

[Rat Insulin ELISA Kit (S-type)]

(Code. No.:AKRIN-010S)

Please, read this instruction carefully before use.

This kit is manufactured by Shibayagi Co., Ltd.

Use only the current version of Instruction Manual enclosed with the kit! For the detailed assay procedure, refer to [Key points for ELISA by movie](#) on our website:

<http://www.shibayagi.co.jp/index-E.htm>

1. Intended use

Rat Insulin ELISA Kit (S-type) is a sandwich ELISA system for quantitative measurement of rat insulin (this kit can restrain cross reactivity with proinsulin and assay insulin specifically). This is intended for research use only.

2. Storage and expiration

When the complete kit is stored at 2-8°C, the kit is stable until the expiration date shown on the label on the box. Opened reagents should be used as soon as possible to avoid less than optimal performance caused by storage environment.

3. Introduction

Insulin is a peptide hormone secreted from B cells of islet of Langerhans in the pancreas with a molecular weight of about 5,800 and pI 5.4. It is consisted of 2 chains, A and B. It has 3 disulfide bonds formed between A6 and A11, A7 and B7, and A20 and B19. Insulin exists as a dimer molecule in acidic to neutral solution without Zn ion, and as a hexamer including two Zn ions in neutral solution if Zn ions are present. Main targets of insulin are liver, muscle, and adipose tissue. Insulin actions in these targets are as follows. In the liver, it promotes glycogenesis, protein synthesis, fatty acid synthesis, carbohydrate utilization, and inhibition of gluconeogenesis.

In the muscle, it promotes membrane permeability for carbohydrates, amino acids and K ion, glycogenesis, protein synthesis, while inhibits protein degradation. In the adipose tissue, it promotes membrane permeability for glucose and fatty acid synthesis. A precursor of insulin, called proinsulin with a single polypeptide chain, is first synthesized in the cell, then sulfide bonds are formed, and finally by enzymatic cutting at two sites, active insulin and c-peptide (connecting peptide) are formed. Potency of an insulin preparation was originally determined by bioassay. However, whole body bioassay inevitably shows poor precision owing to individual variation.

WHO issued 1st International Standard for human insulin in 1986 which has the potency of 26 IU/mg (0.038 mg/IU). In the same year, 1st International Standard of bovine insulin, the potency of which is 25.7 IU/mg, and Porcine insulin 1st International Standard, 26 IU/mg, were provided. Before these standards, in 1974, 1st International Reference Preparation of human insulin for immunoassay was provided as 3 IU/ampoule. Based on the above data, if the biological activity of insulin per molecule is the same among various animal species, potencies of animal insulin might be calculated from their molecular weights. But, so far, we do not have experimental proof about this. As the molecular weights of insulin of various animals are nearly the same, and the differences are within 1%, there may be no critical fault if we think that the general potency of insulin is 26 IU/mg. Rat and mouse have two molecular species of insulin, type 1 and type 2. Amino acid sequences of these molecular species are same between rat and mouse. But as their ratios are different between these two animal species, it is recommended to use standard preparation derived from each animals.

4. Assay principle

In Shibayagi's Rat Insulin ELISA Kit (S-type), biotin conjugated anti insulin, and standard or sample are incubated in monoclonal anti-insulin-coated wells to capture insulin bound with biotin conjugated anti insulin. After 2 hours incubation and washing, HRP (horse radish peroxidase) conjugated streptavidin is added, and incubated for 30 minutes. After washing, HRP conjugated streptavidin remaining in wells are reacted with a substrate chromogen reagent (TMB) for 20 minutes, and reaction is stopped by addition of acidic solution, and absorbance of yellow product is

measured spectrophotometrically at 450 nm. The absorbance is proportional to insulin concentration. The standard curve is prepared by plotting absorbance against standard insulin concentrations. Insulin concentrations in unknown samples are determined using this standard curve.

5. Precautions

- For professional use only, beginners are advised to use this kit under the guidance of experienced person. In manual operation, proficiency in pipetting technique is recommended.
- Use clean laboratory glassware.
- Avoid contact with the acidic Reaction stopper solution and Chromogenic substrate solution containing hydrogen peroxide and tetramethylbenzidine (TMB). Wear gloves and eye and clothing protection when handling these reagents.
- Be careful not to allow the reagent solutions of the kit to touch the skin, eyes and mucus membranes. Especially be careful for the reaction stopper because it is 1M sulfuric acid. The reaction stopper and the substrate solution may cause skin/eyes irritation. In case of contact with these wash skin/eyes thoroughly with water and seek medical attention, when necessary.
- Do not drink, eat or smoke in the areas where assays are carried out.
- In treating assay samples of animal origin, be careful for possible biohazards.
- This kit contains components of animal origin. These materials should be handled as potentially infectious.
- Unused samples and used tips should be rinsed in 1% formalin, 2% glutal aldehyde, or more than 0.1% sodium hypochlorite solution for more than 1 hour, or be treated by an autoclave before disposal.
- Dispose consumable materials and unused contents in accordance with applicable regional/national regulatory requirements.
- The materials must not be pipetted by mouth.
- In order to avoid dryness of wells, contamination of foreign substances and evaporation of dispensed reagents, never forget to cover the well plate with a plate seal supplied, during incubation.
- ELISA can be easily affected by your laboratory environment. Room temperature should be at 20-25°C strictly. Avoid airstream velocity over 0.4 m/sec. ① (including wind from air conditioner), and humidity less than 30%. ①For airstream, refer to [\[Assay circumstance\]](#) on our web site.

6. Reagents supplied

Components	State	Amount
(A) Anti-Insulin-coated plate	Dried-plate.	96 wells/1 plate
(B) Standard Rat Insulin solution (200 ng/ml) (derived from rat pancreas extract)	Concentrated. Use after dilution	50 µl/1 vial
(C) Buffer solution	Ready for use.	60 ml/1 bottle
(D) Biotin conjugated anti-insulin	Concentrated. Use after dilution.	200 µl/1 vial
(E) HRP conjugated streptavidin	Concentrated. Use after dilution.	200 µl/1 vial
(F) Substrate chromogen reagent (TMB)	Ready for use.	12 ml/1 bottle
(H) Reaction stopper (1M H ₂ SO ₄) Be careful!	Ready for use.	12 ml/1 bottle
(I) Washing buffer concentrate (10x)	Concentrated. Use after dilution.	100 ml/1 bottle
Plate seal	—	3 sheets
Instruction Manual	—	1 copy

7. Equipments or supplies required but not supplied

Use as a check box

- Purified water (distilled water)
- Test tubes for preparation of standard solution series.
- Glassware for dilution of washing buffer (a graduated cylinder, a bottle)
- Pipettes (disposable tip type). One should be able to deliver 10 µl precisely, and another for 50~200 µl.

- Syringe-type repeating dispenser like Eppendorf multipette plus which can dispense 100 µl.
- Paper towel to remove washing buffer remaining in wells.
- A vortex-type mixer.
- A shaker for 96 well-plate (600-1,200rpm)
- An automatic washer for 96 well-plate (if available), or a washing bottle with a jet nozzle (refer to our web movie [\[Washing of microplate\]](#)).
- A 96 well-plate reader (450nm ±10nm, 620nm: 600-650nm)
- Software for data analysis, if available. Shibayagi is proposing the use of assay results calculation template for EXCEL. Please check our website (http://www.shibayagi.co.jp/en/tech_003.html).

8. Preparation of reagents

- ◆ Bring all reagents of the kit to room temperature (20-25 °C) before use.
- ◆ Prepare reagent solutions in appropriate volume for your assay. Do not store the diluted reagents.

【Concentrated reagents】

[(B) Standard Rat Insulin solution (200 ng/ml)]

Make a serial dilution of master standard (200 ng/ml) solution to prepare each standard solution.

Volume of standard solution	Buffer solution	Concentration (ng/ml)	Concentration (µIU/ml)
Original solution; 10 µl	190 µl	10	260
10 ng/ml solution: 50 µl	50 µl	5.0	130
5.0 ng/ml solution: 50 µl	50 µl	2.5	65
2.5 ng/ml solution: 50 µl	75 µl	1.0	26
1.0 ng/ml solution: 50 µl	50 µl	0.5	13
0.5 ng/ml solution: 50 µl	50 µl	0.25	6.5
0.25 ng/ml solution: 50 µl	75 µl	0.1	2.6
0 (Blank)	50 µl	0	0

[(D) Biotin conjugated anti-insulin]

Prepare working solution by dilution of (D) with the buffer solution (C) to **1:100**.

10 ml of the diluted solution is enough for 96 wells.

[(E) HRP conjugated streptavidin]

Prepare working solution by dilution of (E) with the buffer solution (C) to **1:100**.

10 ml of the diluted solution is enough for 96 wells.

[(I) Washing buffer concentrate (10x)]

Dilute 1 volume of the washing buffer concentrate (10x) to 10 volume with deionized water to prepare working solution. Example: 100 ml of washing buffer concentrate (10x) and 900ml of deionized water.

【Storage and stability】

[(A) Anti-Insulin-coated plate]

If seal is not removed, put the strip back in a plastic bag with zip-seal originally used for well-plate container and store at 2-8 °C. The strip will be stable until expiration date.

[(B) Standard Rat Insulin solution (200 ng/ml)]

Standard solutions prepared above should be used as soon as possible, and should not be stored.

*Unit reduction for µIU/ml is 26 IU/mg. (Refer to **3. Introduction.**)

[(C) Buffer solution] & [(F) Substrate chromogen reagent (TMB)]

If not opened, store at 2-8 °C. It maintains stability until expiration date. Once opened, we recommend using them as soon as possible to avoid influence by environmental condition.

[(D) Biotin conjugated anti insulin] & [(E) HRP conjugated streptavidin]

Unused working solution (already diluted) should be disposed.

[(H) Reaction stopper (1 M H₂SO₄)]

Close the stopper tightly and store at 2-8 °C. It maintains stability until expiration date.

[(I) Washing buffer concentrate (10x)]

The rest of undiluted buffer: if stored tightly closed at 2-8 °C, it is stable until expiration date.

Dispose any unused diluted buffer.

9. Technical tips

- Be careful to avoid any contamination of assay samples and reagents. We recommend the use of disposal pipette tips, and 1 tip for 1 well.
- The reagents are prepared to give accurate results only when used in combination within the same box. Therefore, do not combine the reagents from kits with different lot numbers. Even if the lot number is the same, it is best not to mix the reagents with those that have been preserved for some period.
- Optimally, the reagent solutions of the kit should be used immediately after reconstitution. Otherwise, store them in a dark place at 2-8 °C.
- Time the reaction from the pipetting of the reagent to the first well.
- Dilution of the assay sample must be carried out using the buffer solution provided in the kit.
- The substrate chromogen reagent (TMB) should be almost colorless before use. It turns blue during reaction, and gives yellowish color after addition of reaction stopper. Greenish color means incomplete mixing.
- To avoid denaturation of the coated antibody, do not let the plate go dry.
- When ELISA has to be done under the airstream velocity over 0.4 m/sec. and the humidity less than 30%, seal the well plate with a plate seal and place the well plate in an incubator or a styrofoam box in each step of incubation. For more details, watch our web movie [\[Assay circumstance\]](#).

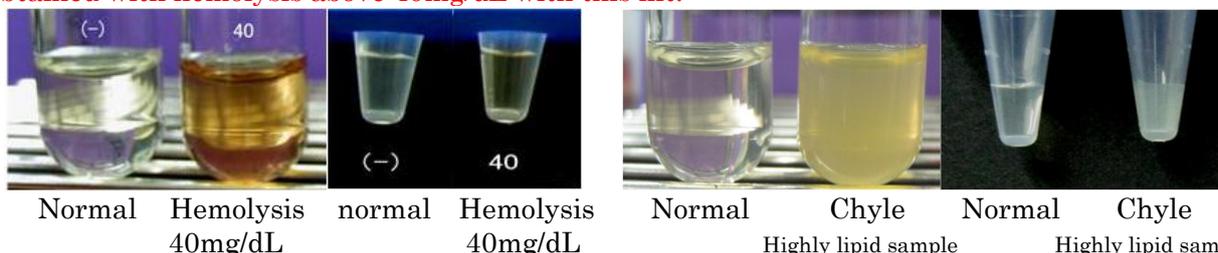
10. Preparation of samples

This kit is intended to measure rat serum, plasma (heparin is recommended for plasma), culture medium and tissue/cell extracts. The necessary sample volume for the standard procedure is 10 µl.

Samples should be immediately assayed or stored below -35 °C for several days. Defrosted samples should be mixed thoroughly for best results. Do not repeat freeze-and-thaw cycles.

[Hemolytic and hyperlipemic serum samples are not suitable.](#)

*** To avoid influence of blood (high lipid or hemolysis, etc.), if your original samples have heavy chyle or hemolysis as the pictures below, do not use them for assay. Abnormal value might be obtained with hemolysis above 40mg/dL with this kit.**



If presence of interfering substance is suspected, examine by dilution test at more than 2 points. Dilution of a sample should be made in a test tube using buffer solution prior to adding them to wells. Turbid samples or those containing insoluble materials should be centrifuged before testing to remove any particulate matter.

Storage and stability

Insulin samples will be inactivated if stored at 2-8°C. If it is necessary to store sample in refrigerator (2-8°C), add aprotinin at final concentration of 100-500KIU/ml. (KIU: kallikrein inhibitor unit).

If you have to store assay samples for a longer period, snap-freeze samples and keep them below -35°C. Avoid repeated freeze-thaw cycles.

- Testing for compatibility of your samples with Shibayagi's kit using a positive sample.

Due to various factors of your sampling conditions (anesthesia, anesthetics, anticoagulants, uprising of pH caused by loss of CO₂ during standing and storage, preservatives used, evaporation and condensation during storage in a freezer, etc), sometimes the kit does not work well with your samples. If the standard curve is in a good shape, while your samples give low absorbance, please check the compatibility of your samples (serum, plasma, or culture medium) by a simple recovery test as follows.

Place 90 µl of your sample (e.g. a sample from control group in your experiment) in a small test tube, then add 10 µl of the highest standard solution (10ng/ml). Assay this mixture together with the original sample, and compare the assay values. The assay value of the mixture will be around

[0.9 x original sample + 0.1 x highest standard concentration]. If the assay value is increased as expected, the assay system is working well with your sample.

Especially when you use Shibayagi's kit for the first time, we recommend you to run this simple recovery test.

● Quality control samples

We recommend preparing quality control samples of your own laboratory by storing many aliquots of serum, plasma or culture medium with known amount of the substance to be measured after initial testing. Keep them in small and tightly capped sample tubes below -35°C . If the sample tube is too big, water will be lost during storage. If possible, prepare high and low controls.

Measure these control samples along with your samples in every run to confirm the reproducibility and successful performance of the assay system.

11. Assay procedure

Remove the cover sheet of the anti-Insulin-coated plate after bringing up to room temperature.

- (1) Pipette 100 μl of biotin conjugated anti-insulin to all wells. Shake the plate gently on a plate shaker. (*③)
- (2) Pipette 10 μl of sample to the designated sample wells.
- (3) Pipette 10 μl of standard solution to the wells designated for standards.
- (4) Shake the plate gently on a plate shaker (*③).
- (5) Stick a plate seal (*④) on the plate and incubate for 2 hours at $20-25^{\circ}\text{C}$.
- (6) Discard the reaction mixture. Rinse wells by filling the wells with washing buffer and discard 4 times(*②), then strike the plate upside-down onto several sheets of paper towel to remove residual buffer in the wells.
- (7) Pipette 100 μl of HRP conjugated streptavidin to all wells, and shake as step (4).
- (8) Stick a plate seal (*④) on the plate and incubate the plate for 30 minutes at $20-25^{\circ}\text{C}$.
- (9) Discard the reaction mixture, and then wash as step (6).
- (10) Pipette 100 μl of substrate chromogen reagent to wells, and shake as step (4).
- (11) Stick a plate seal (*④) on the plate and incubate the plate for 20 minutes at $20-25^{\circ}\text{C}$.
- (12) Add 100 μl of the reaction stopper to all wells and shake as step (4).
- (13) Measure the absorbance of each well at 450 nm (reference wavelength, 620nm) using a plate reader within 30 minutes.

*Refer to the page 7-8 for notes of *②, *③ and *④.

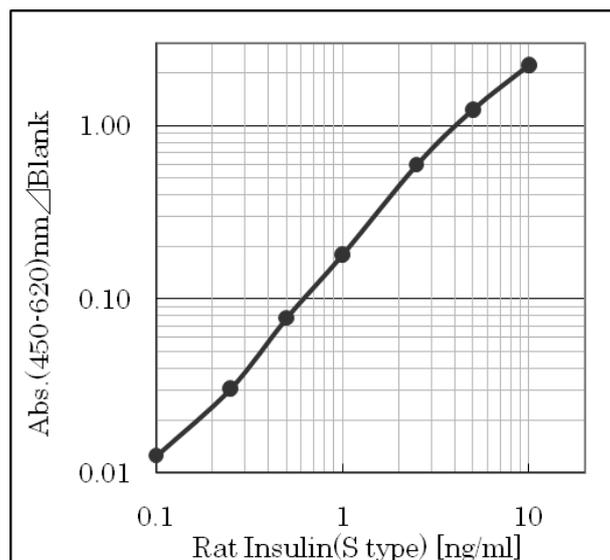
12. Calculations

- (1) Prepare a standard curve using semi-logarithmic or two-way logarithmic section paper by plotting absorbance* (Y-axis) against insulin concentration (ng/ml) on X-axis.
*Absorbance at 450nm minus absorbance at 620nm.

- (2) Using the standard curve, read the insulin concentration of a sample at its absorbance*, and multiply the assay value by dilution factor if the sample has been diluted. Though the assay range is wide enough, in case the absorbance of some samples is higher than that of the highest standard, please repeat the assay after proper dilution of samples with the buffer solution.

* We recommend the use of 3rd order regression curve for log-log plot, or 4 parameters method for log-normal plot in computer calculation.

Physiological or pathological situation of animals should be judged comprehensively taking other examination results into consideration.



Rat insulin assay standard curve (an example)
Absorbance may change due to assay

13. Performance characteristics

- Assay range

The assay range of the kit is 0.1 ~ 10 ng/ml.

- Specificity

The antibodies used in this kit are specific to insulin. Cross-reactivity of the kit is shown below.

Substances	Cross-reactivity	Remarks
Rat C-peptide	—	At 100 ng/ml
Rat proinsulin	Less than 5 %	At 100 ng/ml
Mouse insulin	+	At 10 ng/ml
Human insulin	+	At 10 ng/ml

For details, refer to: <http://www.shibayagi.co.jp/en/pdf/InsulinSpecificity.pdf>

- Precision of assay

Within assay variation (3 samples, 8 replicates assay), Mean CV is less than 5 %.

- Reproducibility

Between assay variation (3 samples, 4 days, assayed in triplicates), Mean CV is less than 5 %

- Recovery test

Standard insulin was added in 4 concentrations to 2 serum samples and assayed.

The recoveries were 94 ~101%

- Dilution test

Two serum samples were serially diluted by 3 steps.

The dilution curves showed excellent linearity with $R^2 = 0.999 \sim 1.00$

14. Reference assay data

Mean Insulin assay value: 0.872 ng/ml, SD: 0.6747 ng/ml

Rat strain: Wistar, 4~16w males and females, ad libitum feeding

Number of animals: 130 / serum

These data should be considered as guidance only. Each laboratory should establish its own normal and pathological reference ranges for insulin levels independently.

15. Trouble shooting

- Low absorbance in all wells

Possible explanations:

- 1) The standard or samples might not be added.
- 2) Reagents necessary for coloration such as Biotin conjugated anti-insulin, HRP conjugated streptavidin, or Substrate chromogen reagent might not be added.
- 3) Wrong reagents related to coloration might have been added. Wrong dilution of biotin conjugated anti-insulin or HRP conjugated streptavidin.
- 4) Contamination of enzyme inhibitor(s).
- 5) Influence of the temperature under which the kits had been stored.
- 6) Excessive hard washing of the well plate.
- 7) Addition of substrate chromogen reagent soon after taking out from a refrigerator might cause poor coloration owing to low temperature.

- The OD of blank is higher than that of the lowest standard concentration (0.1 ng/ml)

Possible explanations:

Improper or inadequate washing. (Change washing repetition from 4 times to 5-8 times after the reaction with HRP-avidin.)

- High coefficient of variation (CV)

Possible explanation:

- 1) Improper or inadequate washing.
- 2) Improper mixing of standard or samples.
- 3) Pipetting at irregular intervals.

- Q-1: Can I divide the plate to use it for the other testing?

A-1: Yes, cut off the clear seal on the plate with cutter along strip. Put the residual plate, which is still the seal on, in a refrigerator soon.

● Q-2: I found 96 well-plate is empty when I opened the box.

A-2: As this kit is dried type, not preservation stabilizer is added.

For detailed FAQs and explanations, refer to “**Trouble shooting and Important Points in Shibayagi’s ELISA kits**” on our website (http://www.shibayagi.co.jp/en/tech_004.html).

16. References

Please, refer to [\[User’s Publication\]](#) on our website.

Summary of assay procedure : Use as a check box

***First, read this instruction manual carefully and start your assay after confirmation of details.**

For more details, watch our web movie [\[ELISA by MOVIE\]](#) on our website.

- Bring the well-plate and all reagents back to **20-25°C for 2 hours**.
- Washing buffer concentrate must be diluted to **10 times** by purified water that returned to 20-25°C.
- Standard Rat Insulin solution dilution example:

Concentration (ng/ml)	10	5.0	2.5	1.0	0.5	0.25	0.1	0
Std. Insulin solution (μl) → Orig.sol.	10	50*	50*	50*	50*	50*	50*	0
Buffer solution (μl)	190	50	50	75	50	50	75	50

Note: *One rank higher standard

- Prepare the positive sample.
- Biotin conjugated anti-insulin(D) : Dilute to **100 times** by using buffer solution(C) returned to 20-25°C.

Precautions & related info

<input type="checkbox"/> Anti-Insulin-coated plate (dried plate)		
<input type="checkbox"/> ↓ No need to wash the plate		
<input type="checkbox"/> Biotin conjugated anti-insulin	100 μl	*⑦ [Handling of pipetting]
<input type="checkbox"/> ↓ Shaking(*③)		
<input type="checkbox"/> Samples/Standards	10 μl	*⑦ [Handling of pipetting]
<input type="checkbox"/> ↓ Shaking(*③), Incubation for 2 hours at 20-25°C. (Standing(*④))		*⑧ [Assay circumstance]
<input type="checkbox"/> HRP conjugated streptavidin(E)		Dilute reagents during the first reaction.
<input type="checkbox"/> Dilute to 100 times by using buffer solution(C) and use.		*⑥
<input type="checkbox"/> ↓ Washing 4 times(*②)		
<input type="checkbox"/> HRP conjugated streptavidin	100 μl	*⑦ [Handling of pipetting]
<input type="checkbox"/> ↓ Shaking(*③), Incubation for 30 minutes at 20-25°C. (Standing(*④))		*⑧ [Assay circumstance]
<input type="checkbox"/> ↓ Washing 4 times(*②)		*⑥
<input type="checkbox"/> Substrate chromogen reagent (TMB)	100 μl	After dispense, the color turns to blue depending on the concentration.
<input type="checkbox"/> ↓ Shaking(*③), Incubation for 20 minutes at 20-25°C. (Standing(*④))		*⑧ [Assay circumstance]
<input type="checkbox"/> Reaction stopper (1M H ₂ SO ₄)	100 μl	After dispense, the color turns to yellow depending on the concentration.
<input type="checkbox"/> ↓ Shaking(*③)		Immediately shake.
<input type="checkbox"/> Measurement of absorbance (450 nm, Ref 620 nm(*⑤))		Ref. wave cancels the dirt in the back of plate.

*②After dispensing wash buffer to wells, lightly shake the plate on your palm for 10 sec and remove the buffer. Guideline of washing volume: 300μl/well for an automatic washer and for a pipette if the washing buffer is added by pipette. In case of washing by using 8 channel pipette, sometimes the back ground tends to be high. If so, change washing frequency from 4

times to 5-8 times at the constant stroke after the reaction with HRP conjugated streptavidin. Standard of plate-washing pressure: 5-25ml/min. (Adjust it depending on the nozzle's diameter.) Refer to our web movie [\[Washing of microplate\]](#).

- *③Guideline of shaking: **600-1,200rpm for 10 seconds x 3 times.**
- *④Seal the plate during the reaction after shaking. Peel off the protective paper from the seal and stick the seal on the plate. Do not reuse the plate seal used once.
- *⑤600-650 nm can be used as reference wavelength.
- *⑥After removal of wash buffer, immediately dispense the next reagent.
- *⑦Refer to our web movie [\[Handling of pipetting\]](#).
- *⑧Refer to our web movie [\[Assay circumstance\]](#).

Worksheet example

	Strip 1&2	Strip 3&4	Strip 5&6	Strip 7&8	Strip 9&10	Strip 11&12
A	10 ng/ml	Pos.Control.	Sample 8	Sample 16	Sample 24	Sample 32
B	5.0 ng/ml	Sample 1	Sample 9	Sample 17	Sample 25	Sample 33
C	2.5 ng/ml	Sample 2	Sample 10	Sample 18	Sample 26	Sample 34
D	1.0 ng/ml	Sample 3	Sample 11	Sample 19	Sample 27	Sample 35
E	0.5 ng/ml	Sample 4	Sample 12	Sample 20	Sample 28	Sample 36
F	0.25 ng/ml	Sample 5	Sample 13	Sample 21	Sample 29	Sample 37
G	0.1 ng/ml	Sample 6	Sample 14	Sample 22	Sample 30	Sample 38
H	0	Sample 7	Sample 15	Sample 23	Sample 31	Sample 39

Assay worksheet

	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												
H												

[Storage condition] Store the kit at 2-8°C (Do not freeze).

[Term of validity] 6 months from production (Expiration date is indicated on the container.)

This kit is manufactured by **Shibayagi Co., Ltd.**
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