What is Eluent Generation?

Monika Verma, Thermo Fisher Scientific, Sunnyvale, CA, USA

Eluent generation is an electrolytic process that allows the production of high purity eluents for ion chromatography, and is a part of Reagent-Free Ion Chromatography™ (RFIC™). The entire process only requires deionised water, eliminating the need to handle any acids or bases.

What exactly does eluent generation mean?

Eluent generation allows the automatic production of high purity ion chromatography (IC) eluents. This is made possible through precise control of the electric current applied to the electrolysis of water to generate hydroxide and hydronium ions. Eluent generation eliminates the need to manually prepare eluents from concentrated acids and bases. The only routine reagent needed is deionised water. Furthermore, since the instrument pump seals and pistons only come in contact with deionised water instead of acids and bases which can precipitate, overall pump maintenance is significantly reduced.

How does the process of eluent generation work?

Figure 1 illustrates how eluent generation is an electrolytic process by which eluent is generated. A pair of electrodes is positioned with an ion exchange membrane separating them; when a current is applied to the electrodes, electrolysis of water generates hydroxide at the cathode and hydronium at the anode. The ion exchange membrane prevents the species from recombining into water, and allows a counter-ion from the Eluent Generation Cartridge to migrate across the membrane to form the eluent. The eluent concentration is varied by changing the applied current to the electrodes; thus the eluent concentration is infinitely variable throughout a single run. This entire process can be done without the use of extra pumps, fittings, valves or any moving parts.

It is important to understand that eluent generation is not the dilution of an eluent concentrate with water by the use of a burette type device. A dilution procedure does not allow the ability to change concentration throughout a run without the use of additional mechanical devices such as valves nor can it further purify the eluent. In addition, dilution is not as accurate and reproducible as Eluent Generation.

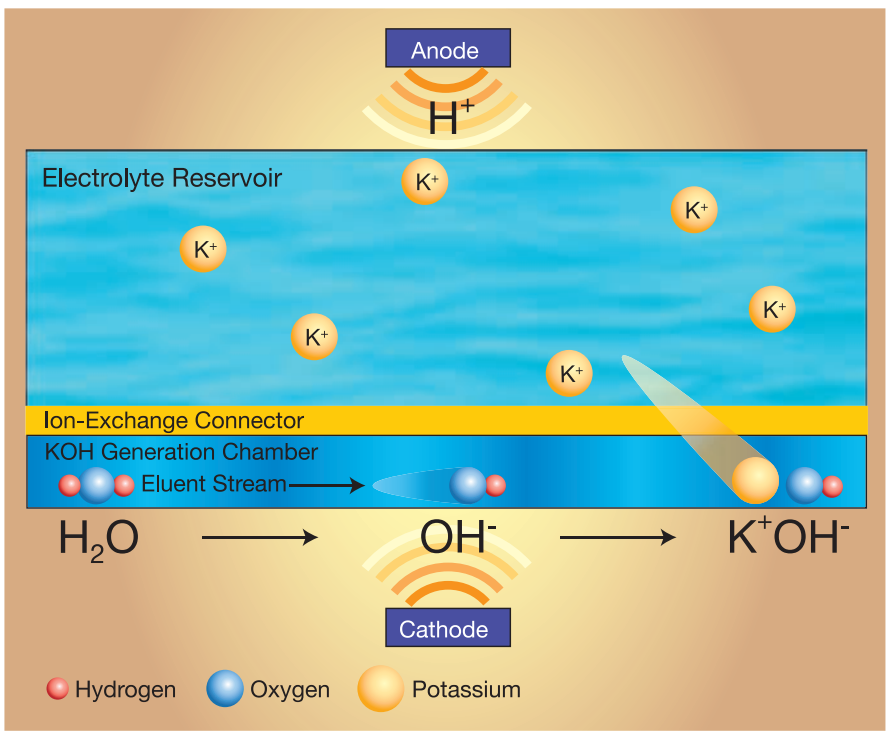

Figure 1. The Thermo Scientific™ Dionex™ EluGen™ EGC III KOH eluent generator cartridge consists of a KOH generation chamber and a K+ electrolyte reservoir, connected by a cation exchange connector. A high pressure connector permits the passage of K+ ions from the K+ electrolyte reservoir into the electroytic chamber.

What applicable solutions exist on the market?

The Dionex Eluent Generator Cartridge (EGC), shown in *Figure 2*, is at the core of the patented eluent generation technology used in RFIC-EG systems. The EGC KOH, NaOH, or LiOH cartridges produce potassium, sodium, or lithium hydroxide eluents respectively for anion exchange applications. With hydroxide-selective columns, such as the Thermo Scientific™ Dionex™ IonPac™ AS18, common anions can be rapidly separated using the simplicity of an RFIC-EG system. The EGC MSA cartridge produces methanesulfonic acid eluent for cation-exchange chromatography applications. When the MSA eluent is used with the Dionex IonPac CS12A and CS16 columns, it allows for isocratic or gradient separation of Group I and Group II cations and ammonium. The EGC K2CO3 cartridge produces carbonate-only eluent. An Electrolytic pH Modifier (EPM) can be added for generating these carbonate/bicarbonate eluents. It is also important to note that these systems eliminate variability and errors associated with manual eluent preparation which directly improves method reproducibility.

Which laboratories will benefit from these solutions?

RFIC-EG systems facilitate drinking, waste, and groundwater analyses for regulatory compliance. Furthermore, they provide the accuracy and reproducibility needed for the analysis of high-purity water in multiple industries.

For example, the EPA's Statistics and Analytical Support Branch and the Office of Ground Water and Drinking Water's Technical Support Center have concluded that the use of hydroxide eluents falls within the method flexibility allowed in EPA Methods 300.0 Part A and 300.1 Part A for determining inorganic anions. These methods are critical for compliance monitoring under the Clean Water Act and Safe Drinking Water Act.

RFIC-EG systems have redefined ion chromatography by making it possible to just add water to completely operate an IC. This system allows for a simpler and more reliable way to help deliver superior results while simultaneously saving time and labour.

Figure 2. Thermo Sceintific Dionex EGC-500 cartridge.

Celebrating 45 years of ion chromatography

For ion analysis, nothing compares to a Thermo Scientific™ Dionex™ ion chromatography (IC) system. Thermo Fisher Scientific has been empowering scientists with innovative Ion Chromatography technology for 45 years across the environmental, industrial, pharmaceutical and food and beverage markets. We are committed to ensuring our IC systems continue to be future-ready, helping laboratory professionals be more productive, be safer with less chemical handling and maximize their resources.

As part of our celebration, we will be launching a new ebook on Ion Chromatography authored by Joachim Weiss, PhD, International Technical Director for Dionex Products at Thermo Fisher Scientific. Dr Weiss is recognised as an international expert in analytical chemistry, and the 4th edition of his Handbook of Ion Chromatography was published in 2016.

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