DXC 800 (CREM) CREATININE

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PURPOSE

To provide instructions for the quantitative determination of Creatinine on the DXC 800.

PRINCIPLE

CREm reagent, when used in conjunction with UniCel® DxC 800 System and SYNCHRON® Systems AQUA CAL 1 and 2, is intended for the quantitative determination of creatinine concentration in human serum, plasma or urine.

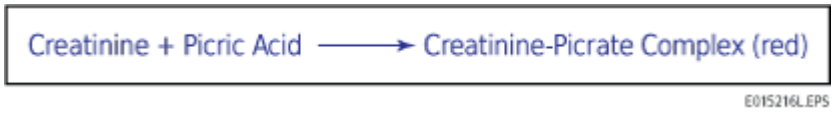
BACKGROUND

Clinical Significance

Creatinine measurements are used in the diagnosis and treatment of renal diseases, in monitoring renal dialysis, and as a calculation basis for measuring other urine analytes.

Methodology

The SYNCHRON® System(s) determine creatinine concentration by means of the Jaffe rate method.[1]
A precise volume of sample (16.5 microliters serum or 5.5 microliters urine) is injected in a reaction cup containing an alkaline picrate solution. The ratio used is one part sample to 35 parts reagent for serum and one part sample to 105 parts reagent for urine. Creatinine from the sample combines with the reagent to produce a red color complex. Absorbance readings are taken at 520 nanometers between 19 and 25 seconds after sample injection. The absorbance rate has been shown to be a direct measure of the concentration of creatinine in the sample.[2,3,4]



RELATED DOCUMENTS

R-PO-CH-0810	Quality Control Program General Laboratory
R-PO-CH-0809	Quality Control Westgard Rules Statistics
R-PR-AD-0540	Specimen Rejection/Cancellation Protocol
J-F-CH-0820	DXC 800 Controls
J-F-CH-0826	DXC 800 Calibrators
J-F-CH-1940	DXC Analytical Measurement Range

SPECIMEN

Type of Specimen

Biological fluid samples should be collected in the same manner routinely used for any laboratory test. Freshly drawn serum, plasma or properly collected urine (random/timed) are the preferred specimens. Acceptable anticoagulants are listed in the PROCEDURAL NOTES section of this chemistry information sheet. Whole blood is not recommended for use as a sample.

Specimen Storage and Stability

1. Tubes of blood are to be kept closed at all times and in a vertical position. It is recommended that the serum or plasma be physically separated from contact with cells within two hours from the time of collection.

2. Separated serum or plasma should not remain at room temperature longer than 8 hours. If assays are not completed within 8 hours, serum or plasma should be stored at +2°C to +8°C. If assays are not completed within 48 hours, or the separated sample is to be stored beyond 48 hours, samples should be frozen at -15°C to -20°C. Frozen samples should be thawed only once. Analyte deterioration may occur in samples that are repeatedly frozen and thawed.

3. It is recommended that urine assays be performed within 2 hours of collection. For timed specimens, the collection container should be kept in the refrigerator or on ice during the timed period. No preservative is required.

Sample Type	Volume	Sample Stability
Plasma Serum Urine Fluid	0.5mL	• Separate serum from cells within 2 hours. • Room Temp 8 hours • Refrigerated 48 hours • Frozen 3 months. • Urine: Analyze within 2 hours or keep on ice; no preservative required

Criteria for Unacceptable Specimens

See Specimen Rejection/Cancellation Protocol
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Sample Volume

A filled 0.5 mL sample cup is the optimum volume. For optimum primary sample tube volumes in primary tube samples and minimum volumes, refer to the Primary Tube Sample Template for your system.

REAGENTS

Contents

Each kit contains the following items:
Two Alkaline Buffer Bottles (1600 mL)
Two Picric Acid Solution Bottles (400 mL)

Volume per Test	
Sample Volume	Serum 16.5 µL Urine 5.5 µL
Total Reagent Volume	570 µL

Reactive Ingredients	
ALKALINE BUFFER: Sodium Hydroxide	0.188 mol/L
PICRIC ACID SOLUTION: Picric Acid	0.05 mol/L

Also non-reactive chemicals necessary for optimal system performance.

Reagent Preparation

Carefully pour 400 mL of Picric Acid Solution into the 1600 mL Alkaline Buffer bottle. Replace cap and mix at least 10 times by gentle inversion. Record preparation date on the end label. If excessive foam is produced when mixing, allow foam to dissipate before loading. Freshly prepared creatinine reagent may contain micro air bubbles that may result in calibration failure or calibration with low span. To prevent this phenomenon, allow the prepared reagent to sit with the cap loosened for a minimum of 30 minutes (or over night) before loading onto the instrument.

Acceptable Reagent Performance

The acceptability of a reagent is determined by successful calibration and by ensuring that quality control results are within your facility's acceptance criteria.

NOTICE: Do not reuse old reagent containers or mix fresh reagent with old reagent.

Reagent Storage and Stability

Alkaline Buffer and Picric Acid Solution stored unopened and unmixed at room temperature are stable until the expiration dates indicated on each bottle. The combined Creatinine Reagent is stable on-instrument for 30 days from the date of preparation. Do not freeze or refrigerate.
If reagent is frozen in transit, thaw completely, warm to room temperature and mix thoroughly by gently inverting bottle a least 10 times.

NOTICE: At reduced temperature, a precipitate may form in the Alkaline Buffer or combined Creatinine Reagent. Do not filter the precipitate. DO NOT USE combined Creatinine Reagent until all precipitate is completely redissolved. It will redissolve upon warming to +21°C to +25°C without any loss of reactivity. A +25°C water bath may be used to warm reagent. Mix after redissolving precipitate by inverting bottle 10 times.

CALIBRATION

Calibrator Required

SYNCHRON® Systems AQUA CAL 1 and 2

Calibrator Preparation

No preparation is required.

Calibrator Storage and Stability

1. If unopened, the calibrators should be stored at +2°C to +8°C until the expiration date printed on the calibrator bottle. Once opened, the calibrators are stable at room temperature for 30 days.

2. Repetitive refrigeration of the aqueous calibrators may facilitate crystal formation. Once removed from refrigerated storage, these calibrators should remain at room temperature.

Calibration Information

1. The system must have a valid calibration in memory before controls or patient samples can be run.

2. Under typical operating conditions the CREm assay must be calibrated every 72 hours or with each new bottle of reagent and also with certain parts replacements or maintenance procedures, as defined in the UniCel DxC 600/800 Systems *Instructions for Use* (IFU) manual.

3. For detailed calibration instructions, refer to the UniCel DxC 600/800 System *Instructions For Use* (IFU) manual.

4. The system will automatically perform checks on the calibration and produce data at the end of calibration. In the event of a failed calibration, the data will be printed with error codes and the system will alert the operator of the failure. For information on error codes, refer to the UniCel DxC 600/800 System *Instructions For Use* (IFU) manual.

Traceablility

For Traceability information refer to the Calibrator instructions for use.

QUALITY CONTROL

See Related Documents J-F-CH0820 DXC 800 Controls

STEPS

1. If necessary prepare reagent as defined in the Reagent Preparation section of this chemistry information sheet and load the reagent onto the system.

2. After reagent load is completed, calibration may be required.

3. Program samples and controls for analysis.

4. After loading samples and controls onto the system, follow the protocols for system operation. For detailed testing procedures, refer to the UniCel DxC 600/800 System *Instructions For Use* (IFU) manual

CALCULATIONS

SYNCHRON® System(s) perform all calculations internally to produce the final reported result. The system will calculate the final result for sample dilutions made by the operator when the dilution factor is entered into the system during sample programming.

ANTICOAGULANT TEST RESULTS

If plasma is the sample of choice, the following anticoagulants were found to be compatible with this method based on a study of 20 healthy volunteers:

Anticoagulant	Level Tested for In Vitro Interference
Ammonium Heparin	14 Units/mL
Lithium Heparin	14 Units/mL
Sodium Heparin	14 Units/mL
Potassium Oxalate/Sodium Fluoride	2.0 / 2.5 mg/mL

PERFORMANCE CHARACTERISTICS

Reference Range

Sample Type	Gender	Conventional Units
Plasma/Serum	Male	0.70-1.30 mg/dL
	Female	0.50-1.00 mg/dL
Urine	N/A	1000-2000 mg/24 hr

Creatinine Clearance Urine Age	Male (mL/min)	Female (mL/min)
0-2 years	51-73	51-73
2-10 years	64-92	64-92
10-12 years	83-119	83-119
12-40 years	97-137	88-128
40-50 years	91-131	82-122
50-60 years	85-125	76-116
60-70 years	79-119	70-110
70-80 years	73-113	64-104
80+ years	67-107	58-98

1. The serum/plasma for the creatinine clearance should be collected within 24 hours of urine collection unless the physician specifies otherwise.

2. Unable to calculate creatinine clearance when total volume is less than 240 mls.

Analytic Range

The SYNCHRON® System(s) method for the determination of this analyte provides the following analytical ranges:

Sample Type	Conventional Units
Serum or Plasma	0.1 – 25 mg/dL
Urine	10 – 400 mg/dL

Samples with activities exceeding the high end of the analytical range should be diluted with saline and reanalyzed.

Reporting results outside of analytical range

Limits	Units	Alpha Responses
Lower limit of detection: serum/plasma	0.10 mg/dL	Results below 0.10, report as <0.10 mg/dL
Upper limit of detection: serum/plasma	25.00 mg/dL	Results >25.00 should be diluted with 0.9% saline, reanalyzed and dilution factor applied. The maximum allowable dilution is X2. Results >50.00 are reported as >50.00 mg/dL.
Lower limit of detection: urine	10 mg/dL	Results below 10, report as <10 mg/dL
Upper limit of detection: urine	400 mg/dL	Results >400 should be diluted with 0.9% saline, reanalyzed and dilution factor applied. The maximum allowable dilution is X5. Results >2000.00 are reported as >2000.00 mg/dL.

NOTE: *Drug screens with results <20 mg/ dL will have the following phrase appended:
DIL1- Creatinine result is < 20 mg/dL. Negative results are inconclusive for urine with creatinine below 20.0 mg/dL. Creatinine results >400 mg/dL for drug screens are not diluted but are reported as >400 mg/dL.

Sensitivity

Sensitivity is defined as the lowest measurable concentration which can be distinguished from zero with 95% confidence. Sensitivity for this analyte determination is 0.1 mg/dL (8.84 µmol/L) for serum or plasma and 10 mg/dL (0.88 mmol/L) for urine.

LIMITATIONS

If urine samples are cloudy or turbid, it is recommended that they be centrifuged before transfer to a sample cup.

Interferences

1. The following substances were tested for interference with this methodology:

Substance	Source	Level Tested	Observed Effect
Acetoacetic Acid	Acetoacetic Lithium Salt	5 mg/dL	+ 0.04 mg/dL
		50 mg/dL	+ 0.4 mg/dL
		125 mg/dL	+ 0.9 mg/dL
		500 mg/dL	+ 3.5 mg/dL
Bilirubin (unconjugated)	Bovine	20 mg/dL INDEX of 14	- 0.2 mg/dL
Cefaclor	NA[d]	100 µg/dL	+ 0.2 mg/dL
Cefoxitin	Cefoxitin sodium salt	50 µg/mL	+ 0.2 mg/dL
Cephalothin	NA	50 µg/mL	+ 0.2 mg/dL
α-D-Glucose	NA	1000 mg/dL	+ 0.2 mg/dL
Fluorescein	Fluorescein Disodium Salt	220 mg/dL	Results suppressed
Glutathione	NA	1.5 mmol/L	+ 0.2 mg/dL
Hemoglobin	RBC hemolysate	500 mg/dL INDEX of 10	No Significant Interference (within ±0.2 mg/dL or 6%)
L-Dopa	NA	160 mg/dL	- 0.2 mg/dL
Lipemia	Intralipid[f]	500 mg/dL	No Significant Interference (within ±0.2 mg/dL or 6%)
	Human	INDEX of 8 Airfuge recommended	No Significant Interference (within ±0.2 mg/dL or 6%)
Methyl dopa	NA	10 mg/dL	- 0.2 mg/dL

Substance	Source	Level Tested	Observed Effect
Pyruvic acid	NA	5 mg/dL	+ 0.2 mg/dL
Sulfasalazine	NA	60 mg/dL	No Significant Interference (within ±0.2 mg/dL or 6%)
Sulfobromophthalein	Sulfobromophthalein sodium salt	2.0 mg/dL	No Significant Interference (within ±0.2 mg/dL or 6%)

2. Lipemic samples with visual turbidity >3+, or with a Lipemia Serum Index >10, should be ultracentrifuged and the analysis performed on the infranate.

3. Refer to References for other interferences caused by drugs, disease and preanalytical variables.

ADDITIONAL INFORMATION

For more detailed information on UniCel DxC Systems, refer to the appropriate system manual.

REFERENCES

1. Jaffe, M. Z., *Physiol. Chem.*, 10:391 (1886).
2. Bartels, E., Cikes, M., *Clin. Chem. Acta*, 26:1 10 (1969).
3. Fabiny, D. L., Ertingshausen, G., *Clin. Chem.*, 17:8 696 (1971).
4. Heinegard, D., Tiderstrom, G., *Clin. Chem. Acta*, 43:305 310 (1973).
5. Tietz, N. W., "Specimen Collection and Processing; Sources of Biological Variation", *Textbook of Clinical Chemistry*, 2nd Edition, W. B. Saunders, Philadelphia, PA (1994).
6. National Committee for Clinical Laboratory Standards, *Procedures for the Handling and Processing of Blood Specimens*, Approved Guideline, NCCLS publication H18-A, Villanova, PA (1990).
7. National Committee for Clinical Laboratory Standards, *Routine Urinalysis and Collection, Transportation and Preservation of Urine Specimens*, Tentative Guideline, NCCLS publication GP16-T, Villanova, PA (1992).
8. Tietz, N. W., *Clinical Guide to Laboratory Tests*, 3rd Edition, W. B. Saunders, Philadelphia, PA (1995).
9. National Committee for Clinical Laboratory Standards, *How to Define, Determine, and Utilize Reference Intervals in the Clinical Laboratory*, Approved Guideline, NCCLS publication C28-A, Villanova, PA (1995).
10. Tietz, N. W., ed., *Fundamentals of Clinical Chemistry*, 3rd Edition, W. B. Saunders, Philadelphia, PA (1987).
11. Henry, J. B., *Clinical Diagnosis and Management by Laboratory Methods*, 18th Edition, W. B. Saunders Company, Philadelphia, PA (1991).
12. Young, D. S., *Effects of Drugs on Clinical Laboratory Tests*, 4th Edition, AACC Press, Washington, D. C. (1995).
13. Friedman, R. B., Young, D. S., *Effects of Disease on Clinical Laboratory Tests*, 3rd Edition, AACC Press, Washington, D.C. (1997).
14. Young, D. S., *Effects of Preanalytical Variables on Clinical Laboratory Tests*, 2nd Edition, AACC Press, Washington, D. C. (1997).
15. De Leacy E. A., Brown N. N., Clague A. E., *Clin Chem* 35:1772-1774 (1989).
16. Stockl D, Reinauer H., *Clin Chem* 39:993-1000 (1993).

17. National Committee for Clinical Laboratory Standards, *Method Comparison and Bias Estimation Using Patient Samples*, Approved Guideline, NCCLS publication EP9-A, Villanova, PA (1995).
18. National Committee for Clinical Laboratory Standards, *Precision Performance of Clinical Chemistry Devices*, Tentative Guideline, 2nd Edition, NCCLS publication EP5-T2, Villanova, PA (1992).

DOCUMENT APPROVAL **Purpose of Document / Reason for Change:**			
8/13/15- Formatting. Removed EDTA as specimen type. Added maximum dilutions. Changed male/female serum ref ranges to match LIS.			
☒ *No significant change to process in above revision. Per CAP, this revision does not require further Medical Director approval.*			
Committee Approval Date	☐ Date: ☒ N/A – revision of department-specific document which is used at only one facility	**Medical Director Approval** *(Electronic Signature)*	Katie Wilkinson, MD 9/25/15