

# LAB-ON-VALVE SYSTEM FOR $^{99}\text{Tc}$ EXTRACTION AND PRE-CONCENTRATION APPLIED TO ENVIRONMENTAL SAMPLES EXPLOITING ICP-MS



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$^{99}\text{Tc}$  isotope is a beta emitter of great concern because of its long half-life ( $2.1 \times 10^5$  y). It is considered one of the most mobile radionuclides in nature easily incorporated into the trophic chain, exposing humans to its beta radiation and its increasing abundance. During the last decades large amounts of this radionuclide have been released into the environment from anthropogenic sources such as nuclear industry and medical applications. Thus,  $^{99}\text{Tc}$  determination is needed in order to establish an environmental control. Therefore, we have developed a novel and miniaturized LOV system, allowing  $^{99}\text{Tc}$  determination in environmental samples (see figure). We propose a fast method that uses TEVA resin and ICP-MS. The developed system allows reduction of reagents volume (e.g. 6 mL  $\text{HNO}_3$  6.5 mol  $\text{L}^{-1}$  as eluent), the minimization of sample handling, improving the reproducibility and the sample throughput and attaining a significant decrease of both time and cost per analysis.

## MANIFOLD AND SOFTWARE

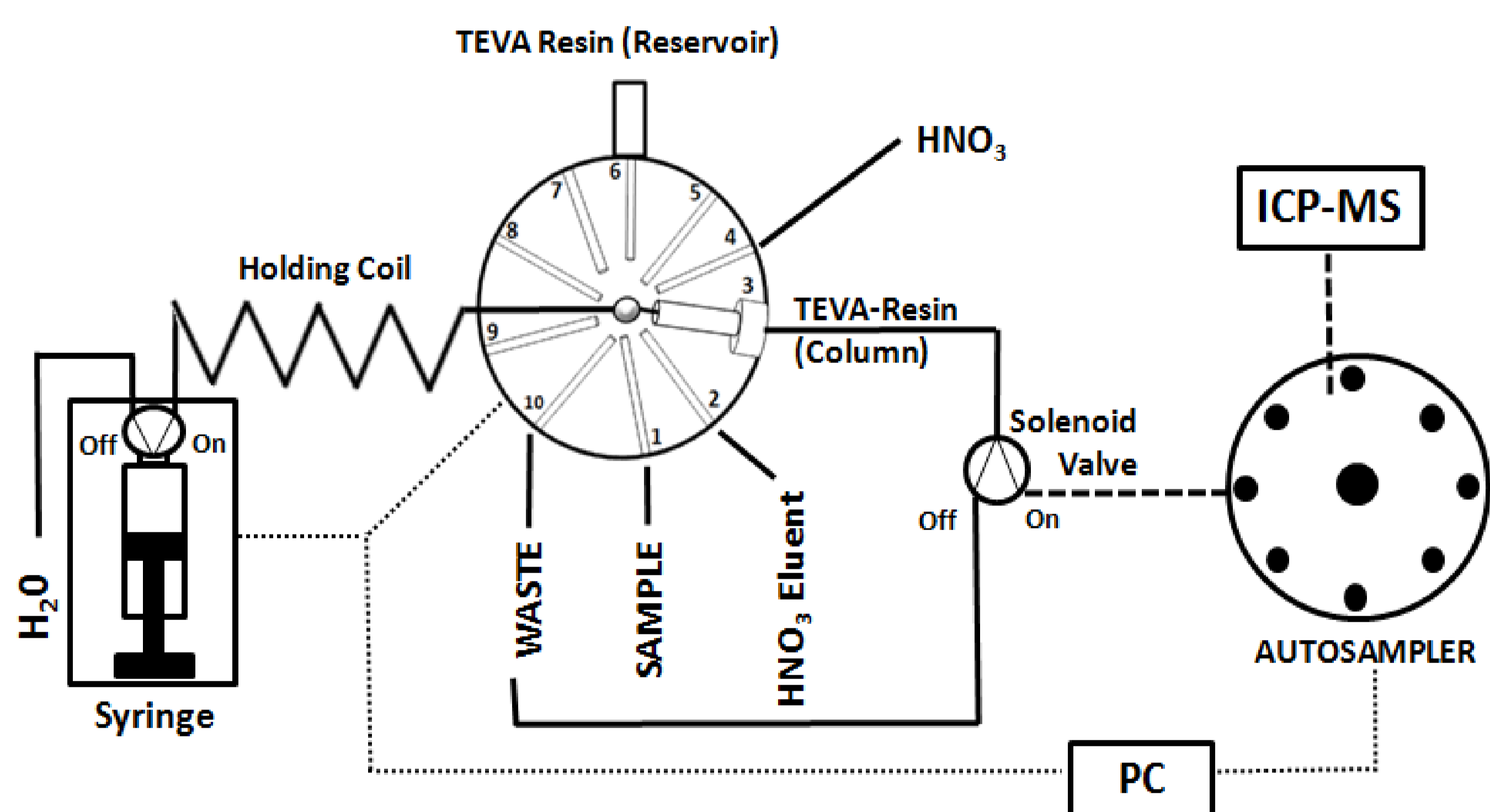


Figure 1. LOV system for miniaturized  $^{99}\text{Tc}$  isolation and pre-concentration prior to ICP-MS detection.

Instrumental control was performed using the software package AutoAnalysis 5.0\* (Sciware Systems, Palma de Mallorca, Spain). The distinguished feature of the developed software based on dynamic link libraries (DLLs) at 32 bits is the viability to use a single and versatile application without further modification for whatever instrumentation and detection system needed. It involves a basic protocol, which allows the implementation of specific and individual DLLs attending the configuration of the assembled flow analyzer.

\*May be requested at: [www.sciware-sl.com](http://www.sciware-sl.com)

E-mail: [info@sciware-sl.com](mailto:info@sciware-sl.com)

## ANALYTICAL FEATURES

Detection limit (ng)	2.05
Repeatability (%) (n=10)	2
Reproducibility (%) (n=5)	3.8
Resin durability (injections)	> 100
Pre-concentration volume (mL)	> 100
Sensitivity (IU $\text{ng}^{-1}$ )	1372.8
Linear working range (ng)	0.17 - 30
Regression coefficient	0.9992
Injection throughput ( $\text{h}^{-1}$ )	5-0.3*

\* Depending on pre-concentrated volume

## Environmental samples

Samples	$^{99}\text{Tc}$ added (ng $\text{L}^{-1}$ )	$^{99}\text{Tc}$ found (ng $\text{L}^{-1}$ )	Recovery (%)
*Dam water	0 3.42	<LD $3.26 \pm 0.05$	95
*Mineral water	0 3.42	<LD $3.19 \pm 0.04$	94
*Tap water	0 3.42	<LD $3.21 \pm 0.02$	94
*Well water	0 3.42	<LD $3.21 \pm 0.10$	94
Soil	0 3.60	<LD $3.44 \pm 0.16$	96

\* Sample volume of 50 mL

## Working conditions

$\text{HNO}_3$ (eluent) concentration (mol $\text{L}^{-1}$ )	6.5
$\text{HNO}_3$ (eluent) volume (mL)	6
Sample loading flow rate (mL $\text{min}^{-1}$ )	0.6

Working conditions were optimized by experimental design using the software STATISTICA 7.0