

IC-Ag and IC-Ag Plus Devices

Introduction

Maxi-Clean™ and Extract-Clean™ IC Devices are solid-phase extraction devices used to eliminate matrix interferences from samples prior to analyses by ion chromatography. Each device consists of either 0.5mL or 1.5mL of polystyrene-based packing sandwiched between polyethylene frits within an injection-molded medical-grade polypropylene housing (Figure 1). Samples and wash solvents are passed through the packing using a luer hub syringe (for Maxi-Cleans™) or a vacuum manifold (for Extract-Cleans™). As sample comes in contact with the packing, specific chemical interactions take place which selectively retain certain components of the matrix in the device while the remaining components pass through the device outlet. The chemical characteristics of the packing dictate which sample components are retained. Seven chemistries are currently available.

Successful application of IC devices requires:

- 1) proper conditioning of the device prior to sample application,
- 2) application of the sample at a rate slow enough to allow the chemical interaction to take place while the sample is in the device, and
- 3) control of sample size to keep within the device's capacity.

The following information provides general recommendations for the use of IC-Ag devices. This procedure may be modified to accommodate samples with different characteristics.

General Information

Maxi-Clean™ and Extract-Clean™ IC-Ag provide a reliable method for the removal of halides prior to the analysis of anions by ion chromatography. IC-Ag devices contain either 0.5mL or 1.5mL of sulfonic acid cation exchange resin in the Ag+1 form. The silver contained on the packing reacts with halides from the sample to form an insoluble salt (silver halide). In this process, cations from the sample are taken up by the resin to replace the silver consumed in the precipitation reaction. The net result is removal of halides (and an equivalent amount of sample cations) from the matrix. This process has little or no effect on sample anions that form soluble silver salts. Thus, the amounts of fluoride, nitrite, nitrate, phosphate and sulfate are not changed. Chloride, bromide, and iodide concentrations are reduced.

When large concentrations of halides are present in a sample, low levels of other anions may be lost during sample pretreatment with IC-Ag. This is probably due to the inclusion of the other ions in the precipitating silver halides. A study of the recovery of ions of interest in each sample matrix should be determined before quantitative results are obtained.

For more information on the use of Maxi-Clean™ IC cartridges and the recovery obtained with each please see:

R. Saari-Nordhaus, J.M. Anderson, Jr. and I.K. Anderson, Am. Lab., August (1990) 18.

I.K. Anderson, R. Saari-Nordhaus and J.M. Anderson, Jr., J. of Chromatography, 546 (1991) 61-71.

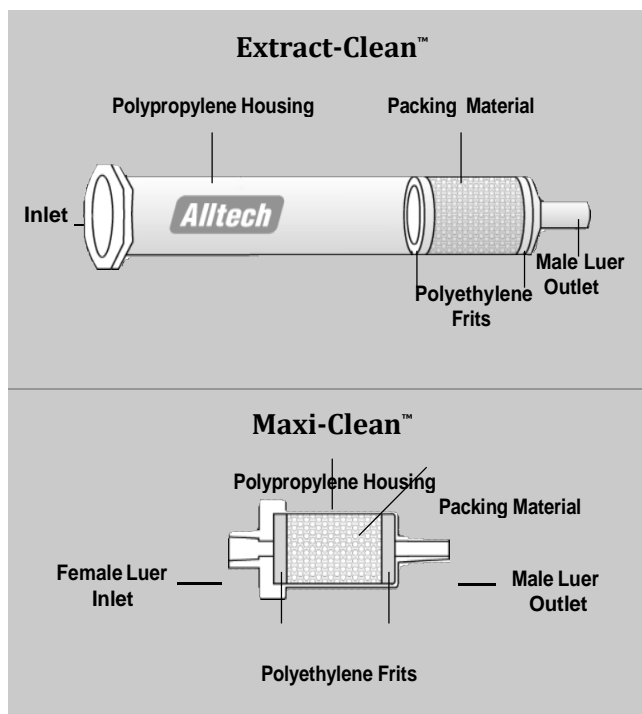


Figure 1

Flowrate

The devices have a number of flow-dependent parameters that may affect results. In general, high flowrates, particularly in the sample loading step, will decrease the performance while low flowrates will improve the extraction process. Low flowrates allow the sample to diffuse into the packing thus increasing capacity and improving the efficiency. The recommended flowrate for sample loading is 1mL/ minute or less.

Sample Mass

Each device contains either 0.8 or 2.0 milliequivalents of Ag⁺¹ (for the 0.5mL or 1.5mL device, respectively), which under ideal conditions will remove an equal amount of halide from the sample. In practice, this maximum capacity may not be realized. The nature of the sample (concentration, ionic strength, solvent) and the rate at which the sample is loaded into the device will affect the capacity. Where possible, adjust sample size to use 50% of less of the device's absolute capacity. Larger amounts of halide may be removed by using two or more Maxi-Clean™ cartridges in series. If the amount of halide in the sample is unknown, a test extraction should be performed to determine the correct sample size.

Sample Volume

The internal volumes of the different devices include the flow passages and interstitial packing volume. Although it is possible to recover all but 100µL (for the 0.5mL devices) or 150µL (for the 1.5mL devices) of sample with an air purge, best results are obtained when the sample volume greatly exceeds the internal volume of the cartridge.

| Device | Bed Size | Internal Volume |
|---------------------|----------|-----------------|
| Maxi-Clean™ | 0.5mL | 300µL |
| Maxi-Clean™ Plus | 1.5mL | 650µL |
| Extract-Clean™ | 0.5mL | 2.5mL |
| Extract-Clean™ Plus | 1.5mL | 1.5mL |

Note: The used Maxi-Clean™ IC-Ag packing will darken when exposed to light.

General Procedure

- 1. Precondition the Device.** Pass 5 to 10mL of IC grade water through the device. This removes interstitial contaminants and wets the packed bed. For trace analysis work, repeat the rinsing procedure until the eluant is free from interferences.
- 2. Load the Sample.** Load the entire sample at 1mL/minute or less. The total amount of halide contained in the sample should not exceed the device capacity and preferably should be below 50% of total capacity. Discard the first 1mL of eluate. Collect the remaining eluate for analysis.

Other IC Devices

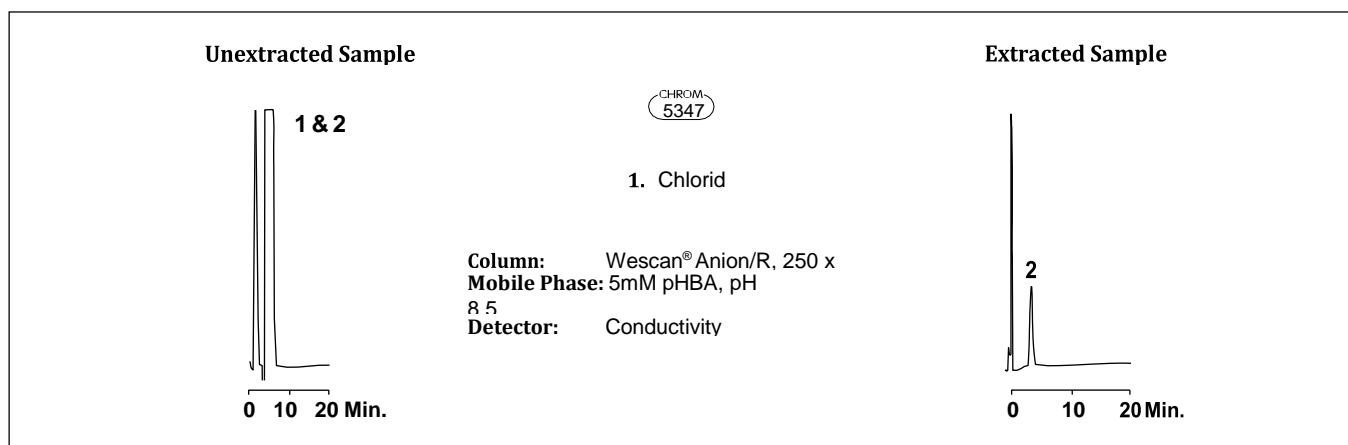
| Device | Retains |
|-----------------------|---|
| IC-RP: | Hydrophobic Components |
| IC-OH: | Anions (pH increase) |
| IC-H: | Cations (pH reduction) |
| IC-Ag: | Chloride, Iodide, Bromide |
| IC-Ba: | Sulfate |
| IC-Na: | Cations (no pH change) |
| IC-Chelate: | Polyvalent Metal Ions |
| IC-Mixed Mode™ RP-OH: | Hydrophobic Components and Anions (pH increase) |
| IC-Mixed Mode™ RP-H: | Hydrophobic Components and Cations (pH reduction) |

Example Nitrite in Brine Procedure:

1. Apply 4mL of sample to a preconditioned cartridge.
2. Discard first 1mL of eluate
3. Collect and analyze remaining mobile phase.

IC-Ag Devices

| DESCRIPTION | VOLUME | QTY | PART No. |
|---------------------------|--------|-----|----------|
| Maxi-Clean™ IC-Ag | 0.5mL | 50 | 5122577 |
| Maxi-Clean™ IC-Ag Plus | 1.5mL | 25 | 5122569 |
| Extract-Clean™ IC-Ag | 0.5mL | 50 | 5121733 |
| Extract-Clean™ IC-Ag Plus | 1.5mL | 30 | 5122035 |



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