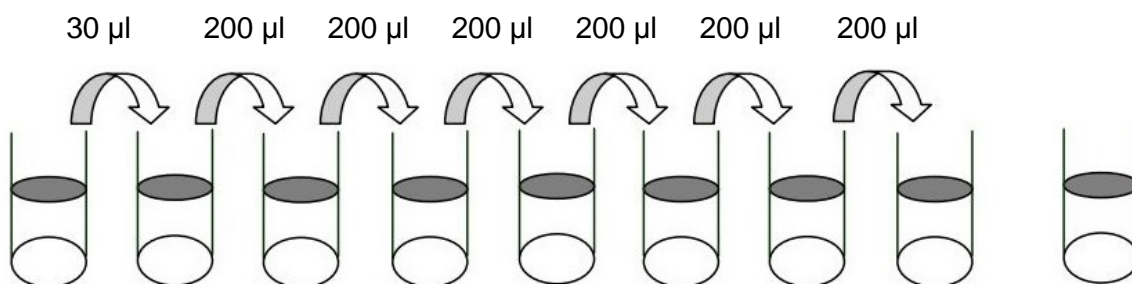
1. Microplate reader capable of measuring absorbance at 450 nm.
2. Precision pipettes to deliver 2 µl to 1 ml volumes.
3. Adjustable 1-25 ml pipettes for reagent preparation.
4. 100 ml and 1 liter graduated cylinders.
5. Absorbent paper.
6. Distilled or deionized water.
7. Log-log graph paper or computer and software for ELISA data analysis.
8. Tubes to prepare standard or sample dilutions.

## Reagent Preparation

1. Bring all reagents and samples to room temperature (18 - 25°C) before use.
2. Assay Diluent B should be diluted 5-fold with deionized or distilled water before use.
3. Sample dilution: Assay Diluent A should be used for dilution of serum samples. 1X Assay Diluent B should be used for dilution of culture supernatants. The suggested dilution for normal serum/plasma is 4 fold.

**Note:** Levels of S-Protein (S1RBD) may vary between different samples. Optimal dilution factors for each sample must be determined by the investigator.

4. Preparation of standard: Briefly spin a vial of standard protein. Add 400 µl Assay Diluent A (for serum samples) or 1X Assay Diluent B (for cell culture supernates) into the Standard Protein vial to prepare a 25 ng/ml standard. Dissolve the powder thoroughly by a gentle mix. Add 30 µl of the standard solution from the vial of Standard Protein, into a tube with 470 µl 1X Assay Diluent A (for serum samples) or 1X Assay Diluent B (for cell culture supernates) to prepare a 1500 pg/ml standard solution. Pipette 300 µl Assay Diluent A or 1X Assay Diluent B into each tube. Use the 1500 pg/ml standard solution to produce a dilution series (shown below). Mix each tube thoroughly before the next transfer. Assay Diluent A or 1x Assay Diluent B serves as the zero standard (0 pg/ml).



		Std1	Std2	Std3	Std4	Std5	Std6	Std7	Zero Standard
<b>Diluent volume</b>	Standard + 400 µl	470 µl	300 µl	300 µl	300 µl	300 µl	300 µl	300 µl	300 µl
<b>Conc.</b>	25 ng/ml	1500 pg/ml	600 pg/ml	240 pg/ml	96 pg/ml	38.40 pg/ml	15.36 pg/ml	6.14 pg/ml	0 pg/ml

5. If the Wash Buffer (20X) contains visible crystals, warm to room temperature and mix gently until dissolved. Dilute 20 ml of Wash Buffer into deionized or distilled water to yield 400 ml of 1X Wash Buffer.
6. Briefly spin the Detection Antibody vial before use. Add 100 µl of 1X Assay Diluent B into the vial to prepare a detection antibody concentrate. Pipette up and down to mix gently (the concentrate can be stored at 4°C for 5 days). The detection antibody concentrate should be diluted 80-fold with 1X Assay Diluent B and used in step 5 of Part VI Assay Procedure.

7. Briefly spin the HRP-Streptavidin concentrate vial and pipette up and down to mix gently before use, as precipitates may form during storage. HRP-Streptavidin concentrate should be diluted 200-fold with 1X Assay Diluent B.

For example: Briefly spin the HRP-Streptavidin vial and pipette up and down to mix gently. Add 50 µl of HRP-Streptavidin concentrate into tube with 10 ml 1X Assay Diluent B to prepare a 200-fold diluted HRP-Streptavidin solution (don't store the diluted solution for next day use). Mix well.

## Assay Procedure

1. Bring all reagents and samples to room temperature (18 - 25°C) before use. It is recommended that all standards and samples be run at least in duplicate.
2. Label removable 8-well strips as appropriate for your experiment.
3. Add 100 µl of each standard (see Reagent Preparation step 4) and sample into appropriate wells. Cover wells and incubate for 2.5 hours at room temperature with gentle shaking.
4. Discard the solution and wash 4 times with 1X Wash Solution. Wash by filling each well with Wash Buffer (300 µl) using a multi-channel Pipette or autowasher. Complete removal of liquid at each step is essential to good performance. After the last wash, remove any remaining Wash Buffer by aspirating or decanting. Invert the plate and blot it against clean paper towels.
5. Add 100 µl of 1X prepared biotinylated antibody (Reagent Preparation step 6) to each well. Incubate for 1 hour at room temperature with gentle shaking.
6. Discard the solution. Repeat the wash as in step 4.
7. Add 100 µl of prepared Streptavidin solution (see Reagent Preparation step 7) to each well. Incubate for 45 minutes at room temperature with gentle shaking.
8. Discard the solution. Repeat the wash as in step 4.
9. Add 100 µl of TMB One-Step Substrate Reagent to each well. Incubate for 30 minutes at room temperature in the dark with gentle shaking.
10. Add 50 µl of Stop Solution to each well. Read at 450 nm immediately.

## Assay Procedure Summary

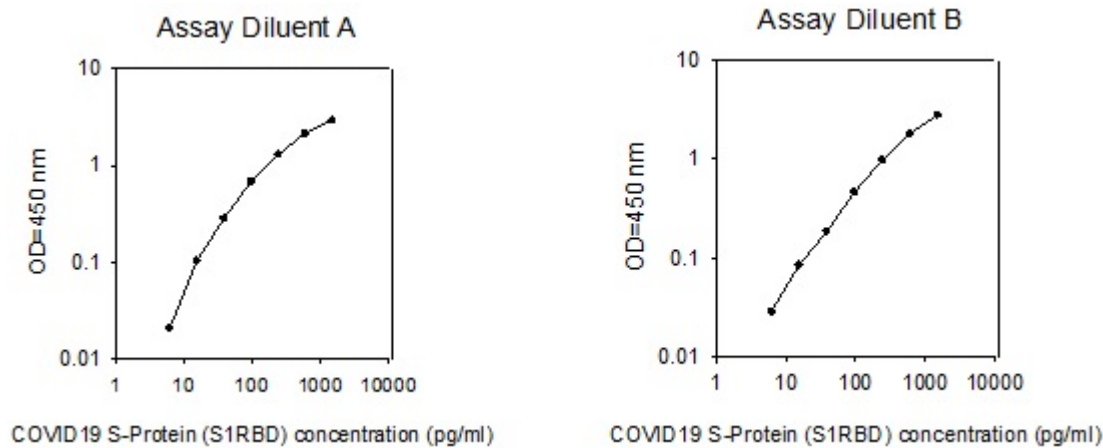
1. Prepare all reagents, samples and standards as instructed.
2. Add 100 µl standard or sample to each well. Incubate 2.5 hours at room temperature.
3. Add 100 µl prepared biotin antibody to each well. Incubate 1 hour at room temperature.
4. Add 100 µl prepared Streptavidin solution. Incubate 45 minutes at room temperature.
5. Add 100 µl TMB One-Step Substrate Reagent to each well. Incubate 30 minutes at room temperature.
6. Add 50 µl Stop Solution to each well. Read at 450 nm immediately.

## Calculation of Results

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 or using Sigma plot software, with standard concentration on the x-axis and absorbance on the y-axis. Draw the best-fit straight line through the standard points.

### A. Typical Data

These standard curves are for demonstration only. A standard curve must be run with each assay.



### B. Sensitivity

The minimum detectable dose of SARS-CoV-2 S-Protein (S1RBD) was determined to be 4.5 pg/ml.

Minimum detectable dose is defined as the analyte concentration resulting in an absorbance that is 2 standard deviations higher than that of the blank (diluent buffer).

### C. Spiking & Recovery

Recovery was determined by spiking various levels of SARS-CoV-2 S-Protein (S1RBD) into the sample types listed below. Mean recoveries are as follows:

Sample Type	Average % Recovery	Range (%)
Serum	104.6	94-117
Cell culture media	105.3	91-113

#### D. Linearity

Sample Type		Serum	Cell Culture Media
1:2	Average % of Expected	92.26	95.43
	Range (%)	90-94	93-98
1:4	Average % of Expected	79.23	74.92
	Range (%)	77-82	72-78

#### E. Reproducibility

Intra-Assay CV%: <10%

Inter-Assay CV%: <12%

#### Specificity

This ELISA antibody pair detects COVID-19 S Protein (S1RBD).

## Troubleshooting Guide

Problem	Cause	Solution
Poor standard curve	<ul style="list-style-type: none"> <li>• Inaccurate pipetting</li> <li>• Improper standard dilution</li> </ul>	<ul style="list-style-type: none"> <li>• Check pipettes</li> <li>• Briefly centrifuge the standard protein and dissolve the powder thoroughly by gently mixing</li> </ul>
Low signal	<ul style="list-style-type: none"> <li>• Improper preparation of standard and/or biotinylated antibody</li> <li>• Too brief incubation times</li> <li>• Inadequate reagent volumes or improper dilution</li> </ul>	<ul style="list-style-type: none"> <li>• Briefly spin down vials before opening. Dissolve the powder thoroughly.</li> <li>• Ensure sufficient incubation time. Assay procedure step 3 may be done overnight at 4°C with gentle shaking (note: may increase overall signals including background).</li> <li>• Check pipettes and ensure correct preparation</li> </ul>
Large CV	<ul style="list-style-type: none"> <li>• Inaccurate pipetting</li> <li>• Air bubbles in wells</li> </ul>	<ul style="list-style-type: none"> <li>• Check pipettes</li> <li>• Remove bubbles in wells</li> </ul>
High background	<ul style="list-style-type: none"> <li>• Plate is insufficiently washed</li> <li>• Contaminated wash buffer</li> </ul>	<ul style="list-style-type: none"> <li>• Review the manual for proper wash. If using a plate washer, ensure that all ports are unobstructed.</li> <li>• Make fresh wash buffer</li> </ul>
Low sensitivity	<ul style="list-style-type: none"> <li>• Improper storage of the ELISA kit</li> <li>• Stop solution</li> </ul>	<ul style="list-style-type: none"> <li>• Store your standard at &lt;-70°C after reconstitution, others at 4°C. Keep substrate solution protected from light.</li> <li>• Add stop solution to each well before reading plate</li> </ul>