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What is Capillary Ion Chromatography?

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Executive Summary

Capillary IC provides versatile benefits in the area of time, speed, sensitivity, and cost of ownership. This becomes possible with the effects of scaling down specific parameters which have successfully simplified ion chromatography.

Keywords

Capillary IC, continuous operate, ICS-5000+, ICS-4000

Introduction

Increasing productivity has become a critical benchmarking metric as laboratories look to operate at near top efficiency within available resources. Capillary IC takes performance and ease-of-use to a whole new level, simplifying ion chromatography analyses while increasing throughput. By scaling down column size, injection volumes, and flow rates by a factor of 10 to 100, Capillary IC provides excellent eluent and waste economy, small sample requirements, and high mass sensitivity.

Parameter	Standard Bore IC	Capillary IC
Column I.D.	4 mm	0.4 mm
Flow Rate	1.0 mL/min	10 µL/min
Injection Volume	40 µL	0.4 µL
Eluent Consumption/Waste Generated	43.2 L/month	0.432 L/month
EGC Lifetime	28 days	18 months
Mass Detection Limits	7000 fg	70 fg

Thermo Scientific Dionex ICS-4000 (left) and ICS-5000+ (right).

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Why is Capillary IC beneficial?

Operating Time

The benefits of capillary IC are both unique and multifaceted. In Capillary IC only 15 mL of water a day is consumed, translating into 5.2 L a year due to the low flow rates of 10 µL/min. As a result, the system can operate with continuous eluent flow, eliminating the need to wait for equilibration and allowing samples to be run at a moments notice.

Costs of Ownership

The waste produced is dramatically minimized which in turn reduces disposal costs. When operated as a Reagent-free Ion Chromatography™ (RFIC™) system, the Eluent Generation Cartridge lasts for 18 months under continuous operate mode. This allows maintenance costs to be nominal as the Eluent Generation Cartridge uses water as an eluent, and results in less frequent replacement of pump seals. On a unrelated but important side note, the ability to electrolytically generate the eluent results in accurate and precise eluent delivery, preventing variations typically found in manual eluent preparation.

Faster Time to Results

Capillary IC allows for lower flow rates by optimizing column dimensions (i.d. 0.4 mm). The typical flow rate is only 1/100th the eluent flow rate of standard bore format. Standard bore column formats typically run at flow rates of 1 mL/min. Due to the smaller cross-sectional area, the flow rate on a capillary format can be scaled down to 10 µL/min. In capillary IC, the flow rates can be increased up to 3 times, or 30 µL/min.

Improved Sensitivity

The combination of a first-dimension standard bore column (i.d. 4 mm) with a second-dimension capillary column (i.d. 0.4 mm) permits lower detection limits in the low ng/L range.

What solutions exist on the market?

The Thermo Scientific™ Dionex™ ICS-5000⁺ and ICS-4000 HPIC™ Systems are the world's first capillary ion chromatography (IC) systems on the market. The Dionex ICS-5000⁺ operates at standard bore, microbore and capillary flow rates at pressures up to 5000 psi enabling it to also perform high-resolution and fast IC analysis with the latest 4 µm particle-size columns. On the other hand, the Dionex ICS-4000 capillary HPIC system is solely dedicated to Capillary IC. This system boasts all of the benefits of Capillary IC discussed, including high-pressure capabilities for high chromatographic resolution. Furthermore, all the Dionex ICS-5000⁺ and ICS-4000 systems are designed to be compatible with small particle IC columns. These columns aid in facilitating separations up to 4 times faster than conventional columns.

References

Dionex Homepage (http://www.dionex.com/en-us/products/ion-chromatography/ic-rfic-systems/ics-5000/lp-72594.html)

Dionex Homepage (http://www.dionex.com/en-us/products/ion-chromatography/ic-rfic-solutions/capillary-ic/always-on-ready/lp-88647.html)

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