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Multi Tools for Elemental Analysis in Soil, Water, Plant and Fertilizer

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SOIL HEALTH PROGRAM

- **Soil Health Project**
  - Soil Fertility Program
  - Soil Composition : State to State
  - >200 Lac land holding

- **Soil Health Imbalance**
  - Intensive agriculture
  - Greater mining of soil nutrients (>10 mt/year)
  - Micronutrients Deficiency
  - Declining water table and Water Quality

NORMS

Water

Directive 91/271/ EEC [1]- Waste Water

Soil

Sewage Sludge Directive 86/278/EEC" [1],
Landfill Directive 1999/31/EC" [2],
Organic Farming Regulation (EEC) No. 2092/91
ISO 18227: Soil quality — Determination of elemental composition by X-ray fluorescence
EN 15309: Characterization of waste and soil - Determination of elemental composition by X-ray fluorescence
ASTM D6052: Preparation and elemental analysis of liquid hazardous waste by EDXRF

Fertilizer

EN 16317 Fertilizers and liming materials
EN 16319 Fertilizers and liming materials
ISO 17318 Fertilizers and soil conditioners
EN 15962 Fertilizers
EN 16963 Fertilizers

ELEMENTS IN FOCUS

- Micro Nutrient : Zn, Fe, Cu, **B***, Mo & Mn
- Macronutrient : Al, Na, S, **Ca*** & Mg
- Fertilizer : **N*+, P*** & K
- Toxic elements (As, Co, Ni, Se, Pb, Cd, Cr, etc.)-If required.

  - **Sample Treatment :** Acid Leaching

+ Limited or No possibility of analysis with Atomic Emission Spectrophotometer

*** By Kjeldhal Method**

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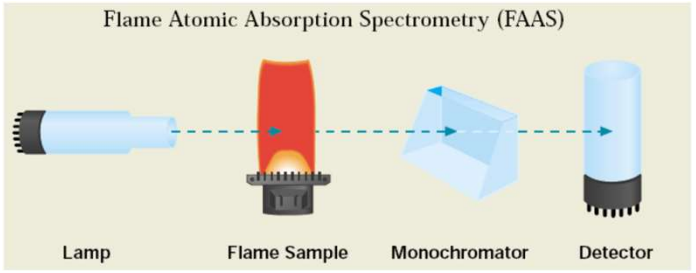
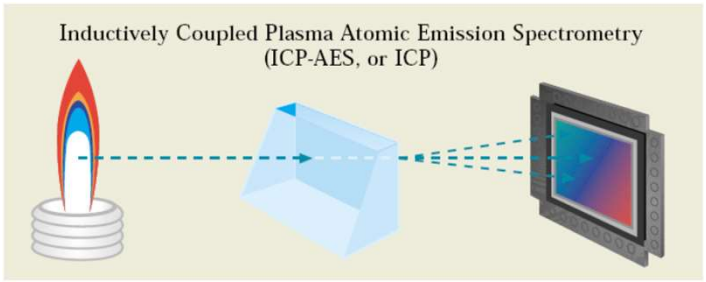
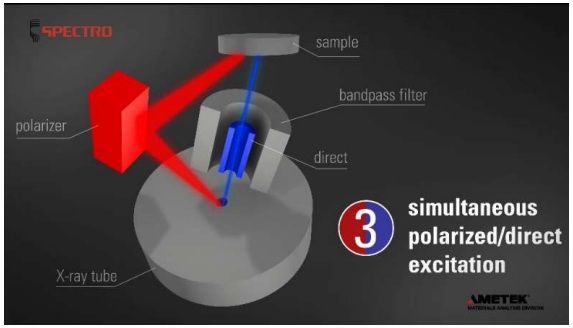
ANALYSIS OFFERINGS







X-Ray Fluorescence Spectrometer

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Challenge & Objective

Zn, Fe, Cu, Mg & Mn –**AAS with Air /Acetylene mode**

Zn, Fe, Cu, Mg, **Mo, Ca** & Mn -**AAS with Nitrox Flame mode**

Zn, Fe, Cu, **Mo, B** & Mn – **AAS with Graphite Mode**

Time consuming…..around 1 minute/element

OR

Simultaneous ICP OES Spectrometer

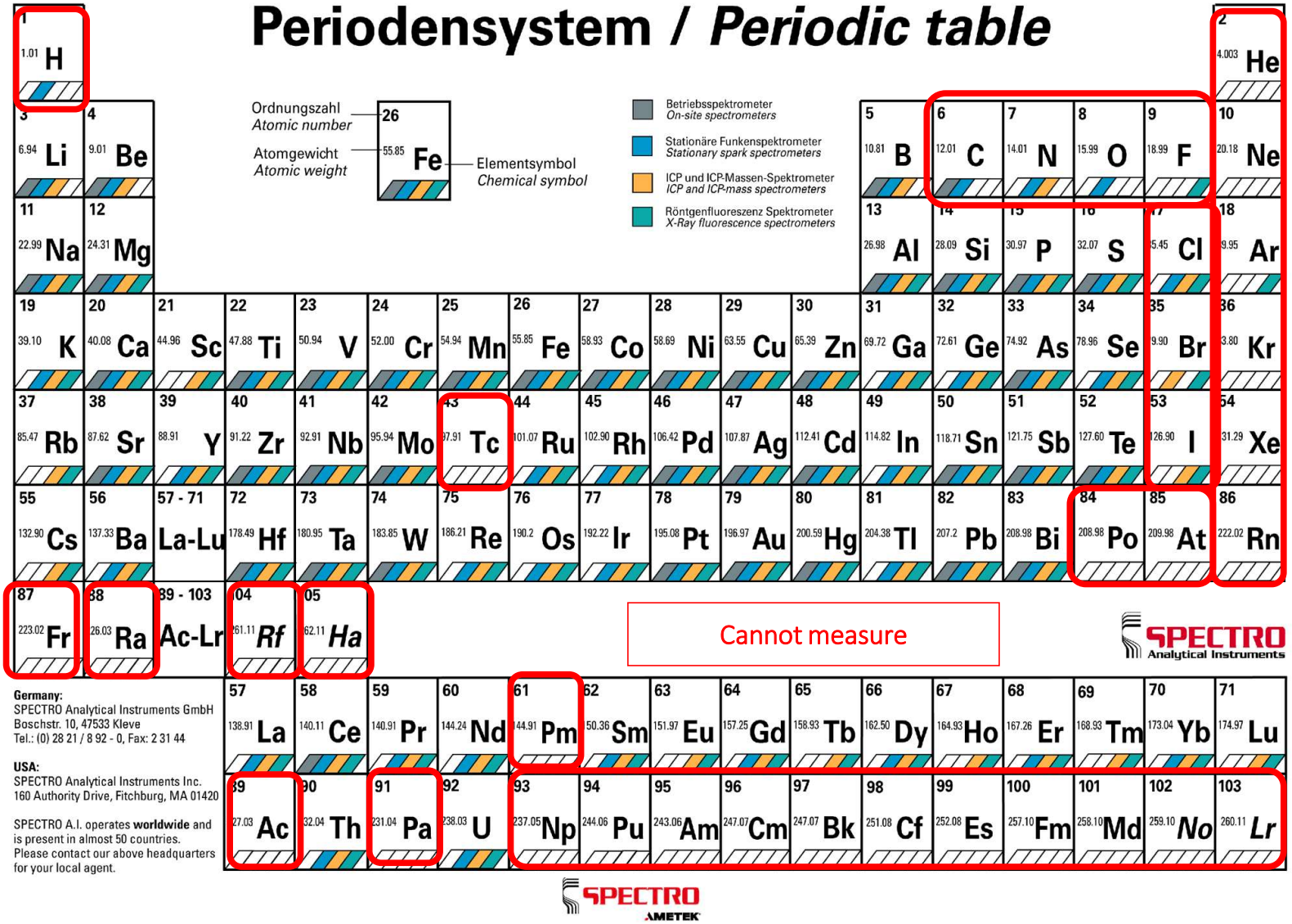
(+70 elements……..No loss of any elements

Soil :21 element in 40 seconds)

SELECTION CRITERIA-ICPOES/ICPAES SPECTROMETER

- True & Fully Simultaneous ICP-OES with **Polychromator Optics**
- High & Low Concn of all element in single sample in single run
- Analysis time of <2 min to save Argon gas consumption
- **Low gas purge @ 0.5 litre/min and not 7-8 litres/min**
- **Non Destructive Image** -NO LOSS OF ANY SAMPLE ANALYSIS DATA !!
- No Water chiller and Air compressor

Periodensystem / *Periodic table*



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SPECTRO A.I. operates **worldwide** and is present in almost 50 countries. Please contact our above headquarters for your local agent.

SPECTRO ICP-OES ,GENESIS DSOI

- Polychromator –Fully Simultaneous for complete wave
- Compact and space saving
  - Pure bench-top design without additional components hidden underneath the table
  - **No Water Chiller**
  - **No Air compressor**
  - **No Neon Light**
  - Size: 87.1 x 57.3 x 100 cm (34.3 x 22.6 x 39.4) (WxDxH
  - Smallest depth of any ICP-OES on the market

- Lightweight and corrosion resistant construction
  - Aluminum and Steel body
  - Weight: 115 kg (254 lb)
  - Epoxy resin-based coating

Application GENESIS DSOI – Unpolluted Waters – LODs Seaspray/Cyclonic

	λ [nm]	LOD 3σ Seaspray [µg/L]		λ [nm]	LOD 3σ Seaspray [µg/L]
Ag	328.068	1.0	Mn	257.611	0.1
Al	396.152	3.5	Mo	202.095	0.8
As	189.042	4.8	Na	589.592	4.0
Au	242.795	1.9	Ni	221.648	1.1
B	249.773	0.70	P	177.495	3.4
Ba	455.404	0.070	P	178.287	4.6
Be	313.042	0.040	Pb	220.353	6.5
Ca	393.366	0.1	Pd	324.27	6.6
Cd	226.502	0.4	Pr	417.939	3.7
Cd	228.802	0.5	Pt	177.708	5.3
Ce	418.66	4.0	Ru	240.272	3.2
Co	228.616	0.8	Sb	206.833	5.2
Cr	205.618	0.6	Se	196.09	6.7
Cu	324.754	0.7	Si	251.612	2.8
Fe	259.941	0.6	Sn	189.991	2.5
Ge	265.118	4.2	Sr	407.771	0.02
Hf	264.141	1.8	Ti	334.941	0.3
Hg	184.95	1.8	Tl	190.864	4.3
Hg	194.227	1.9	V	311.071	0.8
K	766.491	26	W	207.911	3.2
Li	670.78	1.0	Zn	213.856	0.4
Mg	279.553	0.04	Zr	339.198	0.6

Detection Power-Soil

Tab.3: Limits of detection (LOD) of the selected lines

Elem.	λ nm	LOD 3s [mg/kg]
Ag	328.068	0.13
As	189.641	1.8
B	208.959	0.5
Ba	455.404	0.02
Be	313.042	0.009
Cd	214.438	0.2
Cd	228.802	0.1
Co	228.616	0.2
Cr	267.716	0.3
Cu	327.396	0.3
Hg	184.950	0.6
Li	670.784	0.18
Mn	260.569	0.1
Mo	202.030	0.5
Ni	231.604	0.4
Pb	220.353	2.2
Sb	206.833	2.4
Se	196.090	2.9
Sn	189.991	1.1
Sr	421.552	0.06
Tl	190.864	2.8
V	292.464	0.3
Zn	213.856	0.12

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FERTILIZER

Table 5: Typical limits of detection (LOD) in phosphate rock

Element	λ [nm]	LOD 3σ [mg/kg]	Element	λ [nm]	LOD 3σ [mg/kg]	Element	λ [nm]	LOD 3σ [mg/kg]
Al	176.641	0.64	Ho	345.600	0.055	Si	251.612	1.5
As	189.042	0.2	K	766.491	3.1	Sm	428.079	1.7
Au	242.795	0.21	La	333.749	0.070	Sn	189.991	0.51
B	182.641	0.12	Li	670.780	0.12	Sr	407.771	0.70
Ba	455.404	0.024	Lu	261.542	0.025	Ta	268.517	1.7
Cd	226.502	0.13	Mg	202.647	0.92	Tb	350.920	0.37
Co	228.616	0.19	Mn	257.611	0.011	Th	401.913	1.3
Cr	284.325	0.23	Mo	202.095	0.12	Ti	334.941	0.020
Cu	219.226	0.38	Na	589.592	0.61	Tm	346.220	0.083
Dy	353.170	0.14	Nd	406.109	0.41	U	409.014	3.6
Er	326.478	0.56	Ni	231.604	0.077	V	311.071	0.23
Eu	420.505	0.25	Pb	220.353	0.73	W	207.911	0.3
Gd	335.862	0.16	Pr	417.939	1.8	Y	371.030	0.043
Hf	277.336	0.79	Sb	206.833	1.2	Yb	328.937	0.014
Hg	194.227	0.24	Se	196.090	0.85	Zn	213.856	0.029

Table 6: Typical limits of detection (LOD) in solid fertilizer

Element	λ [nm]	LOD 3σ [mg/kg]
B	249.677	0.048
Cd	228.802	0.009
Cr	267.716	0.016
Cu	324.754	0.055
Fe	238.204	0.013
Hg	184.95	0.028
K	766.491	1.6
Mg	279.553	0.0008
Mn	257.611	0.0045
Mo	202.095	0.025
Ni	231.604	0.028
P	177.495	0.050
Pb	220.353	0.143
Zn	213.856	0.006

NORMS

Water

Directive 91/271/ EEC [1])- Waste Water

Soil

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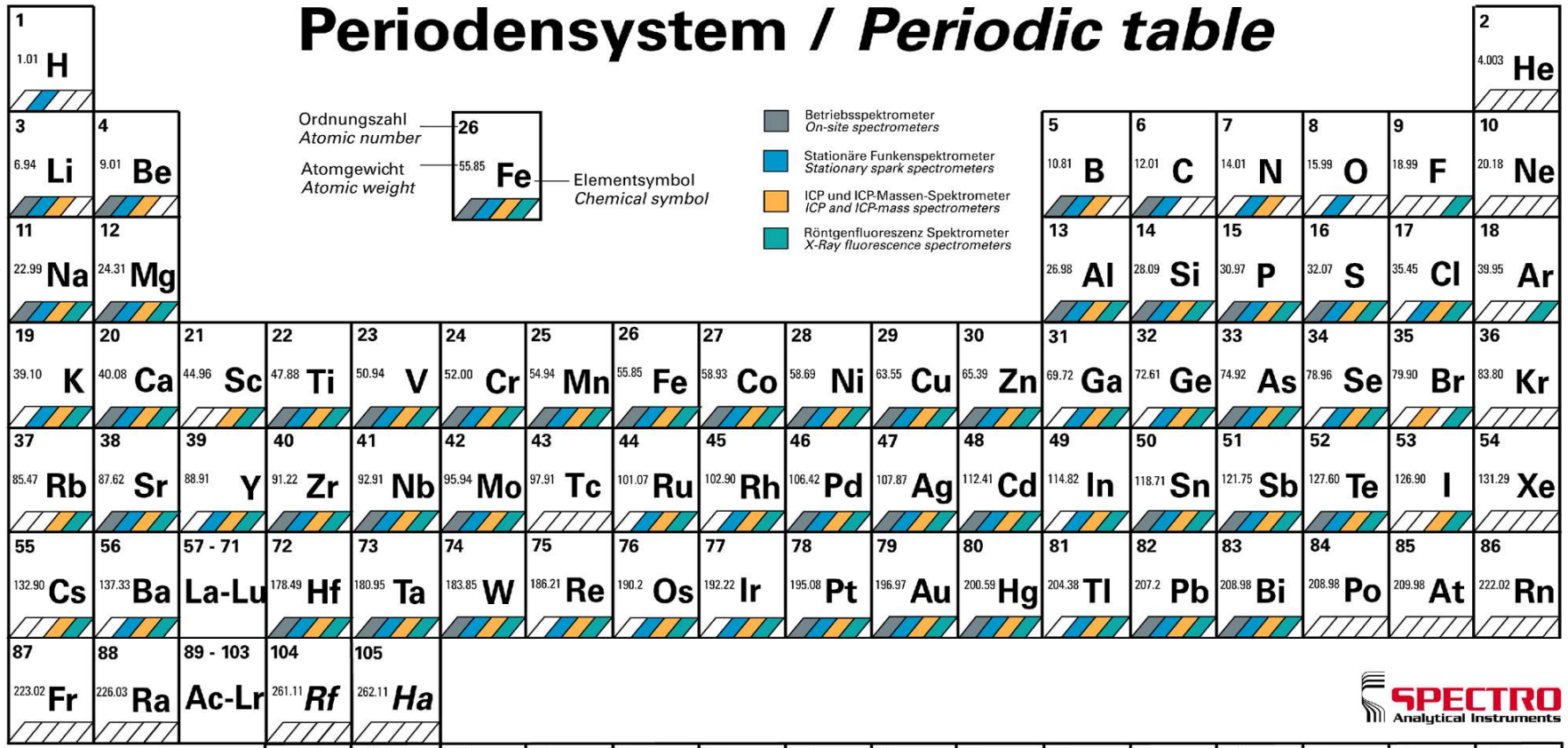

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SAMPLE PREPARATION-XRF

Preparation –I

- 5gm dried powder (65um) + 1gm wax- homogeneity
- Pressed with 15 Tn Press

Preparation-II

- Liquid Samples-No Sample Preparation

SOIL & FERTILIZER

NIST 1570 Soil Analysis-Repeatability

N°\Element	Na (%)	P (%)	K (%)	Ca (%)	Mn (µg/g)	Fe (%)	Cu (µg/g)	Zn (µg/g)	Cd (µg/g)
1	1.916	0.579	3.187	1.662	79.3	0.02513	14.7	89.2	2.8
2	1.917	0.580	3.200	1.668	81.3	0.02515	14.4	91.2	3.1
3	1.928	0.581	3.209	1.671	80.3	0.02589	15.2	91.6	2.3
4	1.924	0.581	3.209	1.673	80.9	0.02520	14.4	91.7	1.9
5	1.928	0.581	3.212	1.675	82.3	0.02517	14.8	91.3	3.0
6	1.927	0.581	3.215	1.675	80.9	0.02524	14.7	90.1	3.3
7	1.918	0.582	3.214	1.675	79.5	0.02513	15.0	90.4	3.2
8	1.930	0.581	3.218	1.679	80.5	0.02547	15.2	91.9	3.4
9	1.924	0.582	3.220	1.678	80.2	0.02533	14.7	92.6	3.2
10	1.928	0.582	3.220	1.679	80.5	0.02529	14.6	91.7	3.4
Average:	**1.924**	**0.581**	**3.210**	**1.674**	**80.6**	**0.02530**	**14.8**	**91.2**	**3.0**
Std. deviation:	**0.005**	**0.001**	**0.010**	**0.005**	**0.8**	**0.00022**	**0.3**	**0.9**	**0.5**

Element	Typ. concentration range [mg/100g]
Na	100 – 450
Mg	30 – 200
P	170 – 1100
Cl	270 – 1000
K	400 – 1700
Ca	250 – 1400
Mn	0.01 – 1.5
Fe	0.4 – 10
Cu	0.1 – 0.9
Zn	3 – 8

ELEMENTAL ANALYSIS OF ENVIRONMENTAL SAMPLES USING XRF

- Screening from Na to U
- Sample preparation-less
- From 0.5ppm and above
- Analysis time : 5 min max

Headquarters – Kleve, Germany

Headquarters, Boschstrasse 10

- 3740 sq. Meters (40225 sq. ft.)
- Management
- Product Management
- Research & Development
- Regional Center Europe
- D,A, CH, Sales & Service
- Human Resources
- Accounting

Production Facility, Boschstrasse 15

- 4,500 sq. meters (48,400 sq ft.)
- Optical System Manufacturing
- **ICP, XRF, SMA & MMA System Manufacturing**
- Warehouse & Parts Distribution
- Purchasing

RECENT EVENTS

Introduction of the
SPECTROCUBE
ED-XRF Analyzer

Introduction of the
SPECTROMAXx LMX08
Stationary Metal Analyzer

Introduction of the
SPECTROMAXx LMX09
Stationary Metal Analyzer

Introduction of the
SPECTROMAXx LMX10
Stationary Metal Analyzer

Introduction of the
SPECTRO GENESIS DSOI
ICP-OES Analyzer

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Introduction of the
SPECTRO ARCOS DSOI
ICP-OES Analyzer

Introduction of the
SPECTROLAB S LAS 02
Stationary Metal Analyzer

PRODUCTS

- Spark Emission Spectrometer-Solid Metal Analysis
- XRF Spectrometer-Handheld /Portable/Benchtop
- ICP-OES Spectrometer
- ICP-MS

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THANK YOU

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