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DESIGN OF A NEW MICROFLUIDIC CHIP FOR THE DETERMINATION OF SELENIUM (IV) USING DITHIAZONE AS REAGENT AS A MODEL OF BIOCHEMICAL APPLICATION

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ABSTRACT: The research involves designing a microfluidic chip with two symmetrical, two-dimensional, micro-channels to be used for determination using a micro flow injection system. It is a simple, new, sensitive, fast and low-cost method. The process is based on the reaction of Se (IV) with Dithizone, observed spectrophotometrically at 410 nm using anew chip. The calibration curve was prepared, repeatability, the dispersion coefficient, interferences and application were studied. The linearity range was 0.01-10 µg mL^{-1} at sampling rate of 120 samples per hour, correlation coefficient, Dispersion coefficient, the limit of detection (LOD), the limit of quantitation (LOQ) were also calculated. Recovery average was 95.990 - 102.990%.

Key words : Selenium, determination, microfluidic chip, dithiazone.

INTRODUCTION

Selenium was detected as an element by the Swedish chemist in 1817 (Rosenfeld *et al*, 1964). Selenium (Se) plays as an essential element in the human body because of its unique biological functions, especially in the oxidation reduction system (Hatfield *et al*, 2011). The primary role of Se is due to its presence in the active site of some enzymes (glutathione peroxidase and iodotironine-5-deiodinase) and the catalytic effect of selenium compounds on the intermediate metabolic reaction and inhibition of the toxic effect of heavy metals (Marlene *et al*, 1984). It is an essential trace element that is jointly integrated into the polypeptide chain as part of the amino acid selenocysteine (Sec). Proteins that include Sec in the polypeptide chain are defined as selenic proteins and are found in all strains of life (bacteria, eukarya) (Mariotti *et al*, 2016). Selenine proteins have central to ideal human and animal health mainly due to their antioxidant activity (Zoidis *et al*, 2018). The health-connected properties of Selenoproteins include, amongst others, protection against cancer (Tan *et al*, 2019), proper thyroid function (Chomburg, 2012)and protection from cardiovascular disease (Handy *et al*, 2016) and muscle disorders; however, the role of selenium supplements in diseases of thyroid gland.

Selenium (IV) is the essential micronutrient to biological systems. It is beneficial or fundamental in amounts from trace to part-per-billion concentrations for human body and some animalsand plants, but toxic at high concentrations present in the environment (Busheina *et al*, 2016). This element may affect survival and growth of plants, birds, fish and mammals (including humans) (Gallignani *et al*, 2016). This element is playing an important role in old people as well as in the barring of many diseases that age-associated and in keeping of normal immune function.The wanted daily amount of Se is (20) mcg day^{-1} and (40–70) mcg day^{-1} for (4–6) years old and adult males, respectively (Soruraddin *et al*, 2011).

Different analytical methods have been notified for the determination of Selenium; such as Liquid-liquid Extraction (Swapnil *et al*, 2013), atomic absorption spectroscopy (AAS) (Samlafo *et al*, 2011), High Performance Liquid Chromatography-Inductively Coupled Plasma-Mass Spectrometry (Bakirdere *et al*, 2015), spectrofluorometry following cloud point extraction (Güler *et al*, 2011), Voltammetric determination (Shahbazi *et al*, 2016), liquid chromatography coupled to hydride generation atomic fluorescence spectrometry (Grijalba *et al*, 2017).

The aim of this study was to find a new, sensitive, simple and selective method for determining selenium (IV) using a µFIA.