

# SIMULTANEOUS DETERMINATION OF ANION AND CATION CONTENT IN WATER SAMPLES THROUGH ICP-AES

**P** PATENTED TECHNOLOGY

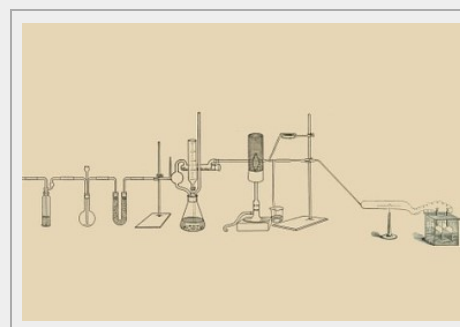
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## ABSTRACT

A single system able to simultaneously provide information on the of anion and cation contents in water samples through ICP-AES has been developed in the polymers and nanomaterials research group of the University of Alicante.

Companies interested in the commercial and technical development of the system are sought.



## TECHNICAL DESCRIPTION

The determination of the content of anions and cations to obtain the ionic balance in water samples is currently requiring the use of several, time consuming and sometimes expensive techniques. The polymers and nanomaterials research group of the University of Alicante has developed a single and unique system providing simultaneously this kind of information.

The system has three vessels containing a first one for the sample (1, Figure 1), a second one for a silver nitrate solution (2, Figure 1) and a third one with a nitric acid diluted solution (3, Figure 1). Three PTFE capillaries (4-6, Figure 1) and two 't-unions' (8-9, Figure 1) are also employed. The setup also has a peristaltic pump (7, Figure 1), a capillary reactor (10, Figure 1), a filter (12, Figure 1), a valve (11, Figure 1) and a liquid – gas phase separation system (13, Figure 1) that is only employed to carry out the analysis of samples with a high content of organic matter.

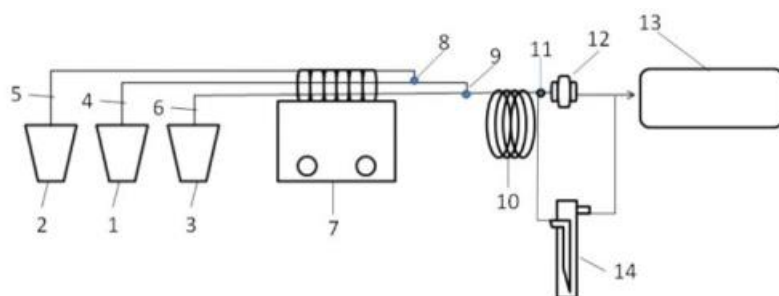


Figure 1

The analysis procedure is carried out in the following steps:

- Mixing: The peristaltic pump aspirates both sample and silver nitrate at a constant flow rate. Both streams mix together by means of a tee shaped unión. Then, the resulting mixture combined with the nitric acid solution by using a second tee union.

b) Reaction: The final solution goes through a capillary reactor where chemical reactions take place.

c) Separation: A filter and/or a gas – phase separator was employed depending on the sample organic matter content. The mixture is forced to pass through a filter. For those samples having high dissolved organic compounds the gas – liquid phase separation system is employed.

d) Measurement: The mixture reaches the ICP-AES spectrometer where the emission intensity of each of the elements of interest is taken at characteristic wavelengths.

The present system is easy-to-automatize through the use of a robotized arm and a carrousel containing the samples. To achieve this an autosampler commonly employed to carry out ICP-AES routine analysis can be used.

The following table shows a comparison between the developed system and the conventional method:

	NEW SYSTEM	CONVENTIONAL METHOD
Sample preparation	None	Filtering (1 min)
Calibration	Simultaneous (3 min per standard, 5 standards)	Metals (2 min per standard, 5 standards)
		Anions (t <sub>r</sub> Sulfate: 11 min per standard, 5 standards)
		Bicarbonate (HCl standardization, 30 min)
Sample analysis	Simultaneous (3 min)	Metals (2 min)
		Anions (t <sub>r</sub> Sulfate: 11 min)
		Bicarbonate (20 min)
Total calibration time	15 min	95 min
Time for sample analysis	3 min	34 min
Sample throughput	155 samples day <sup>-1</sup>	11 samples day <sup>-1</sup>

## ADVANTAGES AND INNOVATIVE ASPECTS

### ADVANTAGES

- Easy-to-atomate system.
- Only an instrument (ICP-AES) instead of three different methods (ICP-AES, acid-base titration and ion chromatography) is required to determine anions and cations.
- Analysis time is drastically shortened thus leading to an increase in the sample throughput.
- Not only water samples but also soils and blood samples, among others, can be analyzed.

### INNOVATIVE ASPECTS

The main innovation of the present system is the development of a single method allowing the sequential preparation and automatic quantification of ionic species in water samples employing a commercially available ICP-AES.

## CURRENT STATE OF DEVELOPMENT

The system has been developed at the laboratory scale and it has been tested with conventional ICP-AES.

## MARKET APPLICATIONS

- Analysis, management and water and waste treatment
- Chemical analysis
- Chemical industry

## COLLABORATION SOUGHT

- Patent licensing for use, manufacturing and/or commercialisation.

- R&D Contract agreements (technical cooperation in order to adapt the developed technology to market needs or to other sectors).
- Commercial agreements.
- Subcontracting agreements
- Joint ventures / Spin Off possibilities.

#### INTELLECTUAL PROPERTY RIGHTS

The present system is patent protected

- Patent No: P201300170
- Date: 18/02/2013

#### RESEARCH GROUP PROFILE

The analysis of polymers and nanomaterials research group is composed by 22 members and has the following research competencies:

- Sample preparation.
- Liquid sample introduction systems for ICP-AES e ICP-MS.
- HPLC-ICP/AES coupling.
- High Temperature Liquid Chromatography (HTLC).
- Fossil fuel and biofuel analysis.
- Food analysis.
- Water analysis.
- Speciation of organometallic compounds
- Foods disinfection

#### MARKET APPLICATION (3)

Pollution and Environmental Impact  
Water Resources  
Chemical Technology