Snibe Diagnostic

CE REF 130253002M:100 tests/kit
130653002M: 50 tests/kit
130753002M: 30 tests/kit

MAGLUMI® Total T4 (CLIA)

INTENDED USE

The kit is an *in vitro* chemiluminescence immunoassay for the quantitative determination of total thyroxine (Total T4) in human serum and plasma using the MAGLUMI series Fully-auto chemiluminescence immunoassay analyzer and Biolumi series Integrated System, and the assay is used for an aid in diagnosis and treatment of individuals with suspected or confirmed thyroid diseases.

SUMMARY

Thyroid hormones (THs) are secreted by the thyroid gland which produces and releases into the circulation at least two potent hormones, thyroxine (T4) and triiodothyronine (T3)[1], and play key roles in the human endocrine system and control the overall metabolism of the body, protein synthesis, carbohydrate and fat metabolism, neural development, normal growth and maturation of bones, as well as cardiovascular and renal functions[2]. Thyroxine (T4) is the principal hormone secreted by the thyroid gland and all the T4 in the circulation is derived from thyroidal secretion, in contrast, only about 20% of circulating triiodothyronine (T3) is of thyroidal origin and most of the T3 in blood is produced enzymatically in nonthyroidal tissues by 5'-monodeiodination of T4[3-5]. Thyroxine (T4) circulates 99.97% bound to the plasma proteins, primarily thyroxine binding globulin TBG (60-75%) but also transthyretin (TTR)/prealbumin (TBPA) (15-30%)[6,7]. Overt hyperthyroidism is characterized by low serum TSH concentrations and raised serum concentrations of thyroid hormones: thyroxine (T4), tri-iodothyronine (T3), or both, and subclinical hyperthyroidism is characterized by low serum TSH, but normal serum T4 and T3 concentrations[8]. It is also useful for evaluating the response to levothyroxine in cases of poor compliance and in the first months of treating patients with chronic, severe hypothyroidism[4].

TEST PRINCIPLE

Competitive chemiluminescence immunoassay.

The sample, displacing solution containing NaOH, ABEI labeled with anti-T4 antibody, buffer containing ANS, magnetic microbeads coated with T4 antigen are mixed thoroughly and incubated. T4 released from the binding proteins in the serum or plasma sample by ANS and NaOH compete with T4 antigen immobilized on the magnetic microbeads for binding anti-T4 antibody labeled with ABEI, and form immuno-complexes. After precipitation in a magnetic field, the supernatant is decanted and then perform a wash cycle. Subsequently, the Starter 1+2 are added to initiate a chemiluminescent reaction. The light signal is measured by a photomultiplier as relative light units (RLUs), which is inversely proportional to the concentration of total T4 present in the sample.

REAGENTS

Kit Contents

Component	Description	100 tests/kit	50 tests/kit	30 tests/kit
Magnetic Microbeads	Magnetic microbeads coated with T4 antigen conjugate (~5.00 μg/mL) in PBS buffer, NaN_3 (<0.1%).	2.5 mL	1.5 mL	1.0 mL
Calibrator Low	A low concentration of T4 antigen, BSA, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
Calibrator High	A high concentration of T4 antigen, BSA, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
Displacing Solution	NaOH (0.4%).	5.5 mL	3.0 mL	2.0 mL
Buffer	ANS, PBS buffer, NaN_3 (<0.1%).	9.5 mL	5.5 mL	3.9 mL
ABEI Label	ABEI labeled with anti-T4 antibody (~0.313 μg /mL) in Tris-HCl buffer, NaN_3 (<0.1%).	6.5 mL	4.0 mL	3.0 mL
Control 1	A low concentration of T4 antigen (7.00 μg/dL), BSA, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
Control 2	A high concentration of T4 antigen (14.0 μg/dL), BSA, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
All reagents are provided ready-to-use.				

Warnings and Precautions

- For *in vitro* diagnostic use.
- For professional use only.
- Personal protective measures should be taken to prevent any part of the human body from contacting samples, reagents, and controls, and should comply with local operating requirements for the assay.
- Exercise the normal precautions required for handling all laboratory reagents.
- A skillful technique and strict adherence to the package insert are necessary to obtain reliable results.
- Do not use kit beyond the expiration date indicated on the label.
- Do not interchange reagent components from different reagents or lots.
- Avoid foam formation in all reagents and sample types (specimens, calibrators and controls).
- All waste associated with biological samples, biological reagents and disposable materials used for the assay should be considered potentially infectious and should be disposed of in accordance with local guidelines.
- This product contains sodium azide. Sodium azide may react with lead or copper plumbing to form highly explosive metal azides. Immediately after disposal, flush with a large volume of water to prevent azide build-up. For additional information, see Safety Data Sheets available for professional user on request.

Note: If any serious incident has occurred in relation to the device, please report to Shenzhen New Industries Biomedical Engineering Co., Ltd. (Snibe) or our authorized representative and the competent authority of the Member State in which you are established.

Reagent Handling

- To avoid contamination, wear clean gloves when operating with a reagent kit and sample. When handling reagent kit, replace the gloves that have been in contact with samples, since introduction of samples will result in unreliable results.
- Do not use kit in malfunction conditions; e.g., the kit leaking at the sealing film or elsewhere, obviously turbid or precipitation is found in reagents (except for Magnetic Microbeads) or control value is out of the specified range repeatedly. When kit in malfunction conditions, please contact Snibe or our authorized distributor.
- To avoid evaporation of the liquid in the opened reagent kits in refrigerator, it is recommended that the opened reagent kits to be sealed with reagent seals contained within the packaging. The reagent seals are single use, and if more seals are needed, please contact Snibe or our authorized distributor.
- Over time, residual liquids may dry on the septum surface. These are typically dried salts and have no effect on assay efficacy.
- Use always the same analyzer for an opened reagent integral.
- For magnetic microbeads mixing instructions, refer to the Preparation of the Reagent section of this package insert.
- For further information about the reagent handing during system operation, please refer to Analyzer Operating Instructions.

Storage and Stability

- Do not freeze the integral reagents.
- Store the reagent kit upright to ensure complete availability of the magnetic microbeads.
- Protect from direct sunlight.

Stability of the Reagents	
Unopened at 2-8°C	until the stated expiration date
Opened at 2-8°C	6 weeks
On-board	4 weeks

Stability of Controls	
Unopened at 2-8°C	until the stated expiration date
Opened at 10-30°C	6 hours
Opened at 2-8°C	6 weeks
Frozen at -20°C	3 months
Frozen and thawed cycles	no more than 3 times

SPECIMEN COLLECTION AND PREPARATION

Specimen Types

Only the specimens listed below were tested and found acceptable.

Specimen Types	Collection Tubes
Serum	Tubes without additive/accessory, or tubes containing clot activator or clot activator with gel.
Plasma	K2-EDTA

- The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Sample collection systems from various manufacturers may contain differing materials which could affect the test results in some cases. Follow tube manufacturers' instructions carefully when using collection tubes.

Specimen Conditions

- Do not use grossly hemolyzed/hyperlipidaemia specimens and specimens with obvious microbial contamination.
- Ensure that complete clot formation in serum specimens has taken place prior to centrifugation. Some serum specimens, especially those from patients receiving anticoagulant or thrombolytic therapy, may exhibit increased clotting time. If the serum specimen is centrifuged before a complete clotting, the presence of fibrin may cause erroneous results.
- Samples must be free of fibrin and other particulate matter.
- To prevent cross contamination, use of disposable pipettes or pipette tips is recommended.

Preparation for Analysis

- Inspect all specimens for foam. Remove foam with an applicator stick before analysis. Use a new applicator stick for each specimen to prevent cross contamination.
- Frozen specimens must be completely thawed before mixing. Mix thawed specimens thoroughly by low speed vortexing or by gently inverting. Visually inspect the specimens. If layering or stratification is observed, mix until specimens are visibly homogeneous. If specimens are not mixed thoroughly, inconsistent results may be obtained.
- Specimens should be free of fibrin, red blood cells, or other particulate matter. Such specimens may give reliable results and must be centrifuged prior to testing. Transfer clarified specimen to a sample cup or secondary tube for testing. For centrifuged specimens with a lipid layer, transfer only the clarified specimen and not the lipemic material.
- The sample volume required for a single determination of this assay is 40 μL.

Specimen Storage

Specimens removed from the separator, red blood cells or clot may be stored up to 8 hours at 10-30°C or 7 days at 2-8°C, or 1 month frozen at -20°C. Frozen specimens subjected to up to 1 freeze/thaw cycles have been evaluated.

Specimen Shipping

- Package and label specimens in compliance with applicable local regulations covering the transport of clinical specimens and infectious substances.
- Do not exceed the storage limitations listed above.

Specimen Dilution

- Samples, TT4 concentrations above the analytical measuring interval, can be diluted with manual dilution procedure. The recommended dilution ratio is 1:2. The concentration of the diluted sample must be >15.0 μg/dL.
- For manual dilution, multiply the result by the dilution factor.
- Please choose applicable diluents or ask Snibe for advice before manual dilution.

PROCEDURE

Materials Provided

Total T4 (CLIA) assay, control barcode labels.

Materials Required (But Not Provided)

- General laboratory equipment.
- Fully-auto chemiluminescence immunoassay analyzer Maglumi 600, Maglumi 800, Maglumi 1000, Maglumi 2000, Maglumi 2000 Plus, Maglumi 4000, Maglumi 4000 Plus, MAGLUMI X3, MAGLUMI X6, MAGLUMI X8, or Integrated System Biolumi 8000 and Biolumi CX8.
- Additional accessories of test required for the above analyzers include Reaction Module, Starter 1+2, Wash Concentrate, Light Check, Tip, and Reaction Cup. Specific accessories and accessories' specification for each model refer to corresponding Analyzer Operating Instructions.
- Please use accessories specified by Snibe to ensure the reliability of the test results.

Assay Procedure

Preparation of the Reagent

- Take the reagent kit out of the box and visually inspect the integral vials for leaking at the sealing film or elsewhere. If there is no leakage, please tear off the sealing film carefully.
- Open the reagent area door; hold the reagent handle to get the RFID label close to the RFID reader (for about 2s); the buzzer will beep; one beep sound indicates successful sensing.
- Keeping the reagent straight insert to the bottom along the blank reagent track.
- Observe whether the reagent information is displayed successfully in the software interface, otherwise repeat the above two steps.
- Resuspension of the magnetic microbeads takes place automatically when the kit is loaded successfully, ensuring the magnetic microbeads are totally resuspended homogenous prior to use.

Assay Calibration

- Select the assay to be calibrated and execute calibration operation in reagent area interface. For specific information on ordering calibrations, refer to the calibration section of Analyzer Operating Instructions.
- Execute recalibration according to the calibration interval required in this package insert.

Quality Control

- When new lot used, check or edit the quality control information.
- Scan the control barcode, choose corresponding quality control information and execute testing. For specific information on ordering quality controls, refer to the quality control section of the Analyzer Operating Instructions.

Sample Testing

- After successfully loading the sample, select the sample in interface and edit the assay for the sample to be tested and execute testing. For specific information on ordering patient specimens, refer to the sample ordering section of the Analyzer Operating Instructions.

To ensure proper test performance, strictly adhere to Analyzer Operating Instructions.

Calibration

Traceability: This method has been standardized against the USP reference standard (Catalog No.: 1365000).

Test of assay specific calibrators allows the detected relative light unit (RLU) values to adjust the master curve.

Recalibration is recommended as follows:

- Whenever a new lot of Reagent or Starter 1+2 is used.

- Every 28 days.
- The analyzer has been serviced.
- Control values lie outside the specified range.

Quality Control

Controls are recommended for the determination of quality control requirements for this assay and should be run in singlicate to monitor the assay performance. Refer to published guidelines for general quality control recommendations, for example Clinical and Laboratory Standards Institute (CLSI) Guideline C24 or other published guidelines[9].

Quality control is recommended once per day of use, or in accordance with local regulations or accreditation requirements and your laboratory's quality control procedures, quality control could be performed by running the Total T4 assay:

- Whenever the kit is calibrated.
- Whenever a new lot of Starter 1+2 or Wash Concentrate is used.

Controls are only applicable with MAGLUMI and Biolumi system and only used matching with the same top seven LOT numbers of corresponding reagents. For each target value and range refer to the label.

The performance of other controls should be evaluated for compatibility with this assay before they are used. Appropriate value ranges should be established for all quality control materials used.

Control values must lie within the specified range, whenever one of the controls lies outside the specified range, calibration should be repeated and controls retested. If control values lie repeatedly outside the predefined ranges after successful calibration, patient results must not be reported and take the following actions:

- Verify that the materials are not expired.
- Verify that required maintenance was performed.
- Verify that the assay was performed according to the package insert.
- If necessary, contact Snibe or our authorized distributors for assistance.

If the controls in kit are not enough for use, please order Total T4 (CLIA) Controls (REF: 160201243MT) from Snibe or our authorized distributors for more.

RESULTS

Calculation

- The analyzer automatically calculates the TT4 concentration in each sample by means of a calibration curve which is generated by a 2-point calibration master curve procedure. The results are expressed in μg/dL. For further information please refer to the Analyzer Operating Instructions.
- Conversion factors:
  nmol/L x 0.077688 = μg/dL
  μg/dL x 12.872 = nmol/L

Interpretation of Results

The expected range for the Total T4 assay was obtained by testing 670 apparently healthy individuals in China, gave the following expected value:

N	Mean (μg/dL)	2.5th percentile (μg/dL)	97.5th percentile (μg/dL)
670	8.607	5.0	13

Results may differ between laboratories due to variations in population and test method. It is recommended that each laboratory establish its own reference interval.

LIMITATIONS

- Results should be used in conjunction with patient's medical history, clinical examination and other findings.
- If the TT4 results are inconsistent with clinical evidence, additional testing is needed to confirm the result.
- Heterophilic antibodies in human serum can react with reagent immunoglobulins, interfering with *in vitro* immunoassays. Patients routinely exposed to animals or animal serum products can be prone to this interference and anomalous values may be observed[10].
- Bacterial contamination of the specimens may affect the test results.
- In pregnancy, the Total T4 results may be incorrect, i.e. falsely-low. This assay should not be used as the only marker for thyroid disease evaluation during pregnancy. To ensure maximum diagnostic accuracy, thyroid status in pregnant women should be determined using thyroid function tests such as TSH, Free T4, and clinical evaluation by the physician.

SPECIFIC PERFORMANCE CHARACTERISTICS

Representative performance data are provided in this section. Results obtained in individual laboratories may vary.

Precision

Precision was determined using the assay, samples and controls in a protocol (EP05-A3) of the CLSI (Clinical and Laboratory Standards Institute): duplicates at two independent runs per day for 5 days at three different sites using three lots of reagent kits (n = 180). The following results were obtained:

Sample	Mean (μg/dL) (n=180)	Within-Run		Between-Run		Reproducibility	
		SD (μg/dL)	%CV	SD (μg/dL)	%CV	SD (μg/dL)	%CV
Serum Pool 1	4.990	0.189	3.79	0.142	2.85	0.326	6.53
Serum Pool 2	8.960	0.316	3.53	0.236	2.63	0.497	5.55
Serum Pool 3	13.156	0.451	3.43	0.278	2.11	0.699	5.31
Plasma Pool 1	5.013	0.159	3.17	0.117	2.33	0.259	5.17
Plasma Pool 2	9.095	0.288	3.17	0.100	1.10	0.453	4.98
Plasma Pool 3	12.915	0.377	2.92	0.084	0.65	0.710	5.50
Control 1	7.038	0.265	3.77	0.174	2.47	0.440	6.25
Control 2	13.827	0.478	3.46	0.305	2.21	0.693	5.01

Linear Range

0.200-30.0 μg/dL (defined by the Limit of Quantitation and the maximum of the master curve).

Reportable Interval

0.150-60.0 μg/dL (defined by the Limit of Detection and the maximum of the master curve×Recommended Dilution Ratio).

Analytical Sensitivity

Limit of Blank (LoB) =0.100 μg/dL.
Limit of Detection (LoD) =0.150 μg/dL.
Limit of Quantitation (LoQ) =0.200 μg/dL.

Analytical Specificity

Interference

Interference was determined using the assay, three samples containing different concentrations of analyte were spiked with potential endogenous and exogenous interferents in a protocol (EP7-A2) of the CLSI. The measurement deviation of the interference substance is within ±10%. The following results were obtained:

Interference	No interference up to	Interference	No interference up to
Bilirubin	40 mg/dL	Rheumatoid factor	2400 IU/mL
Hemoglobin	2300 mg/dL	ANA	398 AU/mL
Intralipid	2500 mg/dL	Biotin	0.5 mg/dL
Phenytoin	6.0 mg/dL	Methimazole	0.4 mg/dL
Phenylbutazone	32.1 mg/dL	Amiodarone	4.2 mg/dL
Acetylsalicylic acid	50 mg/dL	Propylthiouracil	4.0 mg/dL

Cross-Reactivity

Cross-reactivity was determined using the assay, three samples containing different concentrations of analyte were spiked with potential cross-reactants in a protocol (EP7-A2) of the CLSI. The measurement deviation of the interference substance is within ±10%. The following results were obtained:

Cross-reactant	No interference up to	Cross-reactant	No interference up to
L-triiodothyronine	500 ng/mL	D-triiodothyronine	500 ng/mL
Monoiodotyrosine	1000 ng/mL	Diiodotyrosine	1000 ng/mL
Reverse triiodothyronine	100 ng/mL		

Method Comparison

A comparison of the Total T4 assay with a commercially available immunoassay, gave the following correlations (μg/dL):
Number of samples measured: 158
Passing-Bablok: y=1.0009x+0.0215, τ=0.942.
The clinical specimen concentrations were between 0.500 and 29.70 μg/dL.

REFERENCES

1. Demers L M. Thyroid disease: pathophysiology and diagnosis [J]. Clinics in laboratory medicine, 2004, 24(1): 19-28.
2. Mondal S, Raja K, Schweizer U, et al. Chemistry and biology in the biosynthesis and action of thyroid hormones[J]. Angewandte Chemie International Edition, 2016, 55(27): 7606-7630.
3. Baloch Z, Carayon P, Conte-Devolx B, et al. Laboratory medicine practice guidelines. Laboratory support for the diagnosis and monitoring of thyroid disease [J]. Thyroid: official journal of the American Thyroid Association, 2003, 13(1): 3-126.
4. Carvalho G A D, Perez C L S, Ward L S. The clinical use of thyroid function tests [J]. Arq Bras Endocrinol Metabol, 2013, 57: 193-204.
5. Lum S M C, Nicoloff J T, Spencer C A, et al. Peripheral tissue mechanism for maintenance of serum triiodothyronine values in a thyroxine-deficient state in man [J]. The Journal of clinical investigation, 1984, 73(2): 570-575.
6. Spencer C . Thyroid function tests: assay of thyroid hormones and related substances [M]. Thyroid Disease Manager, 2017.
7. Stockigt J R. Free thyroid hormone measurement: a critical appraisal [J]. Endocrinology and metabolism clinics of North America, 2001, 30(2): 265-289.
8. De Leo S, Lee SY, Braverman LE. Hyperthyroidism [J]. The Lancet, 2016, 388 (10047):906-918.
9. CLSI. Statistical Quality Control for Quantitative Measurement Procedures: Principles and Definitions. 4th ed. CLSI guideline C24. Wayne, PA: Clinical and Laboratory Standards Institute; 2016.
10. Boscato L M, Stuart M C. Heterophilic antibodies: a problem for all immunoassays [J]. Clinical Chemistry, 1988, 34 (1):27-33.

SYMBOLS EXPLANATIONS

	Consult instructions for use		Manufacturer
	Temperature limit (Store at 2-8 °C)		Use-by date
	Contains sufficient for<n> tests		Keep away from sunlight
	This way up	EC REP	Authorized representative in the European Community
IVD	*In vitro* diagnostic medical device	CONTENTS	Kit component
REF	Catalogue number	LOT	Batch code
CE	CE marking		

Shenzhen New Industries Biomedical Engineering Co., Ltd.
No.23, Jinxiu East Road, Pingshan District, 518122 Shenzhen, P.R. China
Tel: +86-755-21536601 Fax:+86-755-28292740

EC REP
Shanghai International Holding Corp. GmbH (Europe)
Eiffestrasse 80, 20537 Hamburg, Germany
Tel: +49-40-2513175 Fax: +49-40-255726