

# Creatinine FS\*

**Diagnostic reagent for quantitative in vitro determination of creatinine in serum, plasma or urine on photometric systems**

## Order Information

Cat. No.	Kit size
1 1711 99 10 021	R1 4 x 20 mL + R2 1 x 20 mL + 1 x 3 mL Standard
1 1711 99 10 026	R1 5 x 80 mL + R2 1 x 100 mL
1 1711 99 10 023	R1 1 x 800 mL + R2 1 x 200 mL
1 1711 99 10 704	R1 8 x 50 mL + R2 8 x 12.5 mL
1 1711 99 10 917	R1 8 x 60 mL + R2 8 x 15 mL
1 1711 99 90 314	R1 10 x 20 mL + R2 2 x 30 mL
1 1700 99 10 030	6 x 3 mL Standard

## Summary [1,2]

Creatinine is a waste product excreted by the kidneys mainly by glomerular filtration. The concentration of creatinine in plasma of a healthy individual is fairly constant, independent from water intake, exercise and rate of urine production. Therefore, increased plasma creatinine values always indicate decreased excretion, i.e. impaired kidney function. The creatinine clearance enables a quite good estimation of the glomerular filtration rate (GFR) which allows better detection of kidney diseases and monitoring of renal function. For this purpose creatinine is measured simultaneously in serum and urine collected over a defined time period.

## Method

Kinetic test without deproteinization according to the Jaffé method

## Principle

Creatinine forms a colored orange-red complex in an alkaline picrate solution. The difference in absorbance at fixed times during conversion is proportional to the concentration of creatinine in the sample.

Creatinine + Picric acid  $\longrightarrow$  Creatinine picrate complex

## Reagents

### Components and Concentrations

R1:	Sodium hydroxide	0.2 mol/L
R2:	Picric acid	20 mmol/L
Standard:		2 mg/dL (177 µmol/L)

### Storage Instructions and Reagent Stability

The reagents and the standard are stable up to the end of the indicated month of expiry, if stored at 2 – 25°C and contamination is avoided. Do not freeze the reagents and the standard and protect them from light!

### Waste Management

Please refer to local legal requirements.

### Reagent Preparation

The standard is ready to use.

### Substrate Start

The reagents are ready to use.

### Sample Start

Mix 4 parts of R1 + 1 part of R2

(e.g. 20 mL R1 + 5 mL R2) = mono reagent

Stability of mono reagent: 5 hours at 15 – 25°C

### Warnings and Precautions

- Reagent 1: Warning. H290 May be corrosive to metals. H315 Causes skin irritation. H319 Causes serious eye irritation. P234 Keep only in original container. P264 Wash hands and face thoroughly after handling. P280 Wear protective gloves/protective clothing/eye protection. P302+P352 If on skin: Wash with plenty of water/soap. P332+P313 If skin irritation occurs: Get medical advice/attention. P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P337+P313 If eye irritation persists: Get medical advice/attention. P390 Absorb spillage to prevent material damage.
- Reagent 2: Warning. H290 May be corrosive to metals. P234 Keep only in original container. P280 Wear protective gloves/protective clothing/eye protection. P390 Absorb spillage to prevent material damage.
- High homogenetic acid concentrations in urine samples lead to false results.
- In very rare cases, samples of patients with gammopathy might give falsified results [11].

- Eltrombopag medication leads to falsely low or high results in patient samples.
- Please refer to the safety data sheets and take the necessary precautions for the use of laboratory reagents. For diagnostic purposes, the results should always be assessed with the patient's medical history, clinical examinations and other findings.
- For professional use only!

### Materials required but not provided

NaCl solution 9 g/L

General laboratory equipment

### Specimen

Serum, heparin plasma, urine

Stability [5]

in serum /plasma:	7 days	at	4 – 25°C
	at least 3 months	at	–20°C
in urine:	2 days	at	20 – 25°C
	6 days	at	4 – 8°C
	6 months	at	–20°C

Dilute urine 1 + 49 with dist. water; multiply the result by 50. TruLab Urine controls must be prediluted the same way as patient samples.

Discard contaminated specimens! Only freeze once!

### Assay Procedure

#### Application sheets for automated systems are available on request.

Wavelength	Hg 492 nm, (490 – 510 nm)
Optical path	1 cm
Temperature	20 – 25 °C/37°C
Measurement	Against reagent blank

#### Substrate start

	Blank	Sample or standard
Sample or standard	-	50 µL
Dist. Water	50 µL	-
Reagent 1	1000 µL	1000 µL
Mix, incubate 0 – 5 min., then add:		
Reagent 2	250 µL	250 µL
Mix and read absorbance A1 after 60 sec, read absorbance A2 after further 120 sec.		

$\Delta A = (A2 - A1)$  sample or standard

#### Sample start

	Blank	Sample or standard
Sample or standard	-	50 µL
Dist. Water	50 µL	-
Mono reagent	1000 µL	1000 µL
Mix and read absorbance A1 after 60 sec, read absorbance A2 after further 120 sec.		

$\Delta A = (A2 - A1)$  sample or standard

### Calculation

With standard or calibrator

#### Serum/Plasma

$$\text{Creatinine [mg / dL]} = \frac{\Delta A \text{ Sample}}{\Delta A \text{ Std / Cal}} \times \text{Conc. Std / Cal [mg / dL]}$$

#### Urine

$$\text{Creatinine [mg / dL]} = \frac{\Delta A \text{ Sample}}{\Delta A \text{ Std / Cal}} \times \text{Conc. Std / Cal [mg / dL]} \times 50$$

#### Creatinine Clearance [mL/min/1.73 m<sup>2</sup>] [7]

$$= \frac{\text{mg Creatinine / 100 mL Urine} \times \text{mL Urine}}{\text{mg Creatinine / 100 mL Serum} \times \text{min Urine collection time}}$$

The calculated creatinine clearance refers to the average body surface of an adult (1.73 m<sup>2</sup>).

#### Conversion factor

$$\text{Creatinine [mg/dL]} \times 88.4 = \text{Creatinine [µmol/L]}$$

## Calibrators and Controls

For the calibration of automated photometric systems, DiaSys TruCal U calibrator is recommended. Calibrator values have been made traceable to NIST (National Institute for Standardization) Standard Reference Material SRM 967 using level 1 and 2 and therefore to GC-IDMS (gas chromatography - isotope dilution mass spectrometry). For internal quality control DiaSys TruLab N, P and TruLab Urine controls should be assayed. Each laboratory should establish corrective action in case of deviations in control recovery.

	Cat. No.	Kit size
TruCal U	5 9100 99 10 063	20 x 3 mL
	5 9100 99 10 064	6 x 3 mL
TruLab N	5 9000 99 10 062	20 x 5 mL
	5 9000 99 10 061	6 x 5 mL
TruLab P	5 9050 99 10 062	20 x 5 mL
	5 9050 99 10 061	6 x 5 mL
TruLab Urine Level 1	5 9170 99 10 062	20 x 5 mL
	5 9170 99 10 061	6 x 5 mL
TruLab Urine Level 2	5 9180 99 10 062	20 x 5 mL
	5 9180 99 10 061	6 x 5 mL

## Compensated method [3,4]

Picric acid which forms the colored complex reacts unspecifically with interfering serum components, so-called pseudo-creatinines. This leads to falsely elevated creatinine values in serum and plasma samples especially in the low measuring range. To compensate these interferences the calibrator value for the compensated method indicated in the value sheet of TruCal U has to be used for calculation. Additionally 0.3 mg/dL (27 µmol/L) has to be subtracted from the calculated creatinine value.

For use of the compensated method calibration with the calibrator TruCal U is strictly recommended. The method is applicable only for serum and plasma samples. The compensated method is traceable to GC-IDMS.

## Performance Characteristics

### Measuring range

The test has been developed to determine creatinine concentrations within a measuring range from 0.2 – 15 mg/dL (18 – 1330 µmol/L). When values exceed this range samples should be diluted 1 + 1 with NaCl solution (9 g/L) and the result multiplied by 2.

### Sensitivity/Limit of Detection

The lower limit of detection is 0.2 mg/dL (17.7 µmol/L).

### Specificity/Interferences

No interference was observed by ascorbic acid up to 30 mg/dL, hemoglobin up to 500 mg/dL and lipemia up to 2000 mg/dL triglycerides. Bilirubin interferes starting with a bilirubin concentration of 4 mg/dL. For further information on interfering substances refer to Young DS [10].

### Precision (at 37°C)

Intra-assay precision n = 20	Mean [mg/dL]	SD [mg/dL]	CV [%]
Sample 1	0.56	0.01	1.30
Sample 2	1.24	0.01	0.83
Sample 3	6.73	0.06	0.93

Inter-assay precision n = 20	Mean [mg/dL]	SD [mg/dL]	CV [%]
Sample 1	0.81	0.03	3.63
Sample 2	1.60	0.01	0.87
Sample 3	5.73	0.05	0.85

### Method Comparison

A comparison of DiaSys Creatinine FS (y) with a commercially available Jaffé method (x) using 68 human sera samples within a range of 0.6 – 10 mg/dL (53.0 – 884 µmol/L) gave following results:  
 $y = 1.014 x - 0.031 \text{ mg/dL}$ ;  $r = 1.000$

A comparison of DiaSys Creatinine FS compensated (y) with the enzymatic method DiaSys Creatinine PAP FS (x) using 65 human sera samples within a range of 0.5 – 4.3 mg/dL (44.2 – 380 µmol/L) gave following results:

$y = 0.986 x + 0.043 \text{ mg/dL}$ ;  $r = 0.998$

## Reference Range

### Serum/plasma, Jaffé-method not compensated

	mg/dL	µmol/L
<b>Adults</b> [1]		
Women	0.6 – 1.1	53 – 97
Men	0.7 – 1.3	62 – 115
<b>Children</b> [2,8]		
Neonate	0.5 – 1.2	44 – 106
Infant	0.4 – 0.7	35 – 62
Child	0.5 – 1.2	44 – 106

### Serum/plasma, Jaffé-method compensated

	mg/dL	µmol/L
<b>Adults</b> [3]		
Women	0.5 – 0.9	44 – 80
Men	0.7 – 1.2	62 – 106
<b>Children</b> [9]		
Neonate	0.24 – 1.04	21 – 92
Infant	0.17 – 0.42	15 – 37
Child	0.24 – 0.87	21 – 77

### 24h urine [1]

Women	11 – 20 mg/kg/24h	97 – 177 µmol/kg/24h
Men	14 – 26 mg/kg/24h	124 – 230 µmol/kg/24h

### Albumin/creatinine ratio (early morning urine) [12]:

< 30 mg/g Creatinine

### Creatinine clearance [2]

Women	95 – 160 mL/min/1.73 m <sup>2</sup>
Men	98 – 156 mL/min/1.73 m <sup>2</sup>

Each laboratory should check if the reference ranges are transferable to its own patient population and determine own reference ranges if necessary.

## Literature

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