Optimizing the Use of High Purity Water in Ion Chromatography – Direct-Feed and Hints and Tips

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Water Quality in Ion Chromatography

As instrumentation and analytical methods are becoming increasingly sensitive, the ability to perform trace and ultra trace analyses relies on the high quality and purity of the reagents used.

High purity water is probably the most commonly used reagent. It is used for the preparation of samples, reagents and mobile phases, in standard dilutions and blanks.

Water quality may impact both the analytical results and the analytical instrument itself.

Impact of water contaminants on IC:

- Ions can cause noisy baselines, shifted calibration curves and negative peaks. They also reduce the lifetime of the suppressor.
- Organics can reduce column lifetime due to fouling and modify elution patterns. They may also alter the performance of the suppressor. Some charged organics (ammoniums, carboxylates) may complex with inorganic ions being analyzed and interfere with analyses.
- Particulates may increase system back-pressure and affect the pump heads.
- Bacteria can release inorganic ions and small organic acids, which may interfere with chromatograms. Additionally, bacteria can behave as particulates and affect columns and frits.

For reliable results, and to preserve the lifetime of instruments and consumables, it is important not to use merely deionized water, but rather high purity water free of all 4 types of contaminants.

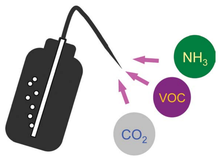
Modern water purification systems deliver high quality ultrapure water in a reliable manner. However, ultrapure water doesn't stay ultrapure for very long. It is an excellent solvent, sometimes referred to as "hungry" water, and can rapidly become contaminated.

High purity water – Hints and Tips

Ultrapure water can easily be contaminated by CO_2 and volatile compounds present in the laboratory air, by compounds leaching out from containers etc., therefore it should be handled carefully.

Hints and Tips: Minimize the use of wash bottles

In wash bottles, contamination may be caused by airborne contaminants sucked inside the bottle, by contaminants leaching from the bottle into the water, and by long-term storage, leading to bacterial growth. If wash bottles are used, make sure to replace the ultrapure water often, and clean the wash bottles regularly.



Hints and Tips: Handle plasticware carefully

The use of High Density Polyethylene (HDPE) containers is recommended. New containers should be rinsed with Milli-Q® water, filled and left to soak overnight at 30-40°C to eliminate extractibles. This process should be repeated 3 times. Between uses, bottles and flasks should be stored full of Milli-Q® water, in a clean environment, then rinsed.

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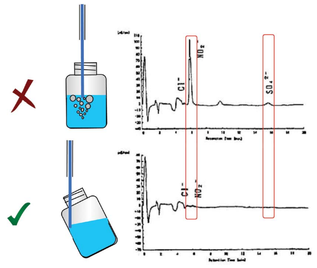
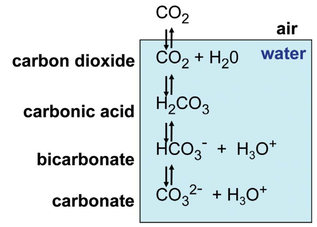
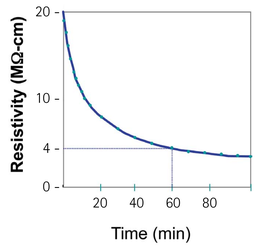
Hints and Tips: Do not generate bubbles when dispensing water



Hints and Tips: Do not store ultrapure water

Carbonates are formed rapidly when ultrapure water is in contact with air. It is best to use freshly purified water, dispensed just when it is needed.

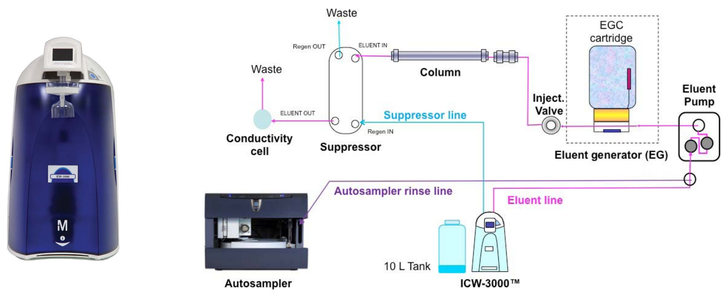




Direct-feed water purification system

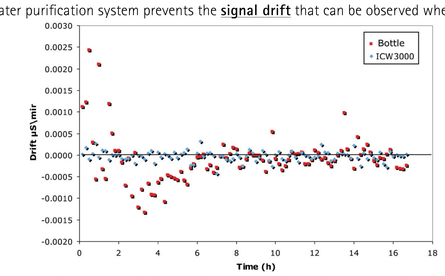
Since storage of ultrapure water is not recommended we developed a "direct feed" water purification system which can be connected to both the eluent generator and the suppressor of Thermo Scientific™ Dionex™ IC systems.

It generates a constant flow of freshly purified water, eliminating the drawbacks of water storage and the need to frequently stop the instrument to change eluent bottles.



Direct-feed water purification system (cont.)

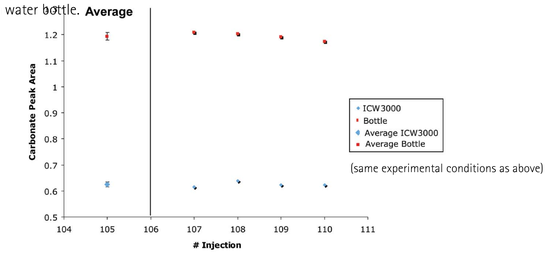
The direct-feed water purification system prevents the **signal drift** that can be observed when a water bottle is used.



Instrument: Dionex® ICS 3000
Column: AS11-HC 4x250 mm
Eluent Source: EGC-KOH
Eluent: 25 mM KOH
Flow Rate: 1.3 mL/min
Column Temp.: 25 °C
Detection: Conductivity

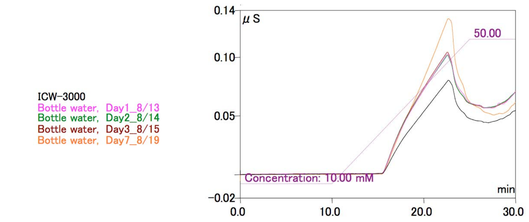
Data courtesy of D. Billet and G. Kitzinger, LIMOS, Univ. Poincaré, Nancy, France

The direct-feed water purification system reduces the formation of , as compared with a water bottle.



(same experimental conditions as above)

The direct-feed system is compatible with a capillary IC setup and provides water of reliably high quality, as compared with bottled water used on several consecutive days.



Instrument: Dionex® ICS 5000
Column: IonPac® AG19/AS19, capillary
Eluent Source: EGC-KOH capillary
Eluent: 10-50 mM KOH
Flow Rate: 10 µL/min
Column Temp.: 30 °C
Suppressor: ACES (capillary)
Detection: Conductivity

Data courtesy of Y. Sekiguchi, Nippon Dionex KK (Thermo Fisher Scientific), Osaka, Japan

Conclusions

Performing trace ion analysis remains a challenge. In order to obtain reliable results, experimental conditions need to be optimal, and eluent quality must be considered with great care.

Eluent generation is less labor-intensive than if bottles are refilled regularly with high purity water, baselines are more stable, and there is less risk of contamination from the laboratory atmosphere.

Acknowledgments

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