

A miniaturized chip in a multi-syringe flow system for spectrofluorimetric determination of iodide in urine samples

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Iodine is essential for human growth and development, being a nutrient and a component of the thyroid hormones [1]. The determination of iodine status is based on the concentration of iodine excreted in urine [2]. Most of the methods used for urinary iodine concentration measurement are based on the Sandell-Kolthoff reaction [3]. In this study, a fluorometric detection approach of the Sandell-Kolthoff reaction is proposed. The catalytic effect of the redox reaction between Ce(IV) and As(III), with indirect determination of iodide, is miniaturized in a chip-based flow manifold. The idea was based on a previous work using an advanced three-dimensional (3D) printing features as a chip for the reaction [4]. The urine samples can be analysed in the developed system without any pre-treatment (ex. digestion). This advantage, combined with the fluorometric reaction, makes this method simpler, faster and more sensitive than the classic approach of the Sandell-Kolthoff reaction method. The manifold implemented, allowed to determine iodide within a range of 25 - 100 µg/L in urine. If an in-line dilution process is implemented, a 100-500 µg/L range can be potentially attained. The method was validated with international interlaboratory validation study samples, provided by the Center for Disease Control, USA.

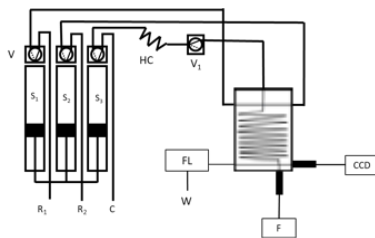


Fig.1. Flow diagram of the chip multi-syringe flow injection analysis for iodide determination in urine. S1–S3: syringe pumps; Vi: three-way solenoid valves; R1: Ce(IV) solution and R2: As(III) solution both in H₂SO₄; C: carrier (water); HC: 300 cm holding coil; F: irradiation from a D2 light source; CCD: optical fiber connected to the multi-channel spectrometer for fluorescence measurement; FL: Fluorimeter; W: waste.

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