



# Determination of cadmium in water and environmental samples by inductively coupled plasma atomic emission spectrometry after solid phase extraction using thiosemicarbazide derivative on alumina

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## KEYWORDS

Alumina; 1-((5-nitrofur-2-yl)methylene)thiosemicarbazide; Cadmium; ICP-AES; Environmental sample.

**Abstract.** A simple and selective method for the determination of cadmium ions in environmental samples by ICP-AES after solid-phase extraction was developed. The method is based on the sorption of  $\text{Cd}^{2+}$  ions on alumina modified by 1-((5-nitrofur-2-yl)) thiosemicarbazide (NFMTTC) at pH of 6. The metal ion retained on solid phase by complexation with ligand was then eluted with 5.0 mL of 1 mol  $\text{L}^{-1}$  nitric acid. A preconcentration factor of 120 was achieved by passing 600 mL of sample through the solid phase, while the Limit Of Detection (LOD) was found to be 0.025 ng  $\text{mL}^{-1}$  and relative standard deviation of  $\pm 2.2\%$  (for 1.0  $\mu\text{g mL}^{-1}$ ), under optimum conditions. The proposed method was successfully applied to the determination of cadmium in water, soil, some food samples, and environmental samples including black tea, rice, wheat, carrot, pistachio and tobacco.

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## 1. Introduction

The presence of heavy metals in the environment is major concern because of their toxicity and threat to human life and environment [1-8]. The accurate and precise determination of heavy metals in the food samples is important to obtain accurate results of them [9-14]. High levels of matrix components are influential in the determination of heavy metal ions. In order to remove matrix components from the traces heavy metals, separation methods like solid phase extraction, cloud point extraction, solvent extraction, etc. have been widely used [15-23]. Another important

advantage of usage of separation methods is improvement in the limit of detection of the analytes, due to lower final volumes [24-31].

Solid-Phase Extraction (SPE) is a universal technique in this respect compared to the conventional liquid-liquid extraction [32-34]. Solid-phase extraction is based on the utilization of a major constituent as bonded stationary phase immobilized with different ligand or functional group [35-39]. Some advantages of SPE are higher enrichment factors, absence of emulsion, and safety with respect to hazardous samples, minimal costs due to low consumption of reagents, and flexibility and easier incorporation into automated analytical techniques [40,41]. Various solid phase extraction materials include microcrystalline naphthalene [42,43], Chelest Fiber [44], activated carbon [45], SDS coated alumina [46], polyurethane foam [47],

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