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# Multiple Electrolytes and Dextrose Injection Type 3

## DEFINITION

Multiple Electrolytes and Dextrose Injection Type 3 is a sterile solution of Dextrose and suitable salts in Water for Injection to provide sodium, potassium, and chloride ions. In addition, the salts provide ions of ammonium, or acetate and phosphate, or phosphate and lactate. It contains NLT 90.0% and NMT 110.0% of the labeled amounts of sodium (Na), potassium (K), ammonium ($NH_4$), acetate ($C_2H_3O_2$), phosphate ($PO_4$), and lactate ($C_3H_5O_3$); NLT 90.0% and NMT 120.0% of the labeled amount of chloride (Cl); and NLT 90.0% and NMT 105.0% of the labeled amount of dextrose ($C_6H_{12}O_6 \cdot H_2O$). It may contain Hydrochloric Acid or Sodium Hydroxide used to adjust the pH. It contains no antimicrobial agents.

## IDENTIFICATION

• **A.**

**Sample solution:** Nominally 50 mg/mL of dextrose from a suitable volume of Injection

**Analysis:** Add a few drops of the *Sample solution* to 5 mL of hot alkaline cupric tartrate TS.

**Acceptance criteria:** A copious red precipitate of cuprous oxide is formed.

• **B.** **Identification Tests—General ⟨191⟩**, *Chloride* and *Ammonium*: Meets the requirements

• **C. Sodium:** The sample imparts an intense yellow color to a nonluminous flame.

• **D. Potassium:** The sample imparts a violet color to a nonluminous flame. Because the presence of small quantities of sodium masks the color, screen out the yellow color produced by sodium by viewing through a blue filter that blocks the emission at 589 nm (sodium), but is transparent to emission at 404 nm (potassium). [Note—Traditionally, cobalt glass has been used, but other suitable filters are commercially available.]

• **E.** Where acetate is purported to be present, the retention time of the acetate peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the *Assay* for *Acetate*.

• **F.** Where phosphate is purported to be present proceed as follows.

**Sample solution:** Add 5 mL of Injection and 1 mL of ammonium molybdate TS to a test tube and mix.

**Acceptance criteria:** A yellow precipitate, which is soluble in 6 N ammonium hydroxide, is formed.

• **G.** Where lactate is purported to be present, the retention time of the lactate peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the *Assay* for *Lactate*.

## ASSAY

• **Acetate** (if present)

**Mobile phase:** 0.05 N sulfuric acid

**Standard solution:** 1.2 mg/mL of sodium acetate trihydrate (0.0088 mEq/mL of acetate) in water

**Sample solution:** Nominally 0.0088 mEq/mL of acetate from a volume of Injection in water

**Chromatographic system**

(See *Chromatography ⟨621⟩, System Suitability*.)

**Mode:** LC

**Detector:** UV 210 nm

**Columns**

**Guard:** 4.6-mm × 3-cm; packing L17

**Analytical:** 7.8-mm × 30-cm; packing L17

**Column temperature:** 60°

**Flow rate:** 0.8 mL/min

**Injection volume:** 20 µL

**System suitability**

**Sample:** *Standard solution*

**Suitability requirements**

**Tailing factor:** NMT 2.0

**Relative standard deviation:** NMT 2.0%

**Analysis**

**Samples:** *Standard solution* and *Sample solution*

Calculate the percentage of the labeled amount of acetate ($C_2H_3O_2$) in the portion of Injection taken:

$$\text{Result} = (r_U/r_S) \times (C_S/C_U) \times 100$$

$r_U$ = peak response of acetate from the *Sample solution*

$r_S$ = peak response of acetate from the *Standard solution*

$C_S$ = concentration of acetate in the *Standard solution* (mEq/mL)

$C_U$ = nominal concentration of acetate in the *Sample solution* (mEq/mL)

**Acceptance criteria:** 90.0%–110.0%

- **Ammonium** (if present)

**Sample solution:** Transfer a volume of Injection, equivalent to 63 mg (3.5 mEq) of ammonium, to a 500-mL Kjeldahl flask. Dilute with water to 200 mL, and add 50 mL of sodium hydroxide solution (2 in 5).

**Titrimetric system**

**Mode:** Direct titration

**Titrant:** 0.1 N sulfuric acid VS

**Endpoint detection:** Visual

**Analysis**

**Sample:** *Sample solution*

Immediately connect the flask containing the *Sample solution* by means of a distillation trap to a well-cooled condenser, the delivery tube of which dips into 40 mL of boric acid solution (1 in 25) contained in a suitable receiver. Heat to boiling, and distill about 200 mL. Cool the liquid in the receiver, if necessary, then add methyl red TS, and titrate with *Titrant*. Perform a blank determination, and make any necessary correction.

Calculate the percentage of the labeled amount of ammonium ($NH_4$) in the portion of Injection taken:

$$\text{Result} = (V_S - V_B) \times N \times (F/W) \times 100$$

$V_S$ = *Titrant* volume consumed by the *Sample solution* (mL)

$V_B$ = *Titrant* volume consumed by the blank (mL)

$N$ = actual normality of the *Titrant* (mEq/mL)

$F$ = equivalency factor, 18.04 mg/mEq

$W$ = nominal amount of ammonium in the *Sample solution* (mg)

**Acceptance criteria:** 90.0%–110.0%

- **Chloride**

**Sample solution:** Transfer a volume of Injection, equivalent to 55 mg of chloride (1.55 mEq), to a suitable conical flask and add water, if necessary, to bring the volume to about 10 mL. Add 10 mL of glacial acetic acid, 75 mL of methanol, and 0.5 mL of eosin Y TS.

**Titrimetric system**

**Mode:** Direct titration

**Titrant:** 0.1 N silver nitrate VS

**Endpoint detection:** Visual

**Analysis**

**Sample:** *Sample solution*

Titrate, with shaking, with *Titrant* to a pink endpoint.

Calculate the percentage of the labeled amount of chloride (Cl) in the portion of Injection taken:

$$\text{Result} = V \times N \times (F/W) \times 100$$

$V$ = *Titrant* volume consumed by the *Sample solution* (mL)

$N$ = actual normality of the *Titrant* (mEq/mL)

$F$ = equivalency factor, 35.45 mg/mEq

$W$ = nominal amount of chloride in the *Sample solution* (mg)

**Acceptance criteria:** 90.0%–120.0%

- **Dextrose**

**Sample solution:** Transfer a volume of Injection containing 2–5 g of dextrose to a 100-mL volumetric flask. Add 0.2 mL of 6 N ammonium hydroxide, and dilute with water to volume.

**Analysis**

**Sample:** *Sample solution*

Determine the angular rotation in a polarimeter tube (see *Optical Rotation ⟨781⟩*).

Calculate the percentage of the labeled amount of dextrose ($C_6H_{12}O_6 \cdot H_2O$) in the portion of Injection taken:

$$\text{Result} = [(100 \times a)/(l \times \alpha)] \times (1/C_U) \times (M_{r1}/M_{r2}) \times 100$$

$a$ = observed angular rotation of the *Sample solution* (°)

$l$ = length of the polarimeter tube (dm)

$\alpha$ = midpoint of the specific rotation range for anhydrous dextrose, 52.9°

$C_U$ = nominal concentration of dextrose in the *Sample solution* (g/100 mL)

$M_{r1}$ = molecular weight of dextrose monohydrate, 198.17

$M_{r2}$ = molecular weight of anhydrous dextrose, 180.16

**Acceptance criteria:** 90.0%–105.0%

- **Lactate** (if present)

**Mobile phase:** Formic acid, dicyclohexylamine, and water (1:1:998)

**System suitability solution:** 3 mg/mL each of anhydrous sodium acetate and USP Sodium Lactate RS in water

**Standard solution:** 2 mg/mL of USP Sodium Lactate RS (0.018 mEq/mL of lactate) in water

**Sample solution**

**For Injections containing >20 mEq/L of lactate:** Nominally 0.02 mEq/mL of lactate from Injection in water

**For Injections containing ≤20 mEq/L of lactate:** Use the undiluted Injection.

**Chromatographic system**

(See *Chromatography ⟨621⟩, System Suitability*.)

**Mode:** LC

**Detector:** UV 210 nm

**Column:** 4.6-mm × 10-cm; packing L1

**Flow rate:** 1 mL/min

**Injection volume:** 20 µL

**System suitability**

**Samples:** *System suitability solution* and *Standard solution*

**Suitability requirements**

**Resolution:** NLT 2 between acetate and lactate, *System suitability solution*

**Tailing factor:** NMT 2.0, *Standard solution*

**Relative standard deviation:** NMT 2.0%, *Standard solution*

**Analysis**

**Samples:** *Standard solution* and *Sample solution*

Calculate the percentage of the labeled amount of lactate ($C_3H_5O_3$) in the portion of Injection taken:

$$\text{Result} = (r_U/r_S) \times (C_S/C_U) \times 100$$

$r_U$ = peak response of lactate from the *Sample solution*

$r_S$ = peak response of lactate from the *Standard solution*

$C_S$ = concentration of lactate in the *Standard solution* (mEq/mL)

$C_U$ = nominal concentration of lactate in the *Sample solution* (mEq/mL)

**Acceptance criteria:** 90.0%–110.0%

- **Phosphate** (if present)

**Solution A:** 50 g/L of ammonium molybdate prepared as follows. Transfer a suitable amount of ammonium molybdate to an appropriate volumetric flask. Add 60% of the final flask volume of water, and swirl to dissolve. Add 15% of the flask volume of sulfuric acid, and swirl. Allow to cool, and dilute with water to volume.

**Solution B:** Dissolve 0.5 g of hydroquinone in 100 mL of water, and add 1 drop of sulfuric acid. Prepare this solution fresh daily.

**Solution C:** Dissolve 1 g of sodium sulfite in water to make 5 mL. Prepare this solution fresh daily.

**Standard solution:** 0.11 mg/mL of monobasic potassium phosphate (0.0008 mEq/mL of phosphate) in water

**Sample solution:** Nominally 0.0008 mEq/mL of phosphate from a volume of Injection

**Blank:** Water

**Instrumental conditions**

**Mode:** Vis

**Analytical wavelength:** 640 nm

**Analysis**

**Samples:** *Standard solution*, *Sample solution*, and *Blank*

Use water to zero the instrument. Transfer 2 mL each of the *Standard solution*, the *Sample solution*, and the *Blank* to separate test tubes. To each test tube add 1 mL of *Solution A*, and allow to stand for 3 min. Add 1 mL of *Solution B*. Add 1 mL of *Solution C*, and allow to stand for 30 min.

Calculate the percentage of the labeled amount of phosphate ($PO_4$) in the portion of the Injection taken:

$$\text{Result} = (A_U/A_S) \times (C_S/C_U) \times 100$$

$A_U$ = absorbance of the *Sample solution*, corrected for any absorbance of the solution from the *Blank*

$A_S$ = absorbance of the *Standard solution*, corrected for any absorbance of the solution from the *Blank*

$C_S$ = concentration of phosphate in the *Standard solution* (mEq/mL)

$C_U$ = nominal concentration of phosphate ($PO_4$) in the *Sample solution* (mEq/mL)

**Acceptance criteria:** 90.0%–110.0%

- **Potassium and Sodium**

**Internal standard solution:** 1.04 mg/mL of lithium nitrate prepared as follows. Transfer 1.04 g of lithium nitrate to a 1000-mL volumetric flask, add a suitable nonionic surfactant, then dilute with water to volume.

**Potassium stock solution:** 74.56 mg/mL of potassium chloride (1 mEq/mL of potassium) prepared as follows. Transfer 18.64 g of potassium chloride, previously dried at 105° for 2 h, to a 250-mL volumetric flask, and dilute with water to volume.

**Sodium stock solution:** 58.44 mg/mL of sodium chloride (1 mEq/mL of sodium) prepared as follows. Transfer 14.61 g of sodium chloride, previously dried at 105° for 2 h, to a 250-mL volumetric flask, and dilute with water to volume.

**Standard stock solution:** 0.0391*J* mg/mL of potassium (K) from *Potassium stock solution* and 0.02299*J'* mg/mL of sodium (Na) from *Sodium stock solution* prepared as follows. Transfer 0.1*J* mL of *Potassium stock solution* and 0.1*J'* mL of *Sodium stock solution* to a 100-mL volumetric flask, where *J* and *J'* are the labeled amounts, in mEq/L, of potassium and sodium, respectively, in the Injection. Dilute with water to volume.

**Standard solution:** Dilute 5.0 mL of *Standard stock solution* with *Internal standard solution* to 500.0 mL.

**Sample solution:** Dilute 5.0 mL of Injection with *Internal standard solution* to 500.0 mL.

**Instrumental conditions**

**Mode:** Flame photometer

**Analytical wavelengths**

**Potassium:** Maximum at 766 nm

**Sodium:** Maximum at 589 nm

**Lithium:** Maximum at 671 nm

**Blank:** *Internal standard solution*

**Analysis**

**Samples:** *Standard solution*, *Sample solution*, and *Blank*

Use the *Blank* to zero the instrument. Concomitantly determine the flame emission readings for the *Standard solution* and *Sample solution*.

Calculate the percentage of the labeled amount of potassium (K) in the portion of Injection taken:

$$\text{Result} = (R_U/R_S) \times (C_S/C_U) \times 100$$

$R_U$ = emission reading ratio of potassium to lithium from the *Sample solution*

$R_S$ = emission reading ratio of potassium to lithium from the *Standard solution*

$C_S$ = concentration of potassium (K) in the *Standardsolution* (mg/mL)

$C_U$ = nominal concentration of potassium (K) in the *Sample solution* (mg/mL)

[NOTE—Each mg of potassium (K) is equivalent to 0.02558 mEq of potassium (K).]

Calculate the percentage of the labeled amount of sodium (Na) in the portion of Injection taken:

$$\text{Result} = (R_U/R_S) \times (C_S/C_U) \times 100$$

$R_U$ = emission reading ratio of sodium to lithium from the *Sample solution*

$R_S$ = emission reading ratio of sodium to lithium from the *Standard solution*

$C_S$ = concentration of sodium (Na) in the *Standard solution* (mg/mL)

$C_U$ = nominal concentration of sodium (Na) in the *Sample solution* (mg/mL)

[NOTE—Each mg of sodium (Na) is equivalent to 0.04350 mEq of sodium (Na).]

**Acceptance criteria**

**Potassium:** 90.0%–110.0%

**Sodium:** 90.0%–110.0%

## SPECIFIC TESTS

- **BACTERIAL ENDOTOXINS TEST ⟨85⟩:** NMT 0.5 USP Endotoxin Units/mL
- **pH ⟨791⟩:** 4.0–6.5
- **OTHER REQUIREMENTS:** It meets the requirements in *Injections and Implanted Drug Products ⟨1⟩*.

## ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in single-dose glass or plastic containers. Glass containers are preferably of Type I or Type II glass.
- **LABELING:** The label states the content of each electrolyte in terms of milliequivalents (mEq) in a given volume. The label states the total osmolar concentration in mOsmol/L. When the contents are less than 100 mL, the label alternatively may state the total osmolar concentration in mOsmol/mL.
- **USP REFERENCE STANDARDS ⟨11⟩**

USP Sodium Lactate RS



**Auxiliary Information** - Please check for your question in the FAQs before contacting USP.

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