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“trace & catch”

## Instruction for Use

### Antibody to cetuximab (Erbix<sup>®</sup>) ELISA

# SHIKARI<sup>®</sup> S-ATC

Enzyme immunoassay for the qualitative determination (screening) of antibodies to cetuximab (Erbix<sup>®</sup>) in serum and plasma

REF TR-ATCv1



12 x8



2-8 C

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	SHIKARI S-ATC
	Cetuximab (Erbix®) antibodies qualitative analyse
Required Volume (µl)	10
Total Time (min)	140
Sample	Serum, plazma
Sample Number	96
Detection Limit (ng/mL)	+/-
Spike Recovery (%)	-
Shelf Life (year)	1

## Intended Use

The Matriks Biotek® Antibody to cetuximab (Erbixux®) Enzyme-Linked-ImmunoSorbent-Assay (ELISA) Kit is intended for the qualitative determination of antibodies to cetuximab (Erbixux®) in serum and plasma. It is for professional use only.

## Summary and Explanation

### Epidermal growth factor receptor (EGFR)

Epidermal growth factor receptor (EGFR; HER1; ErbB1) is a transmembrane tyrosine kinase encoded by *c-erb-B* proto-oncogene, expressed in normal and malignant cells and stimulated by epidermal growth factor (EGF) or transforming growth factor-alpha (TGF-alpha) binding extracellular domain of the receptor, leading receptor to dimerize and activating intracellular kinase domain on each receptor, bringing about phosphorylation of tyrosine residues on each member of the receptor pair. Then, signaling complexes form in cytoplasm to activate gene transcription responding for such as cell proliferation. Termination of signaling occurs through internalization of receptor-ligand complex. Activation of EGFR results in perturbation of mitogen-activated protein kinase (MAPK), phosphatidylinositol 3-kinase, and AKT pathways triggering tumorigenic processes, such as increased proliferation, angiogenesis and metastasis, and prevents apoptosis. Breast, lung, colon, prostate, kidney, bladder, head and neck, and ovary cancers have been associated to EGFR overexpression which causes early disease progression, poor survival, and resistance to chemotherapy in many epithelial malignancies. Epidermal growth factor receptor/human epidermal growth factor receptor 1 (EGFR/HER1) and its ligand, transforming growth factor-alpha (TGF-alpha) were showed to involve in hepatocarcinogenesis. EGFR is overexpressed in hepatocellular carcinoma (HCC). To overcome the uncontrollable effect of EGFR triggering cancer development, monoclonal antibodies have been shown to be used as blockers *in vitro* and *in vivo*.

### Cetuximab

Cetuximab (IMC-C225, Erbixux) is a chimeric monoclonal antibody of the immunoglobulin G1 (IgG1) and FDA-approved epidermal growth factor receptor (EGFR) inhibitor. It is a 152 kDa protein composed of four polypeptide chain. There are 32 cysteine residues forming accordingly 16 potential disulfide bonds. Preclinical studies have shown that cetuximab enhances the antitumour effects of chemotherapy (e.g. that of irinotecan in colorectal cancer) as well as radiotherapy (e.g. in squamous cell carcinoma of the head and neck) by inhibiting cell proliferation, angiogenesis and metastasis and by promoting apoptosis is used for the treatment of metastatic colorectal cancer, metastatic non-small cell lung cancer and head and neck cancer. Cetuximab also blocks growth factor-induced activation of the downstream mitogen-activated

protein kinase, inhibiting cell proliferation. It has been also illustrated that cetuximab increases the receptor internalization which is another mechanism to silence the receptor. Cetuximab arrests cell cycle at G1 gap phase by upregulating anti-proliferative p27<sup>kip1</sup>, which functions via complex formation with Cdk2, and downregulating proliferating cell nuclear antigen (PCNA). It also decreases angiogenic factors, inhibits tumor-cell invasion and metastasis via downregulation of matrix metalloproteinases (MMPs) and VEGF, and promotes apoptosis by upregulating apoptotic protein, Bax, with the help of other chemotherapeutic agents. Cetuximab has been widely shown to display synergistic effect with other agents and/or radiotherapy.

Binding of antigen-binding fragment (Fab) of Cetuximab, which displays higher affinity comparing to ligands of EGFR, takes place via domain III of extracellular EGFR, preventing the receptor from conformational change to be dimerized and blocking EGFR signaling through inhibition of EGF and TGF- $\alpha$ -stimulated phosphorylation of the receptor.

#### **Pharmacokinetics and Pharmacodynamics**

In a study conducted by Fracasso et al., patients with colorectal, breast, and head and neck carcinomas were administered with one of different dosages of cetuximab (50, 100, 250, 400 and 500 mg/m<sup>2</sup>). For each concentration, cetuximab serum concentration was showed to reach maximum at 3 h, and decrease slowly. Serum concentration decreased to baseline at 96 h and 168 h for dosages 50 and 100 mg/m<sup>2</sup>, respectively. Mean maximum observed concentrations (C<sub>max</sub>) increased in a dose dependent manner (from 22.8 ug/ml to 245.6 ug/ml).

It was indistinguishable for 400 mg/m<sup>2</sup> (C<sub>max</sub>=228.9 ug/ml) and 500 mg/m<sup>2</sup> (C<sub>max</sub>=245.6 ug/ml). The mean total body clearance based on body surface area for cetuximab was similar following doses of >100 mg/m<sup>2</sup> (range, 34.4-19.3 L/h/m<sup>2</sup>) but greater in the 50 mg/m<sup>2</sup> dose group (65.9 L/h/m<sup>2</sup>). Biopsy results showed that maximal cytoplasmic EGFR downregulation after treatment was seen in 8 h with 400 mg/m<sup>2</sup> dosage.

After 250 mg/m<sup>2</sup> weekly cetuximab administration, the average trough level of patients with both partial responses (PRs) and stable disease (SD) was 60,742 ng/ml (~400 nmol/l) compared with those patients with progressive disease (PD; 33,208 ng/ml). In another study, cetuximab was infused as loading dose of 400 mg/m<sup>2</sup> followed by weekly infusions of 250 mg/m<sup>2</sup> in colorectal cancer patients. Median residual concentrations were 41 and 54 mg/L on days 14 and 28, respectively. It was determined that initial serum albumin concentration was significantly related to first-order elimination clearance of cetuximab. Central volume of distribution was 2.96 L (4%), peripheral volume of distribution was 4.65 L (6%), elimination clearance was 0.479 L/d (4%) and distribution clearance was 0.836 L/d (8%).

## Test Principle

The Matriks Biotek® Antibody to cetuximab (Erbix®) ELISA is a sandwich assay for the determination of antibodies against cetuximab in serum and plasma samples. During the first incubation period, antibodies to cetuximab (ATC) in patient serum/plasma samples are captured by the drug cetuximab (Erbix®) coated on the wall of the microtiter wells. After washing away the unbound components from samples, a peroxidase-labelled specific conjugate is added to each well and then incubated. After a second washing step, the bound enzymatic activity is detected by addition of tetramethylbenzidine (TMB) chromogen-substrate. Finally, the reaction is terminated with an acidic stop solution. The intensity of the reaction color is directly proportional to the concentration of ATC in sample.

## Warnings and Precautions

1. For professional use only.
2. Before starting the assay, read the instructions completely and carefully. Use the valid version of the package insert provided with the kit. Be sure that everything is understood. For further information (clinical background, test performance, automation protocols, alternative applications, literature, etc.) please refer to the local distributor.
3. In case of severe damage of the kit package please contact Matriksbiotek or your supplier in written form, latest one week after receiving the kit. Do not use damaged components in test runs, but keep safe for complaint related issues.
4. Obey lot number and expiry date. Do not mix reagents of different lots. Do not use expired reagents.
5. Follow good laboratory practice and safety guidelines. Wear lab coats, disposable latex gloves and protective glasses where necessary.
6. Reagents of this kit containing hazardous material may cause eye and skin irritations. See MATERIALS SUPPLIED and labels for details.
7. Chemicals and prepared or used reagents have to be treated as hazardous waste according the national biohazard safety guidelines or regulations.
8. Avoid contact with Stop solution. It may cause skin irritations and burns.
9. Some reagents contain sodium azide ( $\text{NaN}_3$ ) as preservatives. In case of contact with eyes or skin, flush immediately with water.  $\text{NaN}_3$  may react with lead and copper plumbing to form explosive metal azides. When disposing reagents, flush with large volume of water to avoid azide build-up.
10. All reagents of this test kit containing human serum or plasma have been tested and were found negative for HIV I/II, HBSAg and HCV by FDA approved procedures. However, a presence of these or other infectious agents cannot be excluded absolutely and therefore reagents should be treated as potential biohazards in use and for disposal.

## Storage and Stability

The kit is shipped at ambient temperature and should be stored at 2-8°C. Keep away from heat or direct sun light. The storage and stability of specimen and prepared reagents is stated in the corresponding chapters. The strips of microtiter plate is stable up to the expiry date of the kit in the broken, but tightly closed bag when stored at 2-8°C.

## Specimen Collection and Storage

### Serum, Plasma (EDTA, Heparin)\*

The usual precautions for venipuncture should be observed. It is important to preserve the chemical integrity of a blood specimen from the moment it is collected until it is assayed. Do not use grossly hemolytic, icteric or grossly lipemic specimens. Samples appearing turbid should be centrifuged before testing to remove any particulate material.

Storage:	2-8°C	-20°C	Keep away from heat or direct sunlight
Stability:	7 d	6 mon	Avoid repeated freeze-thaw cycles

\*. Cetuximab (Erbitux®) infusion camouflages/masks the presence of antibody to cetuximab in serum/plasma samples. Therefore, blood sampling time is critical for detection of cetuximab. Matriks Biotek® Laboratories propose to obtain blood sample just before the infusion of cetuximab (Erbitux®) or at least 2 weeks after the infusion of cetuximab (Erbitux®).

## Materials Supplied

1 x 12 x 8	MTP	<b>Microtiter Plate</b> Break apart strips. Microtiter plate with 12 rows each of 8 wells coated with cetuximab.
1 x 0.25 mL	RCTV CNTR	<b>Reactive Control</b> Ready-to-use. Contains cetuximab -reactive reagent, human serum, stabilizers and <0.1% NaN <sub>3</sub>
1 x 0.5 mL	NEG CNTR	<b>Negative Control</b> Ready-to-use. Contains human serum, stabilizers and <0.1% NaN <sub>3</sub>
1 x 12 mL	ASSAY BUF	<b>Assay Buffer</b> Blue colored. Ready to use. Contains proteins and <0.1% NaN <sub>3</sub>
1 x 12 mL	POD CONJ	<b>Peroxidase Conjugate</b> Red colored. Ready to use. Contains peroxidase (POD) conjugate, RF blockers, stabilizer and preservatives.
1 x 12 mL	TMB SUBS	<b>TMB Substrate Solution</b> Ready to use. Contains TMB
1 x 12 mL	TMB STOP	<b>TMB Stop Solution</b> Ready to use. 1N HCl.
1 x 50 mL	WASHBUF CONC	<b>Wash Buffer, Concentrate (20x)</b> Contains Buffer with Tween 20.
2 x 1	ADH FILM	<b>Adhesive Film</b> For covering of Microtiter Plate during incubation.

## Materials Required but not Supplied

1. Micropipettes (< 3% CV) and tips to deliver 5-1000  $\mu\text{L}$ .
2. Bidistilled or deionised water
3. Calibrated measures.
4. Absorbent paper and timer.
5. Standard laboratory glass or plastic vials, cups, etc.
6. Wash bottle, automated or semi-automated microtiter plate washing system
7. Microtiter plate reader capable of reading absorbance at 450 nm (reference wavelength 620-690 nm is optional).

## Procedure Notes

1. Any improper handling of samples or modification of the test procedure may influence the results. The indicated pipetting volumes, incubation times, temperatures and pretreatment steps have to be performed strictly according to the instructions. Use calibrated pipettes and devices only.
2. Once the test has been started, all steps should be completed without interruption. Make sure that required reagents, materials and devices are prepared ready at the appropriate time. Allow all reagents and specimens to reach room temperature (18-25  $^{\circ}\text{C}$ ) and gently swirl each vial of liquid reagent and sample before use. Mix reagents without foaming.
3. Avoid contamination of reagents, pipettes and wells/tubes. Use new disposable plastic pipette tips for each reagent, standard or specimen. Do not interchange caps. Always cap not used vials. Do not reuse wells/tubes or reagents.
4. Use a pipetting scheme to verify an appropriate plate layout.
5. Incubation time affects results. All wells should be handled in the same order and time sequences. It is recommended to use an 8-channel Micropipettor for pipetting of solutions in all wells.
6. Microplate washing is important. Improperly washed wells will give erroneous results. It is recommended to use a multichannel pipette or an automatic microplate washing system. Do not allow the wells to dry between incubations. Do not scratch coated wells during rinsing and aspiration. Rinse and fill all reagents with care. While rinsing, check that all wells are filled precisely with Wash Buffer, and that there are no residues in the wells.
7. Humidity affects the coated wells/tubes. Do not open the pouch until it reaches room temperature. Unused wells/tubes should be returned immediately to the resealed pouch including the desiccant.

## Preparation of Component

Dilute/ dissolve	Component	with	Diluent	Relation	Remarks	Storage	Stability
10 mL	Wash Buffer*	Up to 200 mL	Bidist. water	1:20	Warm up at 37°C to dissolve crystals. Mix vigorously.	2-8 °C	3 w

\*. Prepare Wash Buffer before starting assay procedure.

## Test Procedure

1	Pipette 100µl of Assay Buffer non-exceptionally into each of the wells to be used.
2	<p><b>QUALITATIVE ELISA TEST FORMAT</b></p> <p>Pipette 10 µL of ready-to use Cut-Off Serum, Reactive Control, and Samples into the respective wells of microtiter plate.</p> <p><u>Wells</u></p> <p>A1:                      Negative Control            B1:                      Negative Control            C1:                      Reactive Control            D1 and on.:            Sample (Serum/Plasma)</p>
3	Cover the plate with adhesive film. Briefly mix contents by gently shaking the plate. Incubate 60 min at room temperature (18-25°C).
4	Remove adhesive film. Discard incubation solution. Wash plate 3 times each with 300 µL of diluted Wash Buffer. Remove excess solution by tapping the inverted plate on a paper towel.
5	Pipette 100 µL of ready-to use Peroxidase Conjugate into each well.
6	Cover the plate with adhesive film. Incubate 60 min at room temperature (18- 25°C).
7	Remove adhesive film. Discard incubation solution. Wash plate 3 times each with 300 µL of diluted Wash Buffer. Remove excess solution by tapping the inverted plate on a paper towel.
8	Pipette 100 µL of TMB Substrate Solution into each well.
9	Incubate 20 min (without adhesive foil.) at room temperature (18-25°C) in the dark.
10	Stop the substrate reaction by adding 100 µL of Stop Solution into each well. Briefly mix contents by gently shaking the plate. Color changes from blue to yellow
11	Measure optical density with a photometer at 450/650 nm within 30 min after pipetting of the Stop Solution.

## Interpretation Of Results

For the run to be valid, the OD<sub>450/650</sub> nm of Positive Control should be  $\geq 1.00$  and the OD<sub>450/650</sub> nm of each Negative Control should be  $< 0.200$ . If not, improper technique or reagent deterioration may be suspected and the run should be repeated.

**The results are evaluated by a cut-off value which is estimated by multiplying the mean OD<sub>450/650</sub> nm of the negative controls by 3.**

**I.e.;**

**If “Sample OD<sub>450/650</sub> the mean OD<sub>450/650</sub> of Negative Controls” is  $\geq 3$ , the sample is POSITIVE** If “Sample OD<sub>450/650</sub> the mean OD<sub>450/650</sub> of Negative Controls” is  $< 3$ , the sample is NEGATIVE

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