



The measurement of Ni, Cr, Cd, Pb in medicinal plants by PERSEE AAS-Flame method

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Application Note

Metal elements in medicinal plants

Introduction

This method covers the determination of four trace metal elements (Cd, Cr, Ni, Pb) in medicinal plants. Microwave digestion is used for atomization, followed by atomic absorption spectrophotometry-flame methods.

Range of usage

This test method covers the determination of the elemental concentration of Cadmium, Chromium, Nickel, Lead in fresh medicinal plants (such as peppermint leaves, chamomile blossom, etc.) and their infusions.

Introduction

Traditional medicine is an important and often underestimated part of health services. The most common heavy metal pollution listed by the Environment Protect Agency (EPA) are arsenic, cadmium, copper, mercury, nickel, lead and zinc. Chromium, cadmium, lead and nickel in excessive amount are carcinogenic, mutagenic and are harmful to various organs. Therefore, we list this method here as a reference for chemists to test those elements in medicinal plants using PERSEE atomic absorption spectrophotometers. We also have IQ/OQ/PQ procedures for PERSEE AAS. Contact us via the email address at the bottom of this document.

Generally, 0.3 g of each plant sample is taken to microwave digestion using nitric acid and set cool to room temperature. Then, the digested solutions are subject to dilution and they are injected into the atomic absorption spectrophotometer-flame atomizer to get the results.

Equipment and Reagent

Equipment and apparatus:

1. PERSEE A3F/AFG atomic absorption spectrophotometer, with flame atomization method burner head
2. Acetylene-air gas supply
3. TOPEX+ microwave digestion
4. Hotplate
5. Analytical balance

Reagents (spectroscopic grade):

1. concentrated (65%) spectrally pure nitric acid
2. Pure water
3. Cd, Cr, Ni, Pb standard solutions of mass concentration of 1 mg/mL (1000 ug/mL)

Testing Procedures:

1. Take samples of herbs in amount of 0.3 g into the digestion vessel (clean the digestion vessels by putting them in boiling 5% nitrous acid for 30 min)
2. Add 2-5 mL nitrous acid
3. Do the microwave digestion as in the procedure below (or other procedures that would perform complete digestion):

Step	Time (min)	Temperature (°C)		Pressure (bar)	
		Min.	Max.	Min.	Max.
1	2.30	280	285	17	20
2	6.30	285	290	42	45

4. Received digest solutions are to be transferred quantitatively to volumetric flasks
5. Dilute volume to 25 mL to get testing solution
6. Set instrumental parameters as in the figure below
7. Prepare a series of standard solutions for the elements that to be tested and inject them. Then, automatically generate a calibration curve using AAWIN software

One example of a series of concentrations of the standards in each element:

- a. Cadmium standards: 0.0, 0.10, 0.30, 0.50, 0.70, 1.0 ug/mL
 - b. Chromium standards: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0 ug/mL
 - c. Lead standards: 0.0, 1.0, 5.0, 10, 15 ug/mL
 - d. Nickel standards: 0.0, 0.5, 1.0, 2.0, 3.0 ug/mL
8. Inject the testing solutions into the spectrometer and calculate the results

Instrumental Parameters

Recommended parameters for Cadmium

Elements	Cadmium
Wavelength (nm)	228.8
Bandwidth (nm)	0.4
Lamp Current (mA)	2.0
Filter efficient	0.3
Integrating time (s)	3
Height of burning head (mm)	5

Flame type	Air-acetylene (fuel-lean flame)
Pressure of acetylene (MPa)	0.05
Flow rate of acetylene (ml/min)	1300
Pressure of air (MPa)	0.22
Reading Method	Peak Area
Measurement Method	Std. curve

Recommended parameters for Chromium

Elements	Chromium
Wavelength (nm)	357.9
Bandwidth (nm)	0.4
Lamp Current (mA)	4.0
Filter efficient	0.3
Integrating time (s)	3
Height of burning head (mm)	5
Flame type	Air-acetylene (fuel-rich flame)
Pressure of acetylene (MPa)	0.05
Flow rate of acetylene (ml/min)	3000
Pressure of air (MPa)	0.22
Reading Method	Peak Area
Measurement Method	Std. curve

Recommended parameters for Lead

Elements	Lead
Wavelength (nm)	283.3
Bandwidth (nm)	0.4
Lamp Current (mA)	2.0
Filter efficient	0.1
Integrating time (s)	3
Height of burning head (mm)	6
Flame type	Air-acetylene (fuel-lean flame)
Pressure of acetylene (MPa)	0.05
Flow rate of acetylene (ml/min)	1500
Pressure of air (MPa)	0.24
Reading Method	Peak Area
Measurement Method	Std. curve

Recommended parameters for Nickel

Elements	Nickel
Wavelength (nm)	232.0
Bandwidth (nm)	0.2
Lamp Current (mA)	4.0
Filter efficient	0.1
Integrating time (s)	3
Height of burning head (mm)	6
Flame type	Air-acetylene (fuel-lean flame)
Pressure of acetylene (MPa)	0.05
Flow rate of acetylene (ml/min)	1300
Pressure of air (MPa)	0.24
Reading Method	Peak Area
Measurement Method	Std. curve



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