

Status: Currently Official on 17-Feb-2025  
 Official Date: Official as of 01-Jan-2018  
 Document Type: USP Monographs  
 DocId: GUID-0AE39E9C-386B-4A20-BD14-0C182AAF26DB\_3\_en-US  
 DOI: [https://doi.org/10.31003/USPNF\\_M2366\\_03\\_01](https://doi.org/10.31003/USPNF_M2366_03_01)  
 DOI Ref: 6hf9p

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## Aluminum Zirconium Tetrachlorohydrate Solution

» Aluminum Zirconium Tetrachlorohydrate Solution is a polymeric, loosely hydrated complex of basic aluminum zirconium chloride that encompasses a range of aluminum-to-zirconium atomic ratios between 2.0:1 and 5.99:1 and a range of (aluminum plus zirconium)-to-chloride atomic ratios between 1.5:1 and 0.9:1. The following solvents may be used: water, propylene glycol, or dipropylene glycol. It contains the equivalent of not less than 90.0 percent and not more than 110.0 percent of the labeled concentration of anhydrous aluminum zirconium tetrachlorohydrate.

**Packaging and storage**—Preserve in well-closed containers.

**Labeling**—Label Solution to state the solvent used and the claimed concentration of anhydrous aluminum zirconium tetrachlorohydrate.

**Identification**—

**A:** A solution containing the equivalent of about 100 mg of anhydrous aluminum zirconium tetrachlorohydrate per mL responds to the test for [Chloride \(191\)](#).

**B:** *Identification of propylene glycol* (where stated on the label)—Add about 10 mL of isopropyl alcohol to 2 g of Solution, mix, and filter. Evaporate the filtrate to about 1 mL on a steam bath: the IR spectrum of a film of this solution on a silver chloride disk exhibits maxima only at the same wavelengths as that of a similar preparation of a film of propylene glycol.

**C:** *Identification of dipropylene glycol* (where stated on the label)—Add about 10 mL of isopropyl alcohol to 2 g of Solution, mix, and filter. Evaporate the filtrate to about 1 mL on a steam bath: the IR spectrum of a film of this solution on a silver chloride disk exhibits maxima only at the same wavelengths as that of a similar preparation of a film of dipropylene glycol.

**pH (791):** between 3.0 and 5.0, in a solution prepared by diluting 3 g of the Solution with water to obtain 10 mL.

**ARSENIC, Method 1 (211)**—Prepare the *Test Preparation* using an accurately weighed quantity of the Solution. The limit is 2 µg per g.

**Limit of iron**—Using about 5.4 g of Aluminum Zirconium Tetrachlorohydrate Solution, accurately weighed, instead of Aluminum Zirconium Octachlorohydrate, proceed as directed in the test for the *Limit of iron* under [Aluminum Zirconium Octachlorohydrate](#). The limit is 75 µg per g.

**Content of aluminum**—Using about 0.3 g of Aluminum Zirconium Tetrachlorohydrate Solution instead of Aluminum Zirconium Octachlorohydrate, proceed as directed in the test for the *Content of aluminum* under [Aluminum Zirconium Octachlorohydrate](#). Use the result to calculate the *Aluminum/zirconium atomic ratio* and the *(Aluminum plus zirconium)/chloride atomic ratio*.

**Content of zirconium**—Using about 500 mg of Aluminum Zirconium Tetrachlorohydrate Solution, accurately weighed, instead of Aluminum Zirconium Octachlorohydrate, proceed as directed in the test for the *Content of zirconium* under [Aluminum Zirconium Octachlorohydrate](#). Use the result to calculate the *Aluminum/zirconium atomic ratio* and the *(Aluminum plus zirconium)/chloride atomic ratio*.

**Aluminum/zirconium atomic ratio**—Divide the percentage of aluminum found in the test for *Content of aluminum* by the percentage of zirconium found in the test for *Content of zirconium* and multiply by 92.97/26.98, in which 92.97 is the atomic weight of zirconium corrected for 2% hafnium content, and 26.98 is the atomic weight of aluminum: the ratio is between 2.0:1 and 5.99:1.

**Content of chloride**—Using about 500 mg of Aluminum Zirconium Tetrachlorohydrate Solution, accurately weighed, instead of Aluminum Zirconium Octachlorohydrate, proceed as directed in the test for the *Content of chloride* under [Aluminum Zirconium Octachlorohydrate](#). Use the result to calculate the *(Aluminum plus zirconium)/chloride atomic ratio*.

**(Aluminum plus zirconium)/chloride atomic ratio**—Calculate the (aluminum plus zirconium)/chloride atomic ratio by the formula:

$$[(Al/26.98) + (Zr/92.97)]/(Cl/35.453)$$

in which *Al*, *Zr*, and *Cl* are the percentages of aluminum, zirconium, and chloride found in the test for *Content of aluminum*, *Content of zirconium*, and *Content of chloride*, respectively; 26.98 is the atomic weight of aluminum; 92.97 is the atomic weight of zirconium corrected for 2% hafnium content; and 35.453 is the atomic weight of chlorine: the ratio is between 1.5:1 and 0.9:1.

**Assay**—Calculate the percentage of anhydrous aluminum zirconium tetrachlorohydrate in the Solution by the formula:

$$Al/((26.98y + 92.97 + 17.01[3y + 4 - (y + 1)/z] + 35.453(y + 1)/z)/26.98y)$$

in which *Al* is the percentage of aluminum found in the test for *Content of aluminum*, *y* is the aluminum/zirconium atomic ratio found in the test for *Aluminum/zirconium atomic ratio*, *z* is the (aluminum plus zirconium)/chloride atomic ratio found in the test for *(Aluminum plus zirconium)/chloride atomic ratio*, 26.98 is the atomic weight of aluminum, 92.97 is the atomic weight of zirconium corrected for 2% hafnium content, 17.01 is the molecular weight of the hydroxide anion (OH), and 35.453 is the atomic weight of chlorine (Cl).

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Most Recently Appeared In:

Pharmacopeial Forum: Volume No. PF 27(4)

Current DocID: GUID-0AE39E9C-386B-4A20-BD14-0C182AAF26DB\_3\_en-US

Previous DocID: GUID-0AE39E9C-386B-4A20-BD14-0C182AAF26DB\_1\_en-US

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DOI ref: [6hf9p](#)

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