Snibe Diagnostic

CE REF 130213003M:100 tests/kit
130613003M: 50 tests/kit
130713003M: 30 tests/kit

MAGLUMI® EPO (CLIA)

INTENDED USE

The kit is an *in vitro* chemiluminescence immunoassay for the quantitative determination of Erythropoietin (EPO) 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 the diagnosis of anemias and polycythemias.

SUMMARY

Erythropoietin (EPO) is an acidic glycoprotein of about 30 kDa and comprises 165 amino acids and four glycans. EPO is primarily expressed by hepatocytes during the fetal state. After birth, peritubular fibroblasts in the renal cortex become the main production site[1]. In humans, Red blood cells (RBCs) production can be enhanced as much as eightfold the baseline rate in a variety of clinical settings including hemorrhage, hemolysis, and other types of stress that impair the oxygenation of arterial blood or the delivery of oxygen to the tissues. EPO is the primary, and probably the sole mediator of hypoxic induction of erythropoiesis[2]. Lack of oxygen induces EPO gene expression in the kidneys and the liver[3].

Serum EPO levels are useful in determining the cause of polycythemia[4]. Primary polycythemia is a condition in which there is an intrinsic defect in the erythroid precursor cells, which is usually characterized by low serum EPO levels. Secondary polycythemia occurs when EPO production is increased for any reason, either as a physiological response to tissue hypoxia or in pathological circumstances. Most of the secondary polycythemia are acquired, where causes extrinsic to the erythroid compartment induce hypoxia, and as a consequence, EPO is produced at higher levels and then drives the production of RBCs[5].

The primary physiological stimulus of increased EPO gene transcription is tissue hypoxia, which can increase in circulating serum EPO levels[6], such as living at high altitude, chronic obstructive pulmonary disease, cyanotic heart disease, congestive heart failure, ischaemic stroke, sleep apnea, or high oxygen affnity hemoglobinopathy[3,7-9,12]. In other instances, elevated EPO levels are the result of production by neoplastic cells. Cases of increased EPO production and erythrocytosis have been reported for patients with cystic kidney, Hypernephroma, Wilms' tumors, cerebellar hemangioblastomas, uterine leiomyomas, pheochromocytoma, renal cell carcinoma, hepatocellular carcinoma, parathyroid adenomas and meningiomas[3,10,11].

EPO deficiency is found in conjunction with certain forms of anemias. These include anemia of renal failure[2], end-stage renal disease[13], anemia of prematurity[14], anemia of malnutrition[3] and anemia of hypothyroidism[15]. Anemia of chronic disease (ACD) is mild anemia, which frequently develops in patients with chronic infections, autoimmune diseases, or malignancies. Patients with ACD have a less marked impairment of EPO production. The factors causing ACD are include insufficient iron availability in the bone marrow, inhibition of the proliferation of erythrocytic progenitors by inflammatory cytokines (IL-1 and TNF-α), increased hemolysis, and bleeding[2,3,16]. Other forms of anemias are not due to an endogenous EPO deficiency and affected individuals show elevated levels of EPO. These forms include myelodysplastic syndromes, aplastic anemias, iron deficiency anemias, haemolytic anemias, megaloblastic anemias, and pure red cell aplasias[17-20].

The isolation of EPO and the production of recombinant human EPO (rHuEPO) have permitted clinical studies showing the efficacy of this hormone to increase RBCs mass in the correction of anemia with chronic renal failure, cancer or AIDS. Serum EPO concentrations are useful in predicting and assessing the therapeutic response in patients receiving rHuEPO[21-25].

TEST PRINCIPLE

Sandwich chemiluminescence immunoassay.

The sample, buffer, magnetic microbeads coated with anti-EPO monoclonal antibody, ABEI labeled with another anti-EPO monoclonal antibody are mixed thoroughly, reacting to form sandwich complexes and incubating. After precipitation in a magnetic field, the supernatant is decanted and then a wash cycle is performed. 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 proportional to the concentration of EPO present in the sample.

REAGENTS

Kit Contents

Component	Description	100 tests/kit	50 tests/kit	30 tests/kit
Magnetic Microbeads	Magnetic microbeads coated with anti-EPO monoclonal antibody (~10.0 μg/mL) in PBS buffer, NaN_3 (<0.1%).	2.5 mL	2.0 mL	1.0 mL
Calibrator Low	A low concentration of EPO antigen in PBS buffer, NaN_3 (<0.1%).	2.0 mL	1.5 mL	1.5 mL
Calibrator High	A high concentration of EPO antigen in PBS buffer, NaN_3 (<0.1%).	2.0 mL	1.5 mL	1.5 mL
Buffer	Tris-HCl buffer, NaN_3 (<0.1%).	8.5 mL	5.5 mL	3.0 mL
ABEI Label	ABEI labeled with anti-EPO monoclonal antibody (~0.500 μg/mL) in Tris-HCl buffer, NaN_3 (<0.1%).	8.5 mL	5.5 mL	3.3 mL
Diluent	0.9% NaCl.	15.0 mL	10.0 mL	5.0 mL
Control 1	A low concentration of EPO antigen (20.0 mIU/mL) in PBS buffer, NaN_3 (<0.1%).	2.0 mL	2.0 mL	2.0 mL
Control 2	A high concentration of EPO antigen (200 mIU/mL) in PBS buffer, NaN_3 (<0.1%).	2.0 mL	2.0 mL	2.0 mL
All reagents are provided ready-to-use.				

Warnings and Precautions

- For *in vitro* diagnostic use.
- For professional use only.
- Exercise the normal precautions required for handling all laboratory reagents.
- 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.
- 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	Li-heparin

- 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.
- Study had shown a marked circadian rhythm of serum EPO. It is useful to recommend that samples be collected at a consistent time of day. Morning samples taken between 7:30 am and 12:00 noon have been recommended[26].

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 50 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 48 hours at 2-8°C, or 2 months frozen at -20°C. Frozen specimens subjected to up to 3 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, EPO concentrations above the analytical measuring interval, can be diluted with Diluent either automated dilution protocol or manual dilution procedure. The recommended dilution ratio is 1:4. The concentration of the diluted sample must be >300 mIU/mL.
- For manual dilution, multiply the result by the dilution factor. For dilution by the analyzers, the analyzer software automatically takes the dilution into account when calculating the sample concentration.

PROCEDURE

Materials Provided

EPO (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 X8, MAGLUMI X3 or Integrated System Biolumi 8000.
- 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 WHO International Standard 11/170.

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 7 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[29].

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 EPO 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.

▌RESULTS

Calculation

The analyzer automatically calculates the EPO 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 mIU/mL. For further information please refer to the Analyzer Operating Instructions.

Interpretation of Results

The expected range for the EPO assay was obtained by testing 223 apparently healthy individuals in China, gave the following expected value:
2.6-19.0 mIU/mL (2.5^{th}-97.5^{th} percentiles).

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 EPO results are inconsistent with clinical evidence, additional testing is needed to confirm the result.
- After allogeneic bone marrow transplant, impaired EPO response may delay EPO recovery. Patients with hypergammaglobulinemia associated with multiple myeloma or Waldenstrom's disease have impaired production of EPO in relation to hemoglobin concentration, and this has been linked to increased plasma viscosity. EPO levels of persons living at high altitudes with erythrocytosis may rapidly fall to normal after returning to low altitudes[27,28].
- Specimens from patients who have received preparations of mouse monoclonal antibodies for diagnosis or therapy may contain human anti-mouse antibodies (HAMA). Such specimens may show either falsely elevated or depressed values when tested with assay kits which employ mouse monoclonal antibodies[30,31]. Additional information may be required for diagnosis.
- 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[32].
- Bacterial contamination of the specimens may affect the test results.

▌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 (mIU/mL) (n=180)	Within-Run		Between-Run		Reproducibility	
		SD (mIU/mL)	%CV	SD (mIU/mL)	%CV	SD (mIU/mL)	%CV
Serum Pool 1	2.601	0.108	4.15	0.028	1.08	0.140	5.38
Serum Pool 2	19.393	0.432	2.23	0.365	1.88	0.820	4.23
Serum Pool 3	996.757	16.306	1.64	3.418	0.34	20.848	2.09
Plasma Pool 1	2.626	0.100	3.81	0.076	2.89	0.152	5.79
Plasma Pool 2	19.108	0.474	2.48	0.206	1.08	0.630	3.69
Plasma Pool 3	1015.410	15.938	1.57	2.105	0.21	37.170	3.66
Control 1	20.038	0.668	3.33	0.447	2.23	0.939	4.69
Control 2	203.695	5.602	2.75	2.003	0.98	8.178	4.01

Linear Range

0.600-1500 mIU/mL (defined by the Limit of Quantitation and the maximum of the master curve).

Reportable Interval

0.500-7500 mIU/mL (defined by the Limit of Detection and the maximum of the master curve×Recommended Dilution Ratio).

Analytical Sensitivity

Limit of Blank (LoB) =0.300 mIU/mL.
Limit of Detection (LoD) =0.500 mIU/mL.
Limit of Quantitation (LoQ) =0.600 mIU/mL.

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	Biotin	50 μg/mL
Hemoglobin	500 mg/dL	ANA	6 (S/CO) strong positive
Intralipid	1000 mg/dL	Ibuprofen	40 mg/dL
HAMA	40 ng/mL	Acetaminophen	20 mg/dL
Rheumatoid factor	1500 IU/mL	Acetylsalicylic acid	50 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
EPO receptor (rhEPO sR)	50 ng/mL	Thrombopoietin	50 ng/mL
α-2-Macroglobulin	400 mg/dL	α-1-Acid Glycoprotein	80 mg/dL
Transferrin (iron-saturated)	200 mg/dL	α-1-Antitrypsin	200 mg/dL
Transferrin (non-saturated)	200 mg/dL		

High-Dose Hook

No high-dose hook effect was seen for EPO concentrations up to 100000 mIU/mL.

Method Comparison

A comparison of the EPO assay with a commercially available immunoassay, gave the following correlations (mIU/mL):
Number of samples measured: 123

Passing-Bablok: y=1.0161 x-0.0818, τ=0.977.
The clinical specimen concentrations were between 0.84 and 1335.4 mIU/mL.

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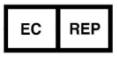
SYMBOLS EXPLANATIONS

	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		Authorized representative in the European Community
	*In vitro* diagnostic medical device		Kit component
	Catalogue number		Batch code
	CE marking		

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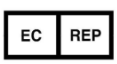

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