BECKMAN COULTER CE

AU

Instructions For Use

ISE

ISE REAGENTS / STANDARDS

REF 66320 ISE Buffer 4 x 2,000 mL
66319 ISE Mid Standard 4 x 2,000 mL
66318 ISE Reference 4 x 1,000 mL
66317 ISE Low Serum Standard 4 x 100 mL
66316 ISE High Serum Standard 4 x 100 mL
66315 ISE Low/High Urine Standard 4 x 100 mL
66314 ISE Internal Reference 2 x 25 mL
66313 ISE Na^+/K^+ Selectivity Check 2 x 25 mL

For *in vitro* diagnostic use only.

ANNUAL REVIEW

Reviewed by	Date	Reviewed by	Date

PRINCIPLE

INTENDED USE

Reagent used in conjunction with the ISE module of Beckman Coulter AU analysers for the quantitative (indirect) determination of Sodium (Na^+), Potassium (K^+) and Chloride (Cl^-) concentrations in human serum, plasma and urine.

SUMMARY AND EXPLANATION

Electrolytes affect most metabolic processes. They serve to maintain osmotic pressure and hydration of various body fluid compartments, proper body pH, and regulation of appropriate heart and muscle functions. Electrolytes are also involved in oxidation-reduction reactions and participate as essential parts or, cofactors, in enzyme reactions.[1]

METHODOLOGY

The ISE module for Na^+, K^+, and Cl^- employs crown ether membrane electrodes for sodium and potassium and a molecular oriented PVC membrane for chloride that are specific for each ion of interest in the sample. An electrical potential is developed according to the Nernst Equation for a specific ion. When compared to an internal reference, this electrical potential is translated into voltage and then into the ion concentration of the sample.[1]

SPECIMEN

TYPE OF SPECIMEN

Serum/plasma: Haemolysed and grossly lipemic samples should be avoided. Potassium from red cells will diffuse into serum/plasma giving falsely elevated results. Separate from cells immediately by centrifugation and do not allow serum/plasma to remain on the cells after centrifugation. Gross lipemia causes pseudohyponatremia therefore grossly lipemic specimens should be cleared by ultracentrifugation. Only use lithium heparinised plasma.[2, 3]

Stable in serum/plasma as follows:[4]

Chloride	7 days when stored at 2…25°C
Potassium	6 weeks when stored at 2…25°C
Sodium	2 weeks when stored at 2…25°C

Urine: Collect 24-hour urine without additives.[5] Turbid urine samples should be cleared by centrifugation. Do not acidify. Stable in urine as follows:

Chloride[6]	45 days when stored at room temperature
Potassium[4]	45 days when stored at 4...25°C
Sodium[4]	45 days when stored at 4...25°C

Refer to Young[6] for a comprehensive list of preanalytical factors associated with Sodium, Potassium and Chloride.

Specimen storage and stability information provides guidance to the laboratory. Based on specific needs, each laboratory may establish alternative storage and stability information according to good laboratory practice or from alternative reference documentation.

REAGENTS

WARNING AND PRECAUTIONS

Exercise the normal precautions required for handling all laboratory reagents.

Dispose of all waste material in accordance with local guidelines.

REACTIVE INGREDIENTS

Concentration of active ingredients:

ISE Low Serum Standard	
Na^+	130 mmol/L
K^+	3.5 mmol/L
Cl^-	85 mmol/L
Preservatives	

ISE Mid-Standard	
Na^+	4.3 mmol/L
K^+	0.13 mmol/L
Cl^-	3.1 mmol/L
Preservatives	

ISE High Serum Standard	
Na^+	160 mmol/L
K^+	6 mmol/L
Cl^-	120 mmol/L
Preservatives	

ISE Buffer	
Triethanolamine	0.1 mol/L
Preservatives	

ISE Reference	
Potassium Chloride	1.00 mol/L

ISE Na^+ Selectivity Check	
Na^+	150 mmol/L
Preservatives	

ISE Low/High Urine Standard	
Na^+	(Low) 50 mmol/L
	(High) 200 mmol/L
K^+	(Low) 10 mmol/L
	(High) 100 mmol/L
Cl^-	(Low) 50 mmol/L
	(High) 180 mmol/L
Preservatives	

ISE Internal Reference	
Potassium Chloride	3.3 mol/L
Silver Chloride	Saturated

ISE K^+ Selectivity Check	
K^+	5 mmol/L
Preservatives	

ISE Configuration

The ISE unit consists of the following measuring devices:

Part No./Order No.	Electrode
MU 9194	Na Electrode
MU 9196	Cl Electrode

Part No./Order No.	Electrode
MU 9197	Ref Electrode
MU 9195	K Electrode

See User's Guide for further information.

The products listed are required to calibrate and calculate results for the ISE Module. Use of any other products may result in inaccurate measurement of routine samples and/or damage to the electrodes.

GHS HAZARD CLASSIFICATION

ISE (K+) SELECTIVITY CHECK SOLUTION	EUH208	May produce an allergic reaction.
		Formaldehyde < 0.1%
ISE (NA+) SELECTIVITY CHECK SOLUTION	EUH208	May produce an allergic reaction.
		Formaldehyde < 0.1%
ISE High Urine Standard	EUH208	May produce an allergic reaction.
		Formaldehyde < 0.1%
ISE Low Urine Standard	EUH208	May produce an allergic reaction.
		Formaldehyde < 0.1%
ISE High Serum Standard	EUH208	May produce an allergic reaction.
		Formaldehyde < 0.1%
ISE Low Serum Standard	EUH208	May produce an allergic reaction.
		Formaldehyde < 0.1%
ISE Mid Standard	DANGER	
		
		
	H316	Causes mild skin irritation.
	H317	May cause an allergic skin reaction.
	H350	May cause cancer.
	P201	Obtain special instructions before use.
	P280	Wear protective gloves, protective clothing and eye/face protection.
	P308+P313	IF exposed or concerned: Get medical advice/attention.
	P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
	P362+P364	Take off contaminated clothing and wash it before use.
		Triethanolamine 1 - 2%
		Formaldehyde 0.2 - 0.5%

ISE Buffer Solution	DANGER	
		
		
	H316	Causes mild skin irritation.
	H317	May cause an allergic skin reaction.
	H350	May cause cancer.
	P201	Obtain special instructions before use.
	P280	Wear protective gloves, protective clothing and eye/face protection.
	P308+P313	IF exposed or concerned: Get medical advice/attention.
	P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
	P362+P364	Take off contaminated clothing and wash it before use.
		Triethanolamine 1 - 2%
		Formaldehyde 0.2 - 0.5%

SDS	Safety Data Sheet is available at techdocs.beckmancoulter.com

REAGENT PREPARATION

The reagents and standards are ready for use.

STORAGE AND STABILITY

66314 should be stored at 15…25°C. Once open, 66314 is stable for 90 days when stored at 15…25°C.

The following reagents and standards are stable, unopened up to the stated expiry date when stored at 2…25°C. However, once opened they are stable when stored at 2…25°C as follows:

66320	ISE Buffer	2 months
66319	ISE Mid Standard	1 month
66318	ISE Reference	2 months
66317	ISE Low Serum standard	90 days

66316	ISE High Serum Standard	90 days
66315	ISE Low/High Urine Standard	90 days
66313	ISE Na^+ /K^+ Selectivity Check	90 days

Reagents and standards should be allowed to equilibrate to room temperature prior to use.

Note: 66317, 66316, 66315, 66314 and 66313 should have the caps replaced immediately after each use.

Some precipitation may be present in the ISE Internal Reference Solution. This does not affect the performance of the reagent however the reagent should be thoroughly mixed before use.

CALIBRATION

CALIBRATION INFORMATION

Application	Standard	Cat. No.
Serum/plasma	ISE Low Serum Standard & ISE High Serum Standard	66317 66316
Urine	ISE Low/High Urine Standard	66315

The ISE standard values are traceable to the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 919 for Sodium and Chloride and the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 918 for Potassium.

Recalibrate the assay every day, or when the following occur:

Change in lot number of ISE Buffer (66320), ISE Mid-Standard (66319) or ISE Reference (66318);

Significant shift in control values;

Change in ISE electrodes (63100, 63101, 63102, 63103);

Major preventative maintenance was performed on the analyser or a critical part was replaced.

QUALITY CONTROL

Serum and Plasma: Controls Cat. No. ODC0003 and ODC0004 or other control materials with values determined by this method may be used.

Urine: All control materials with values determined by this method may be used.

Each laboratory should establish its own control frequency however good laboratory practice suggests that controls be tested each day patient samples are tested and each time calibration is performed.

The results obtained by any individual laboratory may vary from the given mean value. It is therefore recommended that each laboratory generates analyte specific control target values and intervals based on multiple runs according to their requirements. These target values should fall within the corresponding acceptable ranges given in the relevant product literature. If any trends or sudden shifts in values are detected, review all operating parameters.

Each laboratory should establish guidelines for corrective action to be taken if controls do not recover within the specified limits.

TESTING PROCEDURE(S)

Refer to the appropriate Beckman Coulter AU analyser User Guide/Instructions For Use (IFU) for analyser-specific assay instructions for the sample type as listed in the Intended Use statement.

CALCULATIONS

The Beckman Coulter analysers automatically compute the sodium, potassium and chloride values of each sample.

REPORTING RESULTS

REFERENCE INTERVALS

Reference[7]

Sodium		
Serum or plasma	Adult	136 – 146 mmol/L
Urine, 24h	Adult	40 – 220 mmol/day

Chloride		
Serum or plasma[8]	Adult	101 – 109 mmol/L
Urine, 24h	Adult	110 – 250 mmol/day

Potassium		
Serum	Adult	3.5 – 5.1 mmol/L
Plasma	Adult	3.4 – 4.5 mmol/L
Urine, 24h	Adult	25 – 125 mmol/day

Expected values may vary with age, sex, sample type, diet and geographical location. Each laboratory should verify the transferability of the expected values to its own population, and if necessary determine its own reference interval according to good laboratory practice. For diagnostic purposes, results should always be assessed in conjunction with the patient's medical history, clinical examinations and other findings.

Care should be taken when interpreting results from patients with hyperlipidemia and hyperproteinemia due to the electrolyte exclusion effect.[3]

PROCEDURAL NOTES

INTERFERENCES

Certain anticoagulants, preservatives, drugs and organophilic compounds may affect electrolyte determinations. Refer to Young[9] for further information on interfering substances.

The following substances were tested for interference with this methodology:

Chloride

SUBSTANCE	SOURCE	LEVEL TESTED	OBSERVED EFFECT
Bilirubin (unconjugated)	Porcine	40 mg/dL	NSI[a]
Haemoglobin	RBC hemolysate	500 mg/dL	NSI
Lipemia	Intralipid[b]	500 mg/dL	NSI

Potassium

SUBSTANCE	SOURCE	LEVEL TESTED	OBSERVED EFFECT
Bilirubin (unconjugated)	Porcine	40 mg/dL	NSI[a]
Haemoglobin	RBC hemolysate	50 mg/dL	NSI
Lipemia	Intralipid[b]	500 mg/dL	NSI

Sodium

SUBSTANCE	SOURCE	LEVEL TESTED	OBSERVED EFFECT
Bilirubin (unconjugated)	Porcine	40 mg/dL	NSI[a]
Haemoglobin	RBC hemolysate	500 mg/dL	NSI
Lipemia	Intralipid[b]	500 mg/dL	NSI

a = NSI = No Significant Interference (Chloride ± 4%, Potassium ± 4% above 3.5mmol/L or ± 0.14mmol/L below 3.5mmol/L, Sodium ± 2.5%)

b = Intralipid is a registered trademark of KabiVitrum, Inc., Clayton, NC 27250.

PERFORMANCE CHARACTERISTICS

PERFORMANCE CHARACTERISTICS

Data contained within this section is representative of performance on Beckman Coulter systems. Data obtained in your laboratory may differ from these values.

LINEARITY

The ISE Module is linear in serum, plasma or urine samples as follows:

Serum	
Na^+	50 – 200 mmol/L
K^+	1.0 - 10.0 mmol/L
Cl^-	50 – 200 mmol/L

Urine	
Na^+	10 - 400 mmol/L
K^+	2.0 - 200 mmol/L
Cl^-	15 – 400 mmol/L

METHODS COMPARISON

Patient serum samples were used to compare this ISE module on the AU400 against another commercially available ISE module. Results of linear regression analysis were as follows:

	Sodium	Potassium	Chloride
Y Method	AU400	AU400	AU400
X Method	Method 2	Method 2	Method 2
Slope	1.016	0.977	1.024
Intercept	-2.428	0.107	-2.302
Correlation Coeff (r)	0.981	0.991	0.977
No. of samples	239	238	233
Range (mmol/L)	118.0 – 157.0	1.5 – 7.0	80.0 – 125.0

PRECISION

The following data was obtained on an AU2700 using a serum pool analysed over 10 days.

	n = 60	Within-run		Total	
	Mean mmol/L	SD	CV%	SD	CV%
Sodium (Na^+)	138	0.68	0.49	0.89	0.64
Potassium (K^+)	4.8	0.03	0.65	0.04	0.76
Chloride (Cl^-)	90	0.58	0.64	0.63	0.71

The following data was obtained on an AU2700 using a urine pool analysed over 10 days.

	n = 60	Within-run		Total	
	Mean mmol/L	SD	CV%	SD	CV%
Sodium (Na^+)	166	0.73	0.44	1.29	0.78
Potassium (K^+)	100	0.48	0.48	1.30	1.29
Chloride (Cl^-)	245	1.06	0.43	2.22	0.9

ADDITIONAL INFORMATION

Setting Sheet Footnotes

Greyed areas are hardcoded information. Not accessible and cannot be changed.

Dynamic range information needed for parameter entry.

Analytical Measuring range information needed for parameter entry.

Correlation factors default to A = 1.0 and B = 0.0.

Entry of specified Correlation Factor A and B for Serum Na to be programmed during instrument installation.

Dynamic Range and Correlation Factor settings apply to both cell 1 and 2 for the AU5800.

REVISION HISTORY

Updated Specimen Section

Preceding version revision history

IFU updated to add Vietnamese language.

Updated Warning and Precautions section

REFERENCES

1. Tietz NW, Pruden EL, Siggaard-Anderson O. Electrolytes. In: Teitz NW, ed. Fundamentals of clinical chemistry. Philadelphia: WB Saunders Company, 1987:614-624.

2. Tietz NW, ed. Clinical guide to laboratory tests, 3rd ed. Philadelphia: WB Saunders Company,1995:124pp, 502-504,562-564.

3. Scott MG, Heusel JW, LeGrys VA, Siggaard-Anderson O.Electrolytes and blood gases. In: Burtis CA, Ashwood ER, eds. Tietz textbook of clinical chemistry. Philadelphia:WB Saunders Company, 1999;1061-1062.

4. Ehret W, Heil W, Schmitt Y, Töpfer G, Wisser H, Zawta B, et al. Use of anticoagulants in diagnostic laboratory investigations and stability of blood, plasma and serum samples. WHO/DIL/LAB/99.1 Rev.2:26,39,41,48pp.

5. NCCLS. Urinalysis and collection, transportation, and preservation of urine specimens; approved guideline. NCCLS Document GP16-A2, 2nd ed. Pennsylvania: NCCLS, 2001.

6. Young DS. Effects of preanalytical variables on clinical laboratory tests. 2nd ed. Washington. AACC Press, 1997.

7. Tietz NW, Logan NM. Appendix. In: Teitz NW, ed. Fundamentals of clinical chemistry. Philadelphia: WB Saunders Company, 1987:948,962,965pp.

8. Matsubara A, Ichihara K, Fukutani S. Determination of reference intervals for 26 commonly measured biochemical analytes with consideration of long-term within-individual variation. Clin Chem Lab Med 2008;46:691-98.

9. Young DS.Effects of Drugs on Clinical Laboratory Tests, AACC, 5th ed. AACC Press, 2000.

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