

# The use of MP-AES for the analysis of major and micronutrients in soil

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## Introduction

Quantitative analytical techniques for the determination of plant available macro- and microelements in soil:

- Vis spectrometry
- AAS
- ICP-OES & ICP-MS
- MP-AES



## Methods

Plant available macro and microelements were extracted from soil using Mehlich 3 (M3) extraction method

MP AES Agilent 4200 was used for the analysis





## Methods

### Elements determined by M3 extraction method were:

- K, Ca, Mg
- Fe, Mn, Zn, Cu, B
- Al



K by Mehlich 3 method

### CALIBRATION GRAPH IN RANGE 1 – 20 ppm AT WAVELENGTH $\lambda$ =769.897 nm

#### PEAK OF K at $\lambda$ =769.897 nm FROM M3 SOIL EXTRACT



Correlation coefficient: 0.99973



Ca by Mehlich 3 method

#### CALIBRATION GRAPH IN RANGE 40 – 200 ppm AT WAVELENGTH λ=430.253 nm

### PEAK OF Ca at $\lambda$ =430.253 nm FROM M3 SOIL EXTRACT



Correlation coefficient: 0.99740



Mg by Mehlich 3 method

#### CALIBRATION GRAPH IN RANGE 2 – 25 ppm AT WAVELENGTH λ=518.360 nm

### PEAK OF Mg at $\lambda$ =518.360 FROM M3 SOIL EXTRACT





## Peak of Al at $\lambda$ =396,152 nm

#### PEAK OF AI 100 ppm IN M3 EXTRACTING SOLUTION

#### PEAK OF AI FROM OF SOIL EXTRACT PREPARED BY M3 METHOD





# Calibration graph of Al by M3 method in range 5 – 100 ppm at $\lambda$ =396.152 nm



Intensity = (23348.51 \* Concentration + 21527.52) / (1 + 0.00 \* Concentration) Correlation coefficient: 0.99978



## Peaks of Fe from M3 extracts, $\lambda$ =373.486 nm

#### PEAK OF Fe 10 ppm IN EXTRACTION SOLUTION



#### PEAK OF Fe OF M3 SOIL SAMPLE EXRACT





# Calibration graph of Fe by M3 method in range 0.5 – 10.0 ppm at $\lambda$ =373.486 nm



Correlation coefficient: 0.99974



## Peaks of Mn from M3 extracts, $\lambda$ =403.076 nm

#### PEAK OF Mn 5 ppm IN M3 EXTRACTION SOLUTION

#### Mn IN M3 SOIL SAMPLE EXTRACT





# Calibration graph of Mn by M3 method in range 0.1 – 5.0 ppm at $\lambda$ =403.076 nm



Intensity = 93850.03 \* Concentration + 1.36 Correlation coefficient: 0.99999



## Peaks of Zn from M3 extracts, $\lambda$ =213.857nm

#### PEAK OF Zn 2 ppm IN M3 EXTRACTION SOLUTION

#### PEAK OF Zn FROM M3 SOIL SAMPLE EXRACT





# Calibration graph of Zn by M3 method in range 0.1 - 2.0 ppm at $\lambda = 213.857$ nm



Intensity = (42109.45 \* Concentration + 73.56) / (1 + 0.14 \* Concentration) Correlation coefficient: 0.99999



## Peaks of Cu from M3 extracts, $\lambda$ =324.754 nm

#### PEAK OF Cu 2 ppm IN M3 EXTRACTION SOLUTION

#### PEAK OF Cu FROM M3 SOIL SAMPLE EXRACT





# Calibration graph of Cu by M3 method in range 0.1 - 2.0 ppm at $\lambda$ =324.754 nm



Correlation coefficient: 0.99987



## Instrumental settings

Element	Wavelength (nm)	Viewing position	Nebulizer pressure (kPa)	<b>Read time</b> (s)	Maximum concentration (ppm)
К	769.897	0	240	3	20
Са	430.253	10	240	3	200
Mg	383.829	10	140	3	30
Mg	518.360	0	180	3	30
Fe	373.486	0	120	3	10
Mn	403.076	0	240	3	5
Zn	213.857	0	140	3	2
Cu	324.754	0	240	3	2
Al	396.152			3	100
В	249.772			3	1

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## Range of elements in analyzed soils

Element	Wavelength of determinationl (nm)	Minimum content in soil (ppm)	Maximum content in soil (ppm)
К	769.897	88	779
Са	430.253	579	15055
Mg	518.360	79	869
Fe	373.486	128	675
Mn	403.076	30	320
Zn	213.857	0.3	14
Cu	324.754	0.2	26
AI	396.152	60	2070
В	249.772	0.3	1.3



## Conclusion

### MP AES Agilent 4200 is suitable device for determination plant available macro and microelements from soil by Mehlich 3 method



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## Thank you for your attention!

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