



## Matched-Pair Antibody Set for ELISA of human Thrombin-Antithrombin complex (TAT)

Sufficient reagent for 5 x 96 well plates

**Product #:** TAT-EIA

**Lot #:** XXXX

**Expiry Date:** XXXX

Store at 2 - 8°C

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For Research Use Only

Not for use in diagnostic procedures.

### Description of Thrombin-Antithrombin Complex (TAT)

The activation of coagulation ultimately leads to the activation of prothrombin to the enzyme thrombin. Unless regulated, thrombin will act on its natural substrates that include fibrinogen, factor V, factor VIII, factor XIII, Protein C, TAFI as well as specific receptors on platelets and endothelial cells. The activity of thrombin in plasma is regulated in part through interaction with protease inhibitors. Based on kinetic rates and physiological concentrations, the primary inhibitor of thrombin in plasma is antithrombin (ATIII), followed by heparin cofactor II and  $\alpha_2$ macroglobulin.

The thrombin-antithrombin complex (TAT) results when thrombin cleaves a scissile bond near the C-terminus of ATIII, forming a covalent, 1:1 acyl enzyme intermediate with ATIII with an apparent mass of 96 kDa. Calcium is not required for this interaction, but the rate of thrombin inhibition by ATIII can be accelerated 1000-fold by optimal concentrations of heparin. Although TAT complex is relatively stable, under conditions of elevated pH and/or enzyme excess, enzymatic degradation and even dissociation of the complex can occur. In serum, vitronectin (also known as S-Protein) has been reported to form larger ternary complexes with TAT (350 kDa), but these ternary S-TAT complexes are not covalently linked and are not stable to denaturants such as SDS. T-AT complex is cleared from circulation by serpin-enzyme complex receptors on the surface of hepatocytes, with a half-life of 15 minutes<sup>1-4</sup>.

### Principle of Sandwich-style ELISA

Affinity-purified antibody to human thrombin is coated onto the wells of a microtitre plate. Any remaining binding sites on the plastic wells are blocked with bovine serum albumin. The plates are washed and plasma or other fluids are applied. The coated antibody will capture the thrombin and thrombin-inhibitor complexes in the sample. After washing the plate to remove unbound material, a peroxidase conjugated second antibody to ATIII is added to the plate to bind to the captured TAT complexes. After washing the plate to remove unbound conjugated antibody, the peroxidase activity is expressed by incubation with o-phenylenediamine (OPD). After a fixed development time the reaction is quenched with the addition of H<sub>2</sub>SO<sub>4</sub> and the colour produced is quantified using a microplate reader. The colour generated is proportional to the concentration of TAT complex present in the sample.

### Supplied Materials:

**1. Capture Antibody (TAT-EIA-C):** One yellow-capped vial containing 0.5 ml of polyclonal affinity purified anti-thrombin antibody for coating plates.

**2. Detecting Antibody (TAT-EIA-D):** One red-capped tube containing 0.5 ml of peroxidase conjugated affinity-purified polyclonal anti-ATIII antibody for detection of captured TAT complex.

**3. Conjugate Diluent:** Five neutral-capped tubes each containing 10 ml of universal diluent for peroxidase conjugated antibody. Each vial sufficient for one 96-well plate.

**Note:** Antibodies are supplied in a 50% (v/v) glycerol solution for storage at 2 - 8°C. Keep vials tightly capped.

### Materials Required but not Provided:

**1. Coating Buffer:** 50 mM Carbonate  
1.59g of Na<sub>2</sub>CO<sub>3</sub> and 2.93g of NaHCO<sub>3</sub> up to 1 litre. Adjust pH to 9.6. Store at 2-8°C up to 1 month.

**2. PBS:** (base for wash buffer and blocking buffer)  
8.0g NaCl, 1.15g Na<sub>2</sub>HPO<sub>4</sub>, 0.2g KH<sub>2</sub>PO<sub>4</sub> and 0.2g KCl, up to 1 litre. Adjust pH to 7.4, if necessary. Store up to 1 month at 2-8°C, discard if there is evidence of microbial growth.

**3. Wash Buffer:** PBS-Tween (0.1%,v/v)  
To 1 litre of PBS add 1.0 ml of Tween-20.  
Check that the pH is 7.4. Store at 2-8°C up to 1 week.

**4. Blocking Buffer:** PBS-BSA (2%, w/v)  
Dissolve 5.0 g of Bovine Serum Albumin (Sigma-RIA grade) in 200 ml of PBS. Adjust pH to 7.4, if required, then make up to 250 ml with PBS. Aliquot and store frozen at -20°C.

**5. Sample Diluent:** HBS-BSA-T20  
5.95g HEPES (free acid), 1.46 g NaCl, 2.5 g Bovine Serum Albumin (Sigma, RIA grade) dissolved in 200 ml H<sub>2</sub>O. Add 0.25 ml of Tween-20, check and adjust pH to 7.2 with NaOH, then make up to a final volume of 250 ml with H<sub>2</sub>O.  
Aliquot and store frozen at -20°C.

**6. Substrate Buffer:** Citrate-Phosphate buffer pH 5.0  
2.6g Citric acid and 6.9g Na<sub>2</sub>HPO<sub>4</sub> up to a final volume of 500 ml with purified H<sub>2</sub>O. Store at 2-8°C up to 1 month.

**7. OPD Substrate:** (o-Phenylenediamine.2HCl) Toxic!  
(5mg tablets: Sigma # P-6912). Make up immediately before use. Dissolve 5mg OPD in 12 ml substrate buffer then add 12  $\mu$ l 30% H<sub>2</sub>O<sub>2</sub>. Do not store.

**8. Stopping Solution:** 2.5 M H<sub>2</sub>SO<sub>4</sub>  
Caution: VERY CORROSIVE! GENERATES HEAT ON DILUTION! Where stock sulphuric acid is 18 Molar, add 13.9 ml to 86 ml H<sub>2</sub>O.  
Store at room temperature.

**9. Materials for making TAT reference standards:**  
- Human thrombin and antithrombin III are available from Enzyme Research Labs, South Bend, IN (tel: 574-288-2268).  
- Antithrombin (ATIII) deficient plasma in 1 mL vials, lyophilized (Affinity, cat# ATIII-LDP).

**10. Other:**  
Microplates, 96-well Immulon 4-HBX (<http://www.labsystems.fi>)  
Microplate washer (optional)  
Microplate reader.

## Assay Procedure:

### 1. Preparation of TAT complex reference standard:

Purified ATIII (295 µg/mL = 5 µM) in 20 mM Tris-HCl, 0.15 M NaCl, pH 7.4, 1 mM EDTA and 0.05 U/mL heparin, is incubated with a limiting amount of thrombin (37 µg/mL = 1 µM) at 37°C for 10 minutes. Complete inhibition should be confirmed by plasma clot time or chromogenic assay. If all thrombin is completely inhibited, the concentration of TAT complex is 1 µM. A series of standards can be made by diluting this stock TAT complex into TAT-poor plasma (plasma shown to be low in TAT by independent assay<sup>2</sup>) or ATIII-deficient plasma. Prepare standards containing 600, 200, 60 and 20 pM respectively.

### 2. Coating of plates:

Dilute the capture antibody 1/100 in coating buffer (preferably in a polypropylene tube) and immediately add 100 µl to every well in the plate. Incubate 2 hours at room temperature or overnight at 2-8°C.

### 3. Blocking:

Empty contents of plate and add 150 µl of blocking buffer to every well and incubate for 90 minutes @ 22°C.

Wash plate X 3 with wash buffer.

### 4. Standards and Test Samples:

Test samples and the reference standards prepared above are each diluted 1/4 in sample diluent. Apply 100 µl/well and incubate plate @ 22°C for 120 minutes. Wash plate X 3 with wash buffer.

### 5. Detecting Antibody:

Dilute the detecting antibody 1/100 in conjugate diluent provided and apply 100 µl to each well. Incubate plate @ 22°C for 60 minutes.

Wash plate X 3 with wash buffer.

### 6. OPD Substrate:

Apply 100 µl of freshly prepared OPD substrate to every well. Allow colour to develop for 10-15 minutes then stop colour reaction with the addition of 50 µl/well of 2.5 M H<sub>2</sub>SO<sub>4</sub>. The plate can be read at wavelength of 490 nm.

## Calculation of Results:

The construction of a proper reference curve is of no less importance than any other aspect of the assay. A reference curve should be constructed by plotting the known concentration of standards versus absorbance. This can be done manually using graph paper, or by using curve-fitting computer software. In our experience, the dose response curves of most immunoassays tend to be sigmoid in shape. Although linear regions can be identified within the curve, the best overall fit is often obtained using an algorithm that provides a weighted theoretical model of fit throughout the entire curve, such as a 4-parameter or 5-parameter logistic curve fit<sup>5,6</sup>. In general, the simplest model that defines the concentration-response relationship should be used<sup>7</sup>.

The "back-fit" test is a simple and reliable method to determine if a curve-fitting method is appropriate. In this test, the apparent concentrations for the absorbance values of each standard point are read from the reference curve. The derived values are compared to the assigned values. An appropriate curve fitting method will produce derived values that closely match assigned values throughout the range of the curve, within user-defined limits<sup>7</sup>. The coefficient of determination ( $R^2$ ) is a valuable indicator of the overall fit, but should not be used by itself in the selection of a curve fitting method, as a poor fit in a particular region of the curve may not be evident from this value alone<sup>6,7</sup>.

**In the quality control of this product we have determined that under the conditions described above, a reference curve constructed as described above will produce a correlation coefficient ( $R^2$ ) of at least 0.980 using a log-log fit, and an  $R^2$  of at least 0.990 using a 4-parameter logistic curve fit algorithm.** However, the performance characteristics of in-house assays developed using this product in other laboratories may vary slightly from ours. Different curve fitting methods may be employed but we recommend that the back-fit test be applied as evidence that the fitting method is appropriate.

## Technical Notes:

- This paired antibody product is intended to facilitate the end user in establishing an in-house immunoassay for research purposes only. It must not be used for diagnostic applications. Assay validation is the responsibility of the end user and should be done according to user-defined protocols<sup>6</sup>.
- Reference standards may not be stable to freeze-thaw. If standards are aliquoted and stored frozen, the concentration of complex should be retested against freshly prepared standards.
- Any test plasma that assays above the readable range should be diluted in TAT-poor or ATIII-deficient plasma and retested.
- Do not use samples diluted less than 1/4, as falsely high readings may result.
- The optimal colour development time should be determined empirically as the time required to obtain an absorbance of at least 1.000 at 490 nm for the 100% reference point, not to exceed 20 minutes.
- Rheumatoid factor in samples may interfere in ELISA by binding to the capture and/or detecting antibodies.
- The wells should not be allowed to become dry. Keep plate covered or in a humid chamber during incubations.
- Stock antibodies are supplied in a 50% glycerol solution and can be centrifuged briefly in a micro-centrifuge to gather residual reagent from the cap and walls of the tube.

## References:

1. Bauer KA; Laboratory Markers of Coagulation Activation; Arch Pathol Lab Med **117**, pp 71-77, 1993.
2. Pelzer H, Schwarz A, Heimburger N; Determination of Thrombin-Antithrombin Complexes in Plasma with an Enzyme-Linked Immunosorbent Assay; Thrombosis and Haemostasis **59**, pp 101-106, 1988.
3. Griffith MJ, Lunblad RL; Dissociation of Antithrombin III-Thrombin Complex. Formation of Active and Inactive Antithrombin III; Biochemistry **20**, pp 105, 1981.
4. Preissner KT, Zwicker L, Muller-Berghaus G; Formation, characterization and detection of a ternary complex between S protein, thrombin and antithrombin III in serum; Biochem. J. **243**, pp 105-111, 1987.
5. Nix B, Wild D, in Immunoassays, A Practical Approach, editor J.P. Gosling, pp. 239-261, Oxford University Press, 2000.
6. NCCLS. Evaluation of the Linearity of Quantitative Analytical Methods; Proposed Guideline - Second Edition. NCCLS Document EP6-P2 (ISBN 1-56238-446-5, NCCLS, Wayne, Pennsylvania USA, 2001.
7. FDA Guidance for Industry. Bioanalytical Method Validation; May 2001, available on the internet: [www.fda.gov/cder/guidance/index.htm](http://www.fda.gov/cder/guidance/index.htm)

## Related Products:

Cat #:	SAHT-IG	Sheep anti-human thrombin, IgG from antiserum
Cat #:	SAHT-AP	Sheep anti-human thrombin, affinity-purified IgG
Cat #:	SAHT-HRP	Sheep anti-human thrombin, IgG-peroxidase conjugate
Cat #:	GAAT-IG	Goat anti-ATIII, whole IgG from antiserum
Cat #:	GAAT-AP	Goat anti-ATIII, affinity-purified IgG
Cat #:	SAAT-IG	Sheep anti-ATIII, whole IgG from antiserum
Cat #:	SAAT-AP	Sheep anti-ATIII, affinity-purified IgG
Cat #:	SAAT-APHRP	Sheep anti-ATIII, APiG-peroxidase conjugate
Cat #:	ATIII-EIA	Paired antibody set for ELISA of ATIII, 5x96 test
Cat #:	THCII-EIA	Paired antibody set for ELISA of Thrombin-HCII complex
Cat #:	AT-NU10	Paired antibody set for ATIII neutralization in plasma
Cat #:	ATIII-LDP	ATIII deficient plasma, immune depleted, lyophilized
Cat #:	ATHC-LDP	ATIII & HCII def plasma, immune depleted, lyophilized
Cat #:	FII-DP	Human plasma deficient in F.II, immune depleted, frozen

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