Status: Currently Official on 15-Feb-2025
Official Date: Official as of 01-May-2018
Document Type: USP Monographs
DocId: GUID-8A64ED66-04F2-414E-A88A-99ACD5AD9BC8_3_en-US
DOI: https://doi.org/10.31003/USPNF_M40165_03_01
DOI Ref: oc1ih

Indium In 111 Chloride Solution

Indium Chloride ($^{111}InCl_3$).

Indium (^{111}In) trichloride

CAS RN®: 10025-82-8.

» Indium In 111 Chloride Solution is a sterile, nonpyrogenic solution of radioactive indium (^{111}In) in dilute hydrochloric acid suitable for the radiolabeling of proteins such as monoclonal antibodies, peptides, or small biologically active organic molecules. The concentration of acid and ^{111}In per mL of Indium In 111 Chloride Solution may require adjustment for the specific antibody or peptide being labeled. It contains not less than 90.0 percent and not more than 110.0 percent of the labeled amount of ^{111}In expressed as megabecquerels (or millicuries) per mL at the time indicated in the labeling. Other chemical forms of radioactivity do not exceed 10.0 percent of the total radioactivity. [Note—Indium In 111 Chloride Solution is generally recommended for use with specific antibodies or peptides. Consult the product labeling for recommendations and applications for radiolabeling.]

Specific activity: not less than 1.85 gigabecquerels (50 millicuries) per µg of indium at the date and time of calibration.

Packaging and storage—Preserve in single-unit containers at controlled room temperature.

Labeling—Label it to include the following, in addition to the information specified for *Labeling ⟨7⟩, Labels and Labeling for Injectable Products*: the time and date of calibration; the amount of ^{111}In as labeled chloride expressed as total megabecquerels (or millicuries) and the concentration as megabecquerels per mL (or as millicuries per mL) on the date and time of calibration; the expiration date; the statement, "Not for direct administration. Use only as an ingredient for radiolabeling;" and the statement, "Caution—Radioactive Material." The labeling indicates that in making dosage calculations, correction is to be made for radioactive decay, and also indicates that the radioactive half-life of ^{111}In is 67.3 hours.

Identification—Add 1 drop of it to 2 drops of 0.1 M silver nitrate in a glass test tube: a white precipitate is formed (presence of chloride).

Bacterial Endotoxins Test ⟨85⟩—It contains not more than 175/*V* USP Endotoxin Unit per mL, in which *V* is the maximum recommended total dose, in mL, at the expiration date or time.

Acidity—Pipet 20 µL of Solution into a plastic tube containing 1 drop of bromocresol green, and titrate with 0.0025 N sodium carbonate to a blue endpoint. Calculate the acidity of the Solution by the formula:

$$0.0025V_T/20$$

in which V_T is the volume of titrant consumed: the molarity of the Solution is between 0.035 and 0.045.

Radionuclide identification ⟨821⟩—Its gamma-ray spectrum is identical to that of a specimen of ^{111}In that exhibits major photopeaks having energies of 0.171 and 0.245 MeV.

Radionuclidic purity (see *Radioactivity ⟨821⟩*)—Using a suitable counting assembly , determine the radioactivity of each radionuclidic impurity, in kBq per MBq (µCi per mCi) of ^{111}In, in the Solution by use of a calibrated system as directed under *Radioactivity ⟨821⟩*.

Indium 110m—The limit of ^{110m}In is 3 kBq per Mbq (or 3 µCi per mCi) of ^{111}In. The presence of ^{110m}In in the Solution is demonstrated by a characteristic gamma-ray spectrum with prominent photopeaks having energies of 0.66 and 0.91 MeV. ^{110m}In decays with a half-life of 4.9 hours.

Indium 114m—The limit of ^{114m}In is 3 kBq per MBq (or 3 µCi per mCi) of ^{111}In. ^{114m}In is quantified by counting the beta emissions of ground state ^{114}In with a beta-liquid scintillation counter having a high-energy channel set to discriminate against all counts arising from ^{111}In.

Zinc 65—The limit of ^{65}Zn is 3 kBq per MBq (or 3 µCi per mCi) of ^{111}In. The presence of ^{65}Zn in the Solution is demonstrated by a characteristic gamma-ray spectrum with a prominent photopeak at 1.116 MeV. ^{65}Zn decays with a radioactive half-life of 243.9 days.

Radiochemical purity—

Adsorbent: instant thin-layer chromatography (ITLC) strips (2.5 cm × 10 cm).[1]

Test solution—Dispense about 50 µL of Solution into 1 mL of 0.05 M hydrochloric acid, taking care to use polypropylene tips prewashed in 0.05 M hydrochloric acid for all dispensings.

Application volume: 2 µL. The amount of ^{111}In spotted should be between 0.5 µCi and 30 µCi as of the day of the test.

Developing solvent system: a mixture of a 1 in 10 solution of ammonium acetate and methanol (1:1).

Procedure—Proceed as directed for *Thin-Layer Chromatography* under *Chromatography ⟨621⟩*. Examine the plate with an appropriate scanner, and determine the percentage of radiochemical purity of the *Test solution*. The indium chloride will remain at the origin. Not less than 95% of indium is present as ionic indium.

Chemical purity—

Copper—Determine the copper, in µg per mL, in the Solution by atomic absorption spectrometry (see *Atomic Absorption Spectroscopy ⟨852⟩*), using a graphite furnace to volatilize the copper, as directed by the manufacturer of the instrument used, and measuring the absorbance at 324.8 nm against a standard.

Nickel—Determine the nickel, in µg per mL, in the Solution by atomic absorption spectrometry (see *Atomic Absorption Spectroscopy ⟨852⟩*), using a graphite furnace to volatilize the nickel, as directed by the manufacturer of the instrument used, and measuring the absorbance at 232.0 nm against a standard.

Cadmium—Determine the cadmium, in µg per mL, in the Solution by atomic absorption spectrometry (see *Atomic Absorption Spectroscopy ⟨852⟩*), using a graphite furnace to volatilize the cadmium, as directed by the manufacturer of the instrument used, and measuring the absorbance at 228.8 nm against a standard.

Lead—Determine the lead, in µg per mL, in the Solution by atomic absorption spectrometry (see *Atomic Absorption Spectroscopy ⟨852⟩*), using a graphite furnace to volatilize the lead, as directed by the manufacturer of the instrument used, and measuring the absorbance at 217.0 nm against a standard.

Mercury—Determine the mercury, in µg per mL, in the Solution by atomic absorption spectrometry (see *Atomic Absorption Spectroscopy ⟨852⟩*), using a graphite furnace to volatilize the mercury, as directed by the manufacturer of the instrument used, and measuring the absorbance at 253.7 nm against a standard.

Iron—Determine the iron, in µg per mL, in the Solution by atomic absorption spectrometry (see *Atomic Absorption Spectroscopy ⟨852⟩*), using a graphite furnace to volatilize the iron, as directed by the manufacturer of the instrument used, and measuring the absorbance at 248.3 nm against a standard.

Zinc—Prepare a zinc stock solution in dilute hydrochloric acid (1 in 100) having a concentration of 1 µg of zinc per mL. Pipet 10 mL of the zinc stock solution into a 100-mL volumetric flask, dilute with water to volume, and mix to obtain a solution having a concentration of 0.1 µg of zinc per mL (*Standard solution A*). Pipet 20 mL of the zinc stock solution into a 100-mL volumetric flask, dilute with water to volume, and mix to obtain a solution having a concentration of 0.2 µg of zinc per mL (*Standard solution B*). Pipet 0.1 mL of Indium Chloride In 111 Solution into a 10-mL volumetric flask, dilute with water to volume, and mix to obtain the test solution. Determine the absorbances of the *Standard solutions* and the test solution at the zinc emission line at 213.9 nm with an atomic absorption spectrophotometer (see *Atomic Absorption Spectroscopy ⟨852⟩*) equipped with a zinc hollow-cathode lamp and an air–acetylene flame, using water as the blank. Determine the quantity of zinc, in µg per mL, in the Solution.

The composite total metal ion content is not greater than 1.0 µg per mL.

Other requirements—It meets the requirements under *Injections and Implanted Drug Products ⟨1⟩*, except that the Solution may be distributed or dispensed prior to completion of the test for *Sterility Tests ⟨71⟩*, the latter test being started on the day of final manufacture, and except that it is not subject to the recommendation on *Container content*.

Assay for radioactivity (see *Radioactivity⟨821⟩*)—Using a suitable counting assembly , determine the radioactivity, in MBq (or in microcuries or millicuries) per mL, of the Solution, by the use of a calibrated system.

[1] Type SG impregnated glass microfiber sheet (Gelman Sciences, Ann Arbor, MI).

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

Topic/Question	Contact	Expert Committee
INDIUM IN 111 CHLORIDE SOLUTION	Documentary Standards Support	SM42020 Small Molecules 4

Chromatographic Database Information: Chromatographic Database

Most Recently Appeared In:
Pharmacopeial Forum: Volume No. PF 32(6)

Current DocID: GUID-8A64ED66-04F2-414E-A88A-99ACD5AD9BC8_3_en-US
Previous DocID: GUID-8A64ED66-04F2-414E-A88A-99ACD5AD9BC8_1_en-US
DOI: https://doi.org/10.31003/USPNF_M40165_03_01
DOI ref: oc1ih