SYNCHRON® System(s)
Chemistry Information Sheet
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For In Vitro Diagnostic Use

ANNUAL REVIEW

Reviewed by:                  Date     Reviewed by:                  Date

PRINCIPLE

INTENDED USE

BUN reagent, when used in conjunction with SYNCHRON LX® System(s), UniCel® DxC 600/800 System(s) and Synchron® Systems Multi Calibrator, is intended for the quantitative determination of urea nitrogen concentration in human serum, plasma or urine.

CLINICAL SIGNIFICANCE

Urea nitrogen or urea measurements are used in the diagnosis and treatment of certain renal and metabolic diseases.

METHODOLOGY

BUN reagent is used to measure urea nitrogen concentration by an enzymatic rate method.¹ ² In the reaction, urea is hydrolyzed by urease to ammonia and carbon dioxide. Glutamate dehydrogenase (GLDH) catalyzes the condensation of ammonia and α-ketoglutarate to glutamate with the concomitant oxidation of reduced β-nicotinamide adenine dinucleotide (NADH) to β-nicotinamide adenine dinucleotide (NAD).

The SYNCHRON® System(s) automatically dilutes urine samples and proportions the appropriate sample and reagent volumes into the cuvette. The ratio used is one part sample to 100 parts reagent for serum or plasma and one part diluted sample to 100 parts reagent for urine. The system monitors the change in absorbance at 340 nanometers. This change in absorbance is directly proportional to the concentration of urea nitrogen in the sample and is used by the System to calculate and express the urea nitrogen concentration.

CHEMICAL REACTION SCHEME

\[
\begin{align*}
\text{Urea} + H_2O & \xrightarrow{\text{Urease}} 2\text{NH}_3 + \text{CO}_2 \\
\text{NH}_3 + \alpha\text{-Ketoglutarate} + \text{NADH} + H^+ & \xrightarrow{\text{GLDH}} \text{Glutamate} + \text{NAD}^+ + \text{H}_2O
\end{align*}
\]
SPECIMEN

TYPE OF SPECIMEN

Biological fluid samples should be collected in the same manner routinely used for any laboratory test. Freshly drawn serum or plasma are the preferred specimens. Freshly collected urine may also be used for testing. 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.

Additional specimen storage and stability conditions as designated by this laboratory:

SAMPLE PREPARATION

Sample preparation is not required. Urine samples are diluted (1:10) automatically by the system using the DIL1 cartridge.

SAMPLE VOLUME

The optimum volume, when using a 0.5 mL sample cup, is 0.3 mL of sample. For optimum primary sample tube volumes and minimum volumes, refer to the Primary Tube Sample Template for your system.

CRITERIA FOR UNACCEPTABLE SPECIMENS

Refer to the PROCEDURAL NOTES section of this chemistry information sheet for information on unacceptable specimens.

Criteria for sample rejection as designated by this laboratory:
PATIENT PREPARATION

Special instructions for patient preparation as designated by this laboratory:

SPECIMEN HANDLING

Special instructions for specimen handling as designated by this laboratory:

REAGENTS

CONTENTS

Each kit contains the following items:

Two BUN Reagent Cartridges (2 x 300 tests)

VOLUMES PER TEST

Serum or Plasma

Sample Volume 3 µL
Total Reagent Volume 300 µL

Cartridge Volumes

A 285 µL
B 15 µL
C --
Urine

Sample Dilution Volumes

<table>
<thead>
<tr>
<th>Sample Volume</th>
<th>20 µL</th>
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<tbody>
<tr>
<td>Diluent Volume</td>
<td>180 µL</td>
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<table>
<thead>
<tr>
<th>Sample Volume</th>
<th>3 µL</th>
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<table>
<thead>
<tr>
<th>Total Reagent Volume</th>
<th>300 µL</th>
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Cartridge Volumes

<table>
<thead>
<tr>
<th>A</th>
<th>285 µL</th>
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<tbody>
<tr>
<td>B</td>
<td>15 µL</td>
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<tr>
<td>C</td>
<td>– –</td>
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</table>

REACTIVE INGREDIENTS

REAGENT CONSTITUENTS

- α-Ketoglutarate: 2.9 mmol/L
- NADH: 0.35 mmol/L
- Urease: >24 KIU/L
- Glutamate dehydrogenase: >1.3 KIU/L

Also non-reactive chemicals necessary for optimal system performance.

⚠️ CAUTION

Sodium azide preservative may form explosive compounds in metal drain lines. See National Institute for Occupational Safety and Health Bulletin: Explosive Azide Hazards (8/16/76).

Avoid skin contact with reagent. Use water to wash reagent from skin.

EUROPEAN HAZARD CLASSIFICATION

Blood Urea Nitrogen Reagent (Compartment B)  
Xn;R22 Harmful if swallowed.
S37/39 Wear suitable gloves and eye/face protection.

MATERIALS NEEDED BUT NOT SUPPLIED WITH REAGENT KIT

- Synchron® Systems Multi Calibrator
- At least two levels of control material
- Saline
- DIL 1 for urine samples

REAGENT PREPARATION

No preparation is required.
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.

REAGENT STORAGE AND STABILITY

BUN reagent when stored unopened at +2°C to +8°C will obtain the shelf-life indicated on the cartridge label. Once opened, the reagent is stable for 30 days at +2°C to +8°C unless the expiration date is exceeded. DO NOT FREEZE.

DIL 1 stored unopened at room temperature is stable until the expiration date indicated on each cartridge. Once opened, DIL 1 is stable for 60 days on instrument or until the expiration date, if sooner.

Reagent storage location:

CALIBRATION

CALIBRATOR REQUIRED

Synchron® Systems Multi Calibrator

CALIBRATOR PREPARATION

No preparation is required.

CALIBRATOR STORAGE AND STABILITY

If unopened, the Synchron® Systems Multi Calibrator should be stored at -15°C to -20°C until the expiration date printed on the calibrator bottle. Opened calibrators that are resealed and stored at +2°C to +8°C are stable for 20 days unless the expiration date is exceeded.

⚠️ CAUTION

Because this product is of human origin, it should be handled as though capable of transmitting infectious diseases. Each serum or plasma donor unit used in the preparation of this material was tested by United States Food and Drug Administration (FDA) approved methods and found to be negative for antibodies to HIV and HCV and nonreactive for HbsAg. Because no test method can offer complete assurance that HIV, hepatitis B virus, and hepatitis C virus or other infectious agents are absent, this material should be handled as though capable of transmitting infectious diseases. This product may also contain other human source material for which there is no approved test. The FDA recommends such samples to be handled as specified in Centers for Disease Control's Biosafety Level 2 guidelines.6
CALIBRATION INFORMATION

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

2. Under typical operating conditions the BUN reagent cartridge must be calibrated every 24 hours and also with certain parts replacement or maintenance procedures, as defined in the SYNCHRON LX Maintenance Manual and Instrument Log, or the UniCel Dxc 600/800 System Instructions For Use (IFU) manual. This assay has within-lot calibration available. Refer to the SYNCHRON LX Operations Manual, or the UniCel Dxc 600/800 Systems Instructions For Use (IFU) manual for information on this feature.

3. For detailed calibration instructions, refer to the SYNCHRON LX Operations Manual, or 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 SYNCHRON LX Diagnostics and Troubleshooting Manual, or the UniCel Dxc 600/800 System Instructions For Use (IFU) manual.

TRACEABILITY

For Traceability information refer to the Calibrator instructions for use.

QUALITY CONTROL

At least two levels of control material should be analyzed daily. In addition, these controls should be run with each new calibration, with each new reagent cartridge, and after specific maintenance or troubleshooting procedures as detailed in the appropriate system manual. More frequent use of controls or the use of additional controls is left to the discretion of the user based on good laboratory practices or laboratory accreditation requirements and applicable laws.

The following controls should be prepared and used in accordance with the package inserts. Discrepant quality control results should be evaluated by your facility.

Table 1.0 Quality Control Material

<table>
<thead>
<tr>
<th>CONTROL NAME</th>
<th>SAMPLE TYPE</th>
<th>STORAGE</th>
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<tbody>
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</tbody>
</table>

BUN
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TESTING PROCEDURE(S)

1. If necessary, 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 operations.

For detailed testing procedures, refer to the SYNCHRON LX Operations Manual, or the UniCel DxC 600/800 System Instructions For Use (IFU) manual.

CALCULATIONS

The SYNCHRON® System(s) performs 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.

REPORTING RESULTS

Equivalency between the SYNCHRON LX and UniCel DxC 600/800 Systems has been established. Chemistry results between these systems are in agreement and data from representative systems may be shown.

REFERENCE INTERVALS

Each laboratory should establish its own reference intervals based upon its patient population. The following reference intervals were taken from literature and a study performed on SYNCHRON Systems.7

Table 2.0 Reference intervals*

<table>
<thead>
<tr>
<th>INTERVALS</th>
<th>SAMPLE TYPE</th>
<th>CONVENTIONAL UNITS (Urea Nitrogen)</th>
<th>S.I. UNITS (Urea)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature</td>
<td>Serum or Plasma</td>
<td>6 – 20 mg/dL</td>
<td>2.1 – 7.1 mmol/L</td>
</tr>
<tr>
<td></td>
<td>Urine (timed)</td>
<td>12 – 20 g/24 hrs</td>
<td>0.43 – 0.71 mol/24 hrs</td>
</tr>
<tr>
<td>SYNCHRON</td>
<td>Serum or Plasma</td>
<td>8 – 26 mg/dL</td>
<td>2.9 – 9.3 mmol/L</td>
</tr>
</tbody>
</table>

a Data shown was collected using SYNCHRON CX Systems. Equivalency between SYNCHRON LX Systems has been established by Deming regression analysis to SYNCHRON CX Systems.

<table>
<thead>
<tr>
<th>INTERVALS</th>
<th>SAMPLE TYPE</th>
<th>CONVENTIONAL UNITS</th>
<th>S.I. UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td></td>
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</tbody>
</table>

Refer to References (8,9,10) for guidelines on establishing laboratory-specific reference intervals.

Additional reporting information as designated by this laboratory:
PROCEDURAL NOTES

ANTICOAGULANT TEST RESULTS

1. 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:

Table 3.0 Acceptable Anticoagulantsa

<table>
<thead>
<tr>
<th>ANTICOAGULANT</th>
<th>LEVEL TESTED FOR IN VITRO INTERFERENCE</th>
<th>AVERAGE PLASMA-SERUM BIAS (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium Heparin</td>
<td>29 Units/mL</td>
<td>NSIb</td>
</tr>
<tr>
<td>Lithium Heparin</td>
<td>29 Units/mL</td>
<td>NSI</td>
</tr>
<tr>
<td>Potassium Oxalate/Sodium Fluoride</td>
<td>4.0 / 5.0 mg/mL</td>
<td>NSI</td>
</tr>
<tr>
<td>Sodium Heparin</td>
<td>29 Units/mL</td>
<td>NSI</td>
</tr>
</tbody>
</table>

a Data shown was collected using SYNCHRON CX Systems. Equivalency between SYNCHRON LX Systems has been established by Deming regression analysis to SYNCHRON CX Systems.
b NSI = No Significant Interference (within ±4.0 mg/dL or 6%).

2. The following anticoagulants were found to be incompatible with this method:

Table 4.0 Incompatible Anticoagulantsa

<table>
<thead>
<tr>
<th>ANTICOAGULANT</th>
<th>LEVEL TESTED FOR IN VITRO INTERFERENCE</th>
<th>AVERAGE PLASMA-SERUM BIAS (mg/dL)b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Citrate</td>
<td>6.6 mg/mL</td>
<td>-5.0</td>
</tr>
</tbody>
</table>

a Data shown was collected using SYNCHRON CX Systems. Equivalency between SYNCHRON LX Systems has been established by Deming regression analysis to SYNCHRON CX Systems.
b Bias is based on worst case instead of average. Plus (+) or minus (-) signs in this column signify positive or negative bias.

LIMITATIONS

None identified.

INTERFERENCES

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

Table 5.0 Interferencesa

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>SOURCE</th>
<th>LEVEL TESTED</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilirubin (unconjugated)</td>
<td>Bovine</td>
<td>30 mg/dL</td>
<td>NSIb</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>RBC hemolysate</td>
<td>500 mg/dL</td>
<td>NSI</td>
</tr>
<tr>
<td>Lipemia</td>
<td>Intralipidc</td>
<td>500 mg/dL</td>
<td>NSI</td>
</tr>
</tbody>
</table>

a Data shown was collected using SYNCHRON CX Systems. Equivalency between SYNCHRON LX Systems has been established by Deming regression analysis to SYNCHRON CX Systems.
b NSI = No Significant Interference (within ±4.0 mg/dL or 6%).
c Intralipid is a registered trademark of KabiVitrum, Inc., Clayton, NC 27250.

2. Fluoride is a known inhibitor of urease activity and will decrease the reaction rate of this chemistry.

3. The presence of ammonium ions in anticoagulants may produce falsely elevated results.
4. Refer to References (11,12,13) for other interferences caused by drugs, disease and preanalytical variables.

PERFORMANCE CHARACTERISTICS

ANALYTIC RANGE

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

Table 6.0 Analytical Range

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>CONVENTIONAL UNITS (Urea Nitrogen)</th>
<th>S.I. UNITS (Urea)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum or Plasma</td>
<td>5 – 100 mg/dL</td>
<td>1.8 – 35.7 mmol/L</td>
</tr>
<tr>
<td>Urine</td>
<td>50 – 1000 mg/dL</td>
<td>17.9 – 357.0 mmol/L</td>
</tr>
</tbody>
</table>

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

REPORTABLE RANGE (AS DETERMINED ON SITE):

Table 7.0 Reportable Range

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>CONVENTIONAL UNITS</th>
<th>S.I. UNITS</th>
</tr>
</thead>
</table>

SENSITIVITY

Sensitivity is defined as the lowest measurable concentration which can be distinguished from zero with 95% confidence. Sensitivity for BUN determination is 5 mg/dL (1.8 mmol/L).

EQUIVALENCY

Equivalency was assessed by Deming regression analysis of patient samples to accepted clinical methods.

Serum or plasma (in the range of 5 to 100 mg/dL):

\[
Y_{(SYNCHRON \, LX \, Systems)} = 0.996X - 0.49 \\
N = 72 \\
\text{MEAN (SYNCHRON LX Systems)} = 28.7 \\
\text{MEAN (SYNCHRON CX7 DELTA)} = 29.3 \\
\text{CORRELATION COEFFICIENT (r)} = 0.9990
\]

Urine (in the range of 53 to 1000 mg/dL):

\[
Y_{(SYNCHRON \, LX \, Systems)} = 0.974X - 1.14 \\
N = 55 \\
\text{MEAN (SYNCHRON LX Systems)} = 589 \\
\text{MEAN (SYNCHRON CX7 DELTA)} = 605 \\
\text{CORRELATION COEFFICIENT (r)} = 0.9981
\]
Refer to References (14) for guidelines on performing equivalency testing.

**PRECISION**

A properly operating SYNCHRON® System(s) should exhibit precision values less than or equal to the following:

<table>
<thead>
<tr>
<th>Table 8.0 Precision Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TYPE OF PRECISION</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td>Within-run</td>
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<td></td>
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<tr>
<td>Total</td>
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</table>

a When the mean of the test precision data is less than or equal to the changeover value, compare the test SD to the SD guideline given above to determine the acceptability of the precision testing. When the mean of the test precision data is greater than the changeover value, compare the test % CV to the guideline given above to determine acceptability. Changeover value = (SD guideline/CV guideline) x 100.

Comparative performance data for a SYNCHRON LX® System evaluated using the NCCLS Proposed Guideline EP5-T2 appears in the table below. Each laboratory should characterize their own instrument performance for comparison purposes.

<table>
<thead>
<tr>
<th>Table 9.0 NCCLS EP5-T2 Precision Estimate Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TYPE OF IMPRECISION</strong></td>
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<tr>
<td>Within-run</td>
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</table>

a The point estimate is based on the pooled data from one system, run for twenty days, two runs per day, two observations per run on an instrument operated and maintained according to the manufacturer’s instructions.

**NOTICE**

These degrees of precision and equivalency were obtained in typical testing procedures on a SYNCHRON LX® System and are not intended to represent the performance specifications for this reagent.

**ADDITIONAL INFORMATION**

For more detailed information on SYNCHRON LX Systems or UniCel DxC Systems, refer to the appropriate system manual.
SHIPPING DAMAGE

If damaged product is received, notify your Beckman Coulter Clinical Support Center.
REFERENCES


