

distributed in the US/Canada by:

EAGLE BIOSCIENCES, INC.

20A NW Blvd, Suite 112 Nashua, NH 03063

Phone: 617-419-2019 FAX: 617-419-1110

[www.EagleBio.com](http://www.EagleBio.com) info@eaglebio.com



EAGLE  
BIOSCIENCES

# Anti-Rituximab (Rituxan™) ELISA

**REF** : KBI2010

Ver 2.0

**RUO**

Enzyme Immunoassay for the Quantitative Determination of Anti-Rituximab in human serum and plasma

<b>RUO</b>	For Research Use	<b>REF</b>	Catalog Number
	Store At	<b>LOT</b>	Batch Code
	Manufactured By		Biological Risk
	Expiry Date		Consult Operating Instructions

*For Research Use Only. Purchase does not include or carry the right to resell or transfer this product either as a stand-alone product or as a component of another product. Any use of this product other than the permitted use without the express written authorization of KRISHGEN BioSystems is strictly prohibited.*

**REF** KBI2010

96 tests



**KRISHGEN BioSystems** | For US / Europe: toll free +1(888)-970-0827 tel: +1(562)-568-5005  
For Asia / India: tel: +91(22)-49198700  
Email: sales@krishgen.com

**Introduction:**

Rituximab is a monoclonal antibody which has high specificity for CD20 and it is used to treat certain autoimmune diseases and types of cancer. It is also used for non-Hodgkin's lymphoma, chronic lymphocytic leukemia, rheumatoid arthritis, and granulomatosis with polyangiitis, idiopathic thrombocytopenic purpura, pemphigus vulgaris, myasthenia gravis and Epstein - Barr virus-positive mucocutaneous ulcers. It is given by slow injection into a vein.

Anti-Drug Antibodies (ADA) may induce unwanted side effects in biopharmaceuticals. Hence, ADA has been subjected to increase in scrutiny by the regulatory authorities using immunogenicity safety studies. ADA has been observed in pre-clinical and clinical studies, resulting in significant changes in toxicology, pharmacokinetics and efficacy.

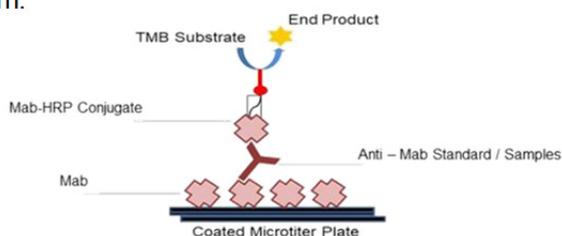
These effects result from the generation of drug-induced (neutralizing) autoantibodies against Rituximab and can be responsible for allergic reaction, or even anaphylactic shock. This ELISA kit detects antibodies for Anti-Rituximab and may be used for monitoring immunogenicity.

**Intended Use:**

The Anti-Rituximab (Rituxan™) ELISA is used as an analytical tool for quantitative determination of Anti-Rituximab in human serum and plasma.

**Principle:**

The method employs the quantitative sandwich enzyme immunoassay technique. Rituximab is pre-coated onto microwells. Samples and standards are pipetted into microwells and antibodies to Rituximab present in the sample are bound by the capture antibody. Then, a HRP (horseradish peroxidase) conjugated Rituximab is pipetted and incubated. After washing microwells in order to remove any non-specific binding, the ready to use substrate solution (TMB) is added to microwells and color develops proportionally to the amount of Anti-Rituximab in the sample. Color development is then stopped by addition of stop solution. Absorbance is measured at 450 nm.

**Materials Provided:**

Part	Description	Qty
Rituximab Coated Microtiter Plate	96 well polystyrene microplate (12 strips of 8 wells) coated with Rituximab.	1 x 96 wells
Anti-Rituximab Standard, (lyophilized)	Recombinant Anti-Rituximab in a buffered protein base and preservatives 0.02% methylisothiazolone and 0.02% bromonitrodioxane – (lyophilized, concentrated 1 ug/ml)	2 vials
Rituximab:HRP Conjugate	Anti-Rituximab conjugated to Horseradish Peroxidase with protein stabilizer and preservatives 0.02% methylisothiazolone and 0.02% bromonitrodioxane.	12 ml
(1X) Standard Diluent	Buffered protein base with preservatives 0.02% methylisothiazolone and 0.02% bromonitrodioxane with 1:1000 dilution human serum.	10 ml
(1X) Sample Diluent	Buffered protein base with preservatives 0.02% methylisothiazolone and 0.02% bromonitrodioxane	2 x 50 ml
(20X) Wash Buffer	20-fold concentrated solution of buffered surfactant with preservative thiomersol < 0.01%. May turn yellow over time.	25 ml
TMB Substrate	Stabilized Chromogen	12 ml
Stop Solution	2N Sulfuric Acid	12 ml
Instruction Manual		1 no

**Materials to be provided by the End-User:**

1. Microtiter Plate Reader able to measure absorbance at 450 nm.
2. Adjustable pipettes and multichannel pipettor to measure volumes ranging from 25 ul to 1000 ul
3. Deionized (DI) water
4. Wash bottle or automated microplate washer
5. Graph paper or software for data analysis
6. Timer
7. Absorbent Paper

**Handling/Storage:**

1. All reagents should be stored at required temperature as indicated on the component label.
2. All the reagents and wash solutions should be used within 12 months from manufacturing date.
3. Before using, bring all components to room temperature (18-25°C). Upon assay completion ensure all components of the kit are returned to appropriate storage conditions.
4. The Substrate is light-sensitive and should be protected from direct sunlight or UV sources.

**Health Hazard Warnings:**

1. Reagents that contain preservatives may be harmful if ingested, inhaled or absorbed through the skin.
2. For Research Use Only.

**Sample Preparation and Storage:**

Blood is taken by venipuncture. Serum is separated after clotting by centrifugation. Plasma can be used, too. Lipaemic, hemolytic or contaminated samples should not be run. Repeated freezing and thawing should be avoided. If samples are to be used for several assays, initially aliquot samples and keep at -20°C.

**Preparation Before Use:**

Allow samples to reach room temperature prior to assay. Take care to agitate patient samples gently in order to ensure homogeneity.

Serum and Plasma Test Sample preparation - Samples have to be diluted 1:1000 (v/v), e.g. 1 ul sample + 999 ul sample diluent prior to assay. The samples may be kept at 2 - 8°C for up to three days. Long-term storage requires -20°C.

**Reagent Preparation (all reagents should be diluted immediately prior to use):**

1. Label any aliquots made with the kit Lot No and Expiration date and store it at appropriate conditions mentioned.
2. Bring all reagents to Room temperature before use.
3. To make Wash Buffer (1X); dilute 25 ml of 20X Wash Buffer in 475 ml of DI water.
4. **Standards Preparation:** Reconstitute the concentrated Standard lyophilized vial with 1 ml of Standard Diluent to obtain a concentration of 1 ug/ml. Keep the vial for 15 mins with gentle agitation before making further dilutions.

Dilute 320 ul of original **Standard (1 ug/ml)** with 180 ul of Standard Diluent to generate a **640 ng/ml Standard Solution**. Prepare further **Standards** by serially diluting the Standard Solution as per the below table. Use the Standard Diluent as the Zero Standard (Standard No.0).

Standard Concentration	Standard Vial	Dilution Particulars
1 ug/ml	Original Standard	Lyophilized Standard provided in the Kit + 1 ml of Standard Diluent
640 ng/ml	Standard No.7	320 ul Reconstituted Standard (1 ug/ml) + 180 ul Standard Diluent
320 ng/ml	Standard No.6	250 ul Standard No.7 + 250 ul Standard Diluent
160 ng/ml	Standard No.5	250 ul Standard No.6 + 250 ul Standard Diluent
80 ng/ml	Standard No.4	250 ul Standard No.5 + 250 ul Standard Diluent
40 ng/ml	Standard No.3	250 ul Standard No.4 + 250 ul Standard Diluent
20 ng/ml	Standard No.2	250 ul Standard No.3 + 250 ul Standard Diluent
10 ng/ml	Standard No.1	250 ul Standard No.2 + 250 ul Standard Diluent
0 ng/ml	Standard No.0	Only Standard Diluent

Use the prepared Standards as soon as possible upon reconstitution. Discard balance prepared standards after use.

#### Procedural Notes:

1. In order to achieve good assay reproducibility and sensitivity, proper washing of the plates to remove excess un-reacted reagents is essential.
2. High Dose Hook Effect may be observed in samples with very high concentrations of Anti-Rituximab. High Dose Hook Effect is due to excess of antibody for very high concentrations of Anti-Rituximab present in the sample. High Dose Hook effect is most likely encountered from samples early in the purification process. If Hook Effect is possible, the samples to be assayed should be diluted with a compatible diluent. Thus if the Anti-Rituximab concentration of the undiluted sample is less than the diluted sample, this may be indicative of the Hook Effect.
3. Avoid assay of Samples containing sodium azide ( $\text{NaN}_3$ ), as it could destroy the HRP activity resulting in under-estimation of the amount of Anti-Rituximab.
4. It is recommended that all Standards and Samples be assayed in duplicates.
5. Maintain a repetitive timing sequence from well to well for all the steps to ensure that the incubation timings are same for each well.
6. If the Substrate has a distinct blue color prior to use it may have been contaminated and use of such substrate can lead to compromisation of the sensitivity of the assay.
7. The plates should be read within 30 minutes after adding the Stop Solution.
8. Make a work list in order to identify the location of Standards and Samples.

#### Assay Procedure:

1. It is strongly recommended that all Standards and Samples be run in duplicates or triplicates. A standard curve is required for each assay. All steps must be performed at 37°C
2. Add **100 ul** of **prepared Standards** or **diluted Samples** into the respective wells.
3. Cover the plate and incubate for 60 minutes at 37°C
4. Aspirate and wash plate 4 times with **Wash Buffer (1X)** and blot residual buffer by firmly tapping plate upside down on absorbent paper. Wipe of any liquid from the bottom outside of the microtiter wells as any residue can interfere in the reading step.
5. Pipette without delay in the same order **100 ul** of **Rituximab:HRP Conjugate** into each well.
6. Cover the plate and incubate for 60 minutes at 37°C
7. Aspirate and wash plate 4 times with **Wash Buffer (1X)** and blot residual buffer by firmly tapping plate upside down on absorbent paper. Wipe of any liquid from the bottom outside of the microtiter wells as any residue can interfere in the reading step.
8. Add **100 ul** of **TMB Substrate** in each well.

9. Incubate the plate at 37°C for 30 minutes in dark. DO NOT SHAKE or else it may result in higher backgrounds and worse precision. Positive wells should turn bluish in color.
10. Pipette out **100 ul** of **Stop Solution**. Wells should turn from blue to yellow in color.
11. Read the absorbance at 450 nm with a microplate reader.

**Calculation of Results:**

Determine the Mean Absorbance for each set of duplicate or triplicate Standards and Samples. Using graph paper, plot the average value (absorbance 450 nm) of each standard on the Y-axis versus the corresponding concentration of the standards on the X-axis. Draw the best fit curve through the standard points. To determine the unknown Anti-Rituximab concentrations, find the unknown's Mean Absorbance value on the Y-axis and draw a horizontal line to the standard curve. At the point of intersection, draw a vertical line to the X-axis and read the Anti-Rituximab Concentration. If samples were diluted, multiply by the appropriate dilution factor.

Software which is able to generate a cubic spline curve-fit or a polynomial curve (2<sup>nd</sup> order) is best recommended for automated results.

**Note:**

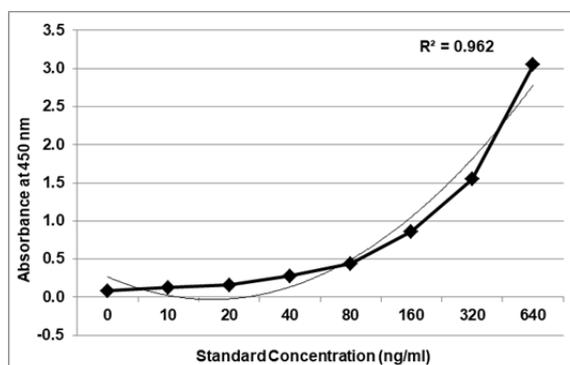
It is recommended to repeat the assay at a different dilution factor in the following cases:

- If the sample absorbance value is below the first standard.
- If the absorbance value is equivalent or higher than the 640 ng/ml standard.

**Typical Data**

Standard Concentration (ng/ml)	Abs A	Abs B	Mean Abs	Interpolated Concentration	% Interpolated Concentration against Actual Concentration
0	0.087	0.081	0.084	--	--
10	0.125	0.124	0.124	9.4	94.5
20	0.157	0.162	0.159	16.9	84.3
40	0.301	0.258	0.279	42.4	105.9
80	0.444	0.438	0.441	77.0	96.3
160	0.817	0.907	0.862	167.5	104.7
320	1.603	1.485	1.544	314.7	98.3
640	3.009	3.089	3.049	641.1	100.2

**Typical Graph**



Abs = absorbance @ 450nm

**Quality Control:**

It is recommended that for each laboratory assay appropriate quality control samples in each run to be used to ensure that all reagents and procedures are correct.

**Performance Characteristics of the Kit:**

This kit has been validated as per EMA/FDA guidelines in line with ICH Code for Harmonization of Biological Assays.

**Sensitivity:**

**Limit Of Detection:** It is defined as the lowest detectable concentration corresponding to a signal of Mean of '0' standard plus 2\* SD.

10 replicates of '0' standards were evaluated and the LOD was found to be less than 10 ng/ml

**Specificity:**

The standard provided in the kit is an Anti-Rituximab antibody which is a recombinant anti-idiotypic IgG antibody. The monovalent intrinsic affinity of this antibody (standard in the kit) was measured as  $KD=0.13$  nM by real time, label-free molecular interaction analysis on immobilized rituximab. The standard has been quantified for protein concentration using the Lowry method.

The capture antibody is a biosimilar to Rituxan™ which is well characterized and validated.

**Linearity:**

The kit has been validated for linearity of Anti-Rituximab in the claimed matrix.

**Precision:**

Precision is defined as the percent coefficient of variation (%CV) i.e. standard deviation divided by the mean and multiplied by 100. Assay precision was determined by both intra (n=5 assays) and inter assay (n=5 assays) reproducibility on two pools with low (10 ng/ml), medium (80 ng/ml) and high (640 ng/ml) concentrations.

While actual precision may vary from laboratory to laboratory and technician to technician, it is recommended that all operators achieve precision below these design goals before reporting results.

Pool	Intra Assay %CV	Inter Assay %CV
Low	<10%	<10%
Medium	<5%	<5%
High	<5%	<5%

**Safety Precautions:**

- **This kit is for Research Use only.** Follow the working instructions carefully.
- The expiration dates stated on the kit are to be observed. The same relates to the stability stated for reagents
- Do not use or mix reagents from different lots.
- Do not use reagents from other manufacturers.
- Avoid time shift during pipetting of reagents.
- All reagents should be kept in the original shipping container.
- Some of the reagents contain small amount of sodium azide (< 0.1 % w/w) as preservative. They must not be swallowed or allowed to come into contact with skin or mucosa.
- Source materials maybe derived from human body fluids or organs used in the preparation of this kit were tested and found negative for HBsAg and HIV as well as for HCV antibodies. However, no known test guarantees the absence of such viral agents. Therefore, handle all components and all patient samples as if potentially hazardous.
- Since the kit contains potentially hazardous materials, the following precautions should be observed
  - Do not smoke, eat or drink while handling kit material
  - Always use protective gloves
  - Never pipette material by mouth
  - Wipe up spills promptly, washing the affected surface thoroughly with a decontaminant.
- In any case GLP should be applied with all general and individual regulations to the use of this kit.



**References:**

Rituximab in clinical practice: dosage, drug adherence, Ig levels, infections, and drug antibodies. Einarsson JT1,2, Evert M3, Geborek P3, Saxne T3, Lundgren M4, Kapetanovic MC3. Clin Rheumatol. 2017...Epub 2017.... Springer

Immunogenicity of rituximab in patients with severe pemphigus...Schmidt E1, Hennig K, Mengede C, Zillikens D, Kromminga A. Clin Immunol. 2009....Elsevier

Development and characterization of an anti-rituximab monoclonal antibody panel...Minoru Tada, Takuo Suzuki & Akiko Ishii-Watabe.. mAbs..2018...Taylor & Francis

Anti-rituximab antibodies contribute to the lack of response to rituximab therapy in some systemic lupus erythematosus patients... Madhvi Menon Edward Smith Elizabeth Jury Claudia Mauri....Rheumatology....2017... British Society for Rheumatology

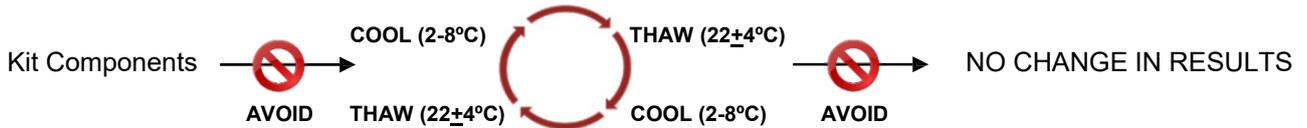
Validation of an ELISA for the determination of rituximab pharmacokinetics in clinical trials subjects...Hampson G1, Ward TH, Cummings J, Bayne M, Tutt AL, Cragg MS, Dive C, Illidge TM... J Immunol Methods. 2010....Elsevier

**SCHEMATIC ASSAY PROCEDURE**

1. Remove all components, 30 minutes before adding into the assay plate.



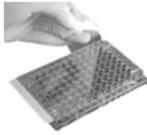
2. Avoid repeated cool-thaw of the components as there will be a loss of activity and this can affect the results.



3. Pipette **100 ul Standards / diluted Samples** into the respective wells.



4. Cover plate and incubate for **60 min** at 37°C.



5. Aspirate and wash wells 4 times with **Wash Buffer (1X)**.



6. Pipette **100 ul Rituximab :HRP** into each well.



7. Cover plate and incubate for **60 min** at 37°C.



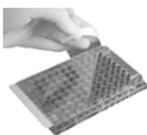
8. Aspirate and wash wells 4 times with **Wash Buffer (1X)**.



9. Pipette **100 ul TMB Substrate** into each well.



10. Cover plate and incubate for **30 min** at 37°C.



11. Pipette **100 ul Stop Solution** into each well.



12. Read absorbance at 450nm with a microplate reader within **30 min** of stopping reaction.



### Typical Example of a Work List

Well #	Contents	Absorbance at 450nm	Mean Absorbance	ng/ml Anti-Rituximab equivalent
1A	zero std			
2A	zero std			
1B	10 ng/ml			
2B	10 ng/ml			
1C	20 ng/ml			
2C	20 ng/ml			
1D	40 ng/ml			
2D	40 ng/ml			
1E	80 ng/ml			
2E	80 ng/ml			
1F	160 ng/ml			
2F	160 ng/ml			
1G	320 ng/ml			
2G	320 ng/ml			
1H	640 ng/ml			
2H	640 ng/ml			
3A	Sample			
4A				
3B	Sample			
4B				
3C	Sample			
4C				

### LIMITED WARRANTY

Krishgen Biosystems does not warrant against damages or defects arising in shipping or handling, or out of accident or improper or abnormal use of the Products; against defects in products or components not manufactured by Krishgen Biosystems, or against damages resulting from such non-Krishgen Biosystems made products or components. Krishgen Biosystems passes on to customer the warranty it received (if any) from the maker thereof of such non Krishgen made products or components. This warranty also does not apply to Products to which changes or modifications have been made or attempted by persons other than pursuant to written authorization by Krishgen Biosystems.

THIS WARRANTY IS EXCLUSIVE. The sole and exclusive obligation of Krishgen Biosystems shall be to repair or replace the defective Products in the manner and for the period provided above. Krishgen Biosystems shall not have any other obligation with respect to the Products or any part thereof, whether based on contract, tort, and strict liability or otherwise. Under no circumstances, whether based on this Limited Warranty or otherwise, shall Krishgen Biosystems be liable for incidental, special, or consequential damages.

This Limited Warranty states the entire obligation of Krishgen Biosystems with respect to the Products. If any part of this Limited Warranty is determined to be void or illegal, the remainder shall remain in full force and effect.

Krishgen Biosystems. 2021

**THANK YOU FOR USING KRISHGEN PRODUCT!**

## SYMBOLS KEY

<b>MTP</b>	Rituximab Microtiter Plate (12 x 8 wells)
<b>STD</b>	Anti-Rituximab Standard
<b>HRP CONJ</b>	Conjugate Horseradish Peroxidase
<b>1X SAMP DIL</b>	(1X) Sample Diluent
<b>1X STD DIL</b>	(1X) Standard Diluent
<b>20X WASH BUF</b>	(20X) Wash Buffer
<b>SUB TMB</b>	TMB Substrate
<b>SOLN STOP</b>	Stop Solution
	Consult Instructions for Use
<b>REF</b>	Catalog Number
	Expiration Date
	Storage Temperature

distributed in the US/Canada by:

**EAGLE BIOSCIENCES, INC.**

20A NW Blvd, Suite 112 Nashua, NH 03063

Phone: 617-419-2019 FAX: 617-419-1110

[www.EagleBio.com](http://www.EagleBio.com) • [info@eaglebio.com](mailto:info@eaglebio.com)



**EAGLE**  
BIOSCIENCES