ИНСТРУМЕНТАЛНИ ПРИЛОЖЕНИЯ ПРИ КОНТРОЛ НА ХРАНИТЕ И ОПАЗВАНЕ НА ОКОЛНАТА СРЕДА

СЕМИНАР

Пловдив, 5-6 Юни 2012

Определяне на следи от тежки метали в храни и обекти на околната среда

FBA *– Food and Bio-product Analysis Work Group*

/Работна група по анализ на храни и био-продукти/

Faculty of Chemistry – working groups in BioSupport

title	Strengthening the University of Plovdiv Research Potential in Plant Systems Biology and Food Biotechnology **(BioSupport)**
funding scheme:	Coordination and support actions (Support) THEME **CAPACITIES – RESEARCH POTENTIAL**
Work programme topics addressed	**Area: 4.1. Unlocking and developing the Research Potential of research entities established in the EU´s Convergence Regions and Outermost regions**

- Bioinformatics and Chemoinformatics
- Gene Regulation
- Plant lant Molecular Genetics
- Oxidative Stress and Cell Death
- Insect Pest Management
- Plant Molecular Virology
- Photosynthesis
- Cell Biology & Biotechnology
- Molecular spectroscopy
- Lipid Research
- Group EIMI
- Food and Bio-products Analysis
- Food Chemistry & Biological Activity

- Prevention
- Atom Economy
- Less Hazardous Chemical
- Designing Safer Chemicals
- Safer Solvents
- Energy Efficiency
- Renewable Feed stocks
- Reduce Derivatives
- Catalysis
- Design for Degradation
- Real-time analysis
- Accident Prevention

Green Analytical Methods Academic Centre

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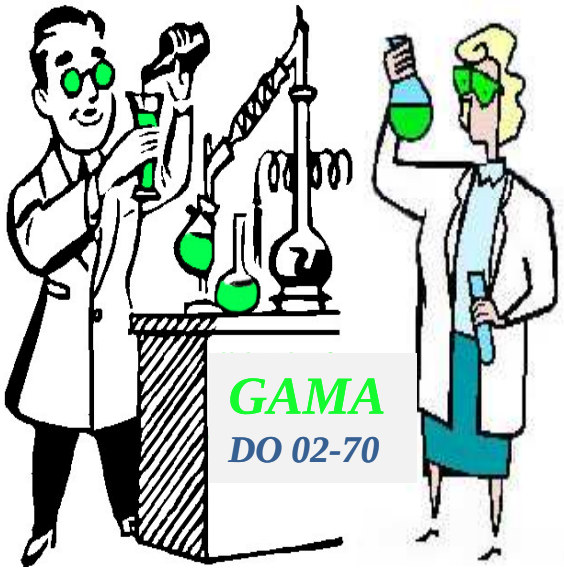

ФОНД НАУЧНИ ИЗСЛЕДВАНИЯ

Министерство на образованието, младежта и науката

Национален Фонд „Научни изследвания"

ИНТЕГРИРАНИ НАУЧНИ ЦЕНТРОВЕ В УНИВЕРСИТЕТИТЕ

УНИВЕРСИТЕТСКИ ЦЕНТЪР ЗА РАЗВИТИЕ НА ЕКОЛОГИЧНО ЦЕЛЕСЪОБРАЗНИ МЕТОДИ НА ОБЕКТ А

MW **SPE** **CPE** **ASDI** **MNPs**

FBA

Thermo SCIENTIFIC

FBA партньорство

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BioSupport

СЕМИНАР 5-6 Юни 2012 г.

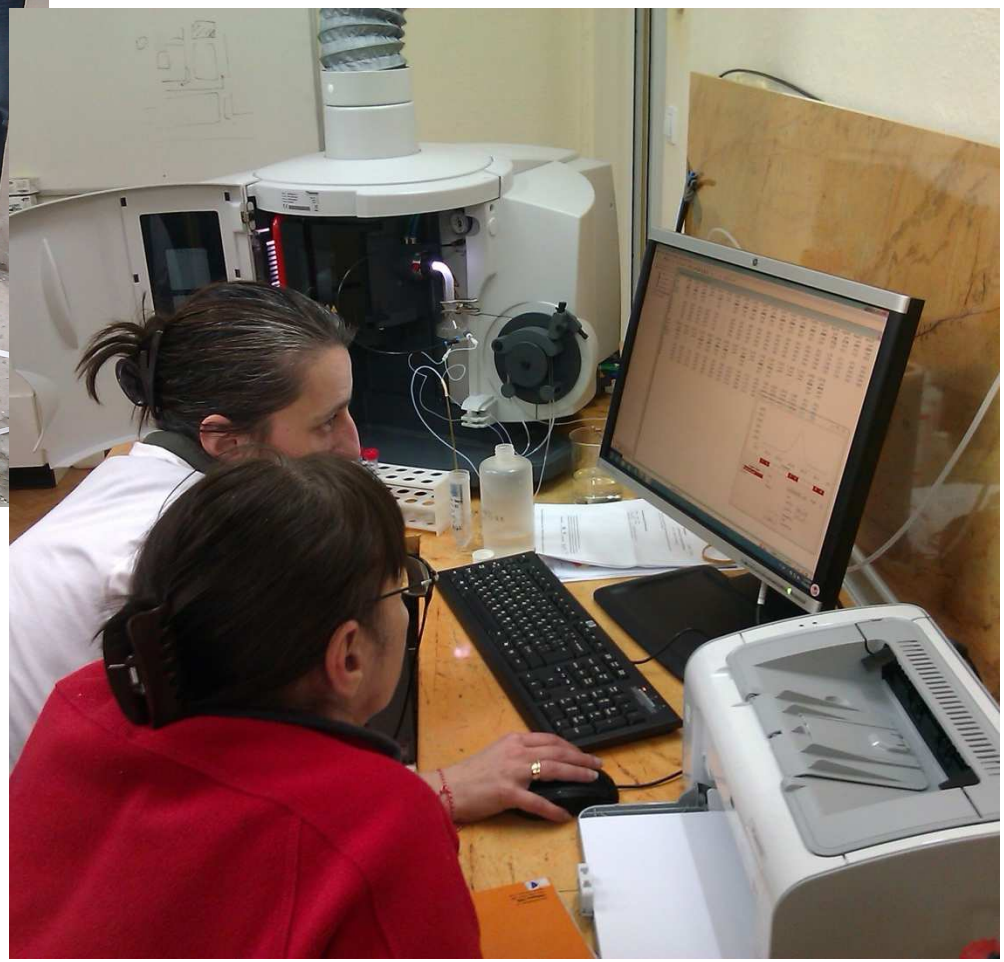
FBA инструментална екипировка

ETAAS with Zeeman Perkin Elmer 5100

ICP-MS with helium collision cell Agilent 7700

FBA апаратура закупена от BioSupport

ACM2



ICP-OES
Duel view
plasma
iCAP 6300
Thermo

FBA апаратура закупена от BioSupport

Microviwe
High pressure
30 At
oven with TV
Milestone
Ehtos One

Old MW
MDS-81D,
CEM
8.2 At

FBA ЛАБОРАТОРИЯ BioSupport

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Unmodified manganese ferrite nanoparticles as a new sorbent for solid phase extraction of trace metals - APDC complexes followed by inductively coupled plasma mass spectrometry analysis

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The applicability of $MnFe_2O_4$ nanoparticles as a new sorbent for group pre-concentration of V, Co, Ni, Cu, Zn, As, Se, Cd and Pb was investigated and compared with magnetite nanoparticles. A solid phase extraction (SPE) of target analytes based on sorption of their hydrophobic complexes with ammonium pyrrolidine dithiocarbamate (APDC) on the surface of unmodified nanoparticles (NPs) was optimized. Magnetic NPs with retained metal complexes were easily separated from the bulk solution by permanent magnet for 5 min. Analytes restoration in final solution was accomplished by heating with 0.5 mL of 7 mol L^{-1} nitric acid. The obtained solutions were suitable for continuous nebulization in ICP-MS. Spectral and non-spectral matrix effects for urine analysis (direct and after SPE) were studied and adequate calibration strategies were suggested. Under optimized conditions the magnetic assisted SPE procedure enables enrichment of target analytes by factors between 7.4 – 10, with linear dynamic ranges 1-100 µg L^{-1} for V, Co, Ni, Cd, Pb and 10-1000 µg L^{-1} for Zn, As, Se. The method detection limits of proposed SPE were improved by factor between 3 and 20 compared to the direct analysis of diluted urine. The accuracy of magnetic NPs-SPE-ICP-MS method was evaluated analysing urine certified reference material Seronorm™ Trace Elements Urine 201205. For correct determination of As and Se in urine, a preliminary microwave sample treatment with a mixture HNO_3+H_2O_2 was needed, but it led to worsening of MLOD. The developed method was successfully applied for analysis of human urine

BALKAN PHYSICS LETTERS

BPL (Proc. Suppl.) BPU-4 (2000)

Investigation the ecological state of the *Maritza-iztok* region in Bulgaria using different methods for analysis

INVESTIGATION THE ECOLOGICAL STATE OF THE *MARITZA-IZTOK* REGION IN BULGARIA USING DIFFERENT METHODS FOR ANALYSIS

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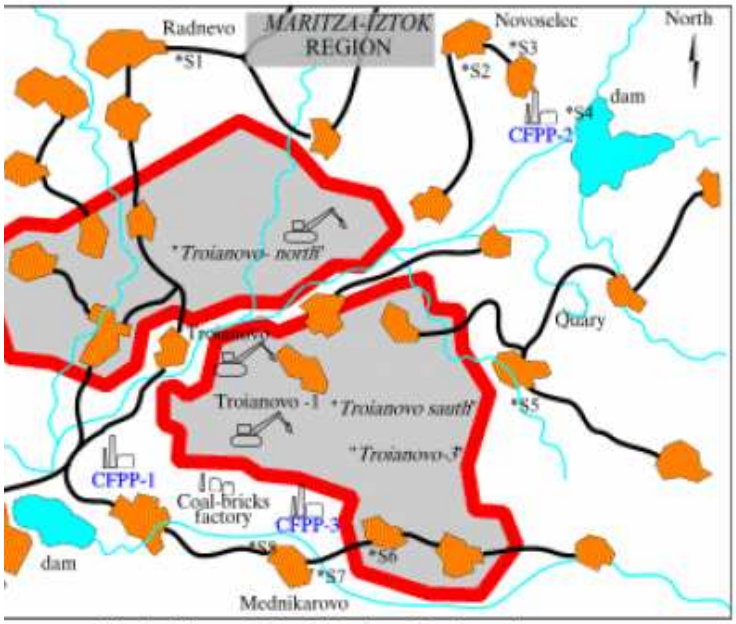


Fig.1. Map of the *Maritza-Iztok* region

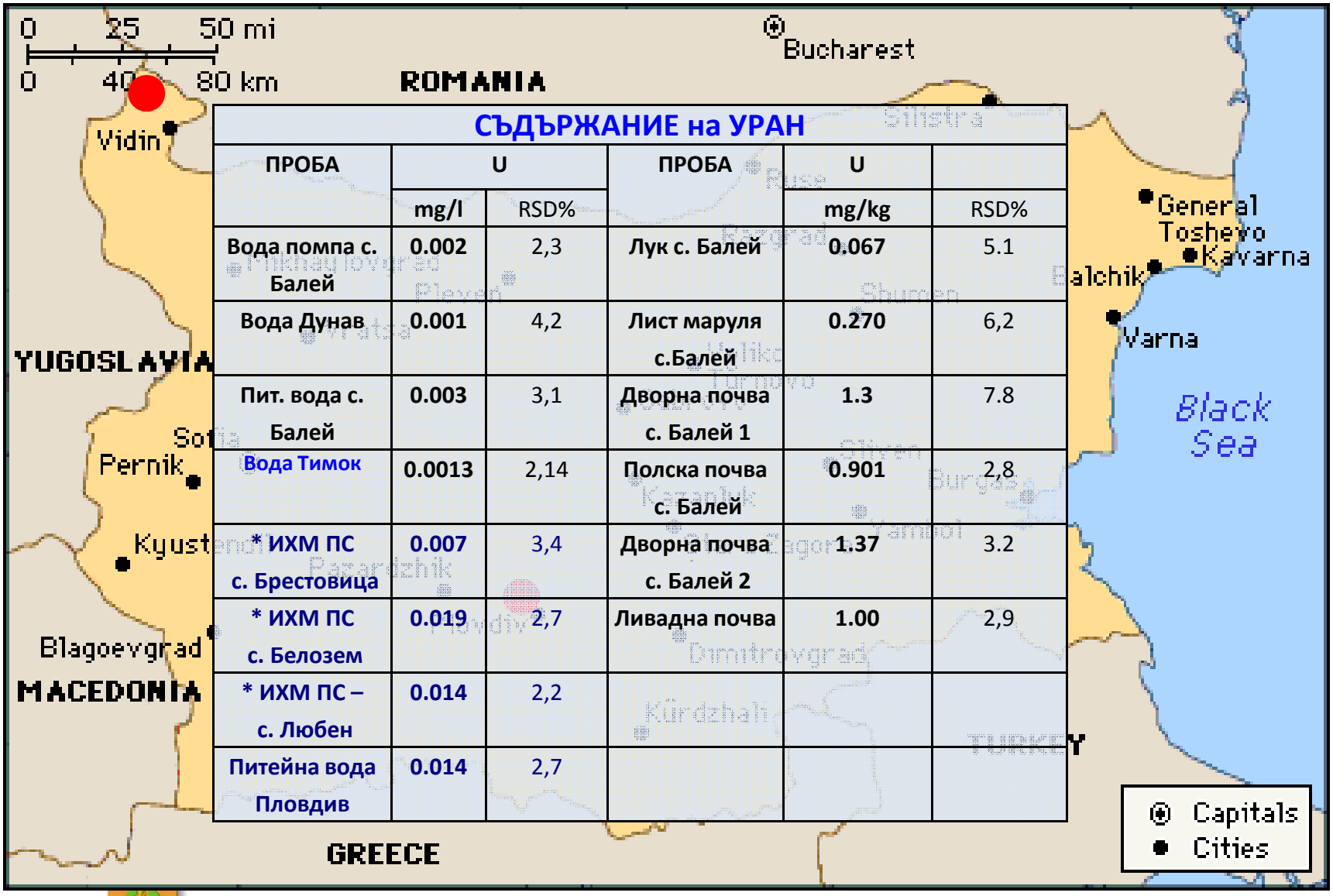
Abstract. *Soil, water and vegetable samples* from the region of *Maritsa-Iztok* Coal-Fired Power Plants (*CFPP*) in Bulgaria have been studied using a large variety of physical methods of analysis : γ- and neutron activation analyses, γ-spectrometry, radiometry, masspectrometry, physicochemical and radiochemical analyses, soil sciences studies.

An information about the concentration of ecologically important elements in the chain: coal's combustion *products* (*bottom* of environmental

Table 1. Element's concentrations in *soil samples* obtained by *IGAA* and *MSA* methods

	C_x(IGAA), [ppm]		C_x(MSA), [ppm] + (SD%)		MAC
Element	**Sample S1**	**Sample S9**	**Drift Soil**	**Depository CFPP3**	**(for pH>7.0)**
Mn	600±46	391±44	**319**(2.0)	**425**(8.7)	
Cu	-	-	**18.2**(3.3)	**58.8**(4.2)	260
Ni	42±11	33±5	**15.5**(3.0)	**63.9**(5.2)	70
Cr	40±12	64±16	**13.9**(3.9)	**47.7**(6.4)	200
Zn	-	-	**16.9**(7.5)	**20.6**(7.5)	340
As	8±1.5	8±3	**2.9**(6.3)	**5.9**(8.4)	25
Cd	-	-	**<0,1**(-)	**0.11**(10.7)	3,0
Ba	478±42	345±33	**117**(2.8)	<0,1(-)	
Pb	46±15	70±25	**12.2**(2.0)	**8.7**(2.7)	80
U	2±0.2	3.5±0.6	**1.3**(3.4)	**6.04**(1.8)	
Hg	-	-	**<0.1**(-)	**<0.1**(-)	1
Th*	7.5±0.6	8.3±1.3	-	-	

Проби от Село Балей и помпени станции в района на Пловдив
Института по Хидрология и Метеорология – БАН филиал Пловдив



СЪДЪРЖАНИЕ на УРАН

ПРОБА	U		ПРОБА	U	
	mg/l	RSD%		mg/kg	RSD%
Вода помпа с. Балей	0.002	2,3	Лук с. Балей	0.067	5.1
Вода Дунав	0.001	4,2	Лист маруля с.Балей	0.270	6,2
Пит. вода с. Балей	0.003	3,1	Дворна почва с. Балей 1	1.3	7.8
Вода Тимок	0.0013	2,14	Полска почва с. Балей	0.901	2,8
* ИХМ ПС с. Брестовица	0.007	3,4	Дворна почва с. Балей 2	1.37	3.2
* ИХМ ПС с. Белозем	0.019	2,7	Ливадна почва	1.00	2,9
* ИХМ ПС – с. Любен	0.014	2,2			
Питейна вода Пловдив	0.014	2,7			

Данни от анализа на As в минерални води

Данни от анализа на As в минерални води

Вода закупена на	Бутилка от	ICP-MS As (ppb)	RSD%	GFAAS As (ppb)	RSD %
M 13.04.05	1500 ml	**100**	4.4	**94**	9
M 13.04.05	500 ml	**102**	4.3	**98**	8
M 14.04.05	1500 ml	**103**	4.2	**99**	8
M 14.04.05	500 ml	**109**	5.6	**93**	9
M 18.05.05	500 ml	**106**	4.3	**99**	8
GB 18.05.05	500 ml	**< 5**	_	**< 10**	_
K 18.05.05	300 ml	**< 5**	_	**< 10**	_
D 18.05.05	500 ml	**< 5**	_	**< 10**	_
DG 18.05.05	1500 ml	**< 5**	_	**< 10**	_

Съдържание на **As** в бутилирана минерална вода **M**

(±) съответната разширена неопределеност **U** при **K=2**

4 mg/L

2 mg/L

DETERMINATION OF TRACE ELEMENTS IN COMMERCIAL BOTTELED BULGARIAN MINERAL WATERS BY MEANS OF ICP-MS AND TXRF

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Рамкова директива за водите и планиране на водните ресурси

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Following extensive consultations on Water Framework Directive River Basin Management Plans should since 22.12.2009 be available in all River Basin Districts across the EU. Follow this link or click on the map to see the current status of adoption of river basin management plans in the different Member States.

On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the **EU Water Framework Directive** (or even shorter the WFD) was finally adopted.

The Directive was published in the Official Journal (OJ L 327) on 22 December 2000 and entered into force the same day. Some amendments have been introduced into the Directive since 2000, and you can download the consolidated version in all EU languages here.

However, even after reading the Directive, you may have still questions, such as: What is this Directive about? What do I need to know about the Directive? What is currently happening in relation to the Directive?

Twelve "Water notes" which intend to give an introduction and overview of key aspects of the implementation of the Water Framework Directive are available to download in all EU languages !

Контролни пунктове – 121 пробни точки от четирите Басейнови дирекции

Анализ на повърхностни води

No	КОД	Al ppb	Al (RSD) %	Cr ppb	Cr (RSD) %	Mn ppb	Mn (RSD) %	Fe ppb	Fe (RSD) %	Ni ppb	Ni (RSD) %	Cu ppb	Cu (RSD) %	As ppb	As (RSD) %	Cd ppb	Cd (RSD) %	Hg ppb	Hg (RSD) %	Pb ppb	Pb (RSD) %	Zn ppb	Zn (RSD) %
1	ССМ	48.6	5	0.22	10	4.2	5	91	7	0.44	8	17.3	7	0.42	8	0.007	25	< 0.01	_	0.1	11	0.99	12
2	Бл 1 А	2	7	0.004	20	4.1	5	5.8	6	0.02	18	12	5	< 0.05	_	0.004	25	< 0.003	_	0.91	5	55	4
3	Бл 1 Б	0.65	10	0.004	20	2.2	6	2.2	6	0.014	20	11.6	5	< 0.05	_	0.003	25	< 0.003	_	0.56	5	54	4
4	ДР1	7.6	5	0.085	9	0.2	6	2.3	6	0.093	9	0.48	4	0.082	9	0.005	11	< 0.003		0.053	6	0.86	12
5	ДР3	2.8	6	0.13	10	9.7	5	13.2	6	0.19	9	0.81	4	0.68	6	0.003	14	1.7	10	0.068	6	0.65	13
6	ДР5	1.8	7	0.052	9	12.5	5	42.3	6	0.33	9	0.81	4	0.47	7	< 0.002	_	0.3	9	0.04	6	0.88	12
7	ДР7	1.65	7	0.017	10	105	4	3.8	6	0.32	9	0.79	4	0.32	7	0.016	8	0.1	13	0.064	6	1.1	12
8	ДР9	0.81	7	0.076	9	2.1	5	7.7	9	0.21	9	0.44	4	0.44	7	0.002	19	1	12	0.033	6	0.44	16
9	ДР13	0.62	10	0.37	8	8.1	5	6.3	6	0.27	9	0.35	4	0.73	7	0.004	13	0.9	10	0.034	6	0.64	15
10	ДР16	4.6	6	0.05	10	0.99	5	3.0	6	<0.02	_	0.85	4	0.24	7	0.002	19	0.3	11	0.034	6	0.92	13
11	ДР18	23	6	0.26	8	2.7	5	19.5	6	0.16	9	1.0	4	0.55	7	0.002	19	1.1	8	0.079	6	0.83	12
12	ДР22	1.45	7	0.081	9	4.4	6	13.1	6	0.31	9	0.44	4	0.48	7	0.004	14	1.9	10	0.265	5	0.91	12
13	ДР26	0.9	9	0.42	8	0.39	6	1.8	6	0.48	9	0.46	4	0.98	7	0.002	17	0.5	9	0.028	6	0.66	15
14	ЗБР1	2.7	6	0.059	10	1.53	4	3.6	6	0.062	10	0.65	4	0.23	7	0.013	8	0.02	10	0.05	6	0.92	12
15	ЗБР2	7.9	5	0.043	10																		
16	ЗБР3	9.4	6	0.018	11																		
17	ЗБР4	3.7	6	0.048	10																		
18	ЗБР5	5.2	6	0.078	9																		
19	ЗБР6	3.9	6	0.014	12																		
20	ЗБР7	19.5	6	0.075	9																		
21	ИБР1	22	5	0.025	11																		
22	ИБР2	7	6	0.01	12																		
23	ИБР3	4	6	0.05	8																		
24	ИБР4	9	6	0.09	7																		
25	ИБР5	1.2	6	0.06	7																		
26	ИБР6	1.7	6	0.25	5																		
27	ИБР7	1.6	6	0.054	7																		
28	ИБР8	13.7	5	0.032	7																		
29	ИБР9	1.6	6	0.021	10																		
30	ИБР10	14.4	6	0.052	8																		
31	ИБР11	6.8	6	0.065	8																		
32	ЧР24	3.1	6	0.075	8																		
33	ЧР25	2.4	6	0.18	8																		
34	ЧР27	2	7	0.037	10																		
35	ЧР28	6.5	8	0.074	10																		
36	ЧР29	1.4	7	0.035	9																		
37	ЧР30	3.2	6	0.19	8																		
38	ЧР31	4	25	0.27	10																		
39	ЧР32	1.7	6	0.039	8																		
40	ЧР33	1.8	8	0.066	10																		

ПРИЛОЖЕНИЕ НА ХЕМОМЕТРИЧНИ ПОДХОДИ ЗА ИНТЕРПРЕТАЦИЯ НА ДАННИ ОТ ICP-MS АНАЛИЗ НА ПОВЪРХНОСТНИ ВОДИ

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Резюме

Обект на изследването са повърхностни води от територията на България, от гледна точка на елементния им състав. Изотопите в диапазона 7- 238 amu бяха измерени с ICP-MS модел Agilent 7700x в 120 проби води от пунктове за мониторинг, регламентирани в законодателството. За обработка на информацията и решаване на класификационни задачи, върху данните от анализа бяха приложени хемометрични методи – CA, PCA с FA, DA. Бяха потърсени елементни маркери за обособените региони с цел идентификация на произход на неизвестни водни проби.

Анализ на повърхностни води

GAMA - lab performance check

River water Reference Material for Trace Metals SLRS-5

Elemet	Measured GAMA lab Agilent ICP-MS 7700 x _+ u_m			Certified SLRS-5 X_a _+ U (k=2)			Z	Z'	*zeta*-score
	x		u_x	X_a		U_a			
Al ppb	**48.6**	_+	2.4	**49.5**	_+	5	-0.4	-0.4	-0.3
Cr ppb	**0.22**	_+	0.022	**0.208**	_+	0.023	1.0	0.5	0.5
Mn ppb	**4.2**	_+	0.21	**4.33**	_+	0.18	-1.4	-0.6	-0.6
Fe ppb	**91**	_+	6.4	**91.2**	_+	5.8	-0.1	0.0	0.0
Ni ppb	**0.44**	_+	0.035	**0.476**	_+	0.064	-1.1	-1.0	-0.8
Cu ppb	**17.3**	_+	1.2	**17.4**	_+	1.3	-0.2	-0.1	-0.1
As ppb	**0.42**	_+	0.034	**0.413**	_+	0.039	0.4	0.2	0.2
Cd ppb	**0.007**	_+	0.0018	**0.006**	_+	0.001	1.4	0.6	0.5
Hg ppb	**< 0.01**								
Pb ppb	**0.1**	_+	0.011	**0.081**	_+	0.006	6.3	1.7	1.7
Zn ppb	**0.99**	_+	0.12	**0.845**	_+	0.095	3.1	1.2	1.1

Приоритетни вещества:
Hg, Cg, Pb, Ni + Zn

директива 2009/90/ ЕО

критерии за анализ :

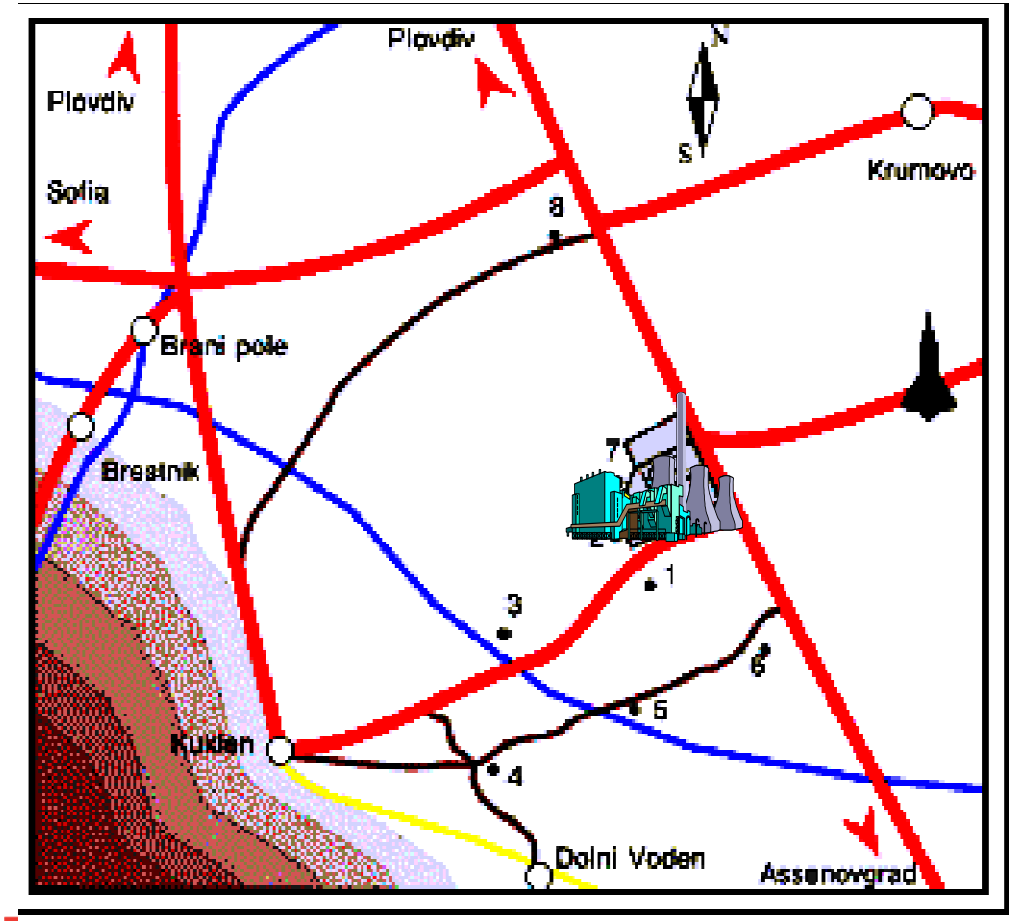
максималните стойности за неопределеност и границата на количествено определяне както следва:

U_{max} = 50% (к=2)

QL_{max} = 30% от определените допустими стойности.

INCO-Copernicus Project CT 98-0334

Оценка на здравния риск в хранителната диета на деца в индустриални райони на Източна Европа



Обследване на източниците на замърсяване с Pb и Cd в ежедневната храна на деца от Куклен – 4 km до КЦМ АД Пловдив

Резултати за Pb и Cd определени в храни чрез ICP-MS и ETAAS

	ICP-MS		ETAAS		ICP-MS		ETAAS	
ПРОБА	Cd µg/kg	SD µg/kg	Cd µg/kg	SD µg/kg	Pb µg/kg	SD µg/kg	Pb µg/kg	SD µg/kg
Зеленчукова салата -1	164	*13*	161	*11*	138	*24*	110	*19*
Зеленчукова салата -2	23	*4.8*	30	*5.6*	11	*1.5*	13	*1.6*
Свински дроб	53	*6.1*	51	*3*	71	*2.6*	67	*3.9*
Мляко Куклен	9	*2.1*	8	*0.82*	11	*1.5*	9	*1*
Мляко Руен	12	*2.3*	13	*1*	8	*2.4*	8	*1.2*

Анализ на храни – деца от Куклен

Вид на пробата	Cd mg/kg	SD mg/kg	Pb mg/kg	SD mg/kg	Вид на пробата	Cd mg/kg	SD mg/kg	Pb mg/kg	SD mg/kg	Вид на пробата	Cd mg/kg	SD mg/kg	Pb mg/kg	SD mg/kg
Меню – детска градина	< 20	-	< 40	-	Хляб с яйца	< 15	-	< 20	-	Яйца	32	4	< 50	-
Компот сливи	< 5	-	< 10	-	Боза	< 5	-	< 10	-	Ориз с месо и зеле	< 30	-	< 40	-
Лютеница	35	4	18500	450	Сирене	< 30	-	< 50	-	Ориз със зеле и месо	< 30	-	< 50	-
Лютеница	70	8	8200	130	Грозде	< 10	-	330	8	Баница	17	2	21	4
Целодневно меню	< 30	-	< 50	-	Хляб с наденица	< 30	-	< 40	-	Хляб с шоколад	< 15	-	< 20	-
Домати	< 10	-	< 10	-	Домати и сирене	14	1	12	1	Ястие с пилешко	< 30	-	< 50	-
Хляб	< 30	-	< 40	-	Домати	24	3	24	2	Месо + зеленчуци	< 30	-	< 50	-
Сирене	< 30	-	< 50	-	Месо с картофи	< 30	-	< 50	-	Компот кайсии	< 5	-	38	3
Дом. сок	< 30	-	< 40	-	Чушка със сирене	23	2	11	2	Консерва	46	6	9450	160
Наденица	< 30	-	< 50	-	Дом.сок	24	2	12	1	Компот сливи	< 5	-	< 10	-
Зеле	< 20	-	< 40	-	Дом. сок	11	2	< 10	-	Лютеница	65	4	25800	550
Кис. мляко	< 5	-	< 5	-	Конфитюр сливи	< 30	-	< 50	-	Праз	< 15	-	< 40	-
Мляко	< 5	-	12	1	Компот кайсии	< 5	-	< 10	-	Чушки	29	3	< 40	-
Макарони + сирене	< 15	-	< 30	-	Компот праскови	< 5	-	< 10	-	Грозде	< 5	-	23	2
Смляно месо	< 30	-	< 50	-	Пресни яйца	< 15	-	< 40	-	Лютеница	60	7	25700	700
Бисквити	< 15	-	< 20	-	Пърж. яйца	< 20	-	42	4	Пърж. картофи сирене	51	4	< 40	-
Ябълка	< 5	-	< 10	-	Салата зеле моркови	< 30	-	< 50	-	Баница	< 15	-	< 20	-
Мусака	< 30	-	< 50	-	Принцеса с кайма	< 30	-	< 50	-	Домати	15	2	< 10	-
Кис. мляко	12	2	8	2	Черен дроб	53	6	71	3	Сок череши	< 5	-	15	2
Пр. мляко	< 5	-	< 5	-	Хляб с яйца	< 15	-	< 20	-	Грозде	< 5	-	75	3
Сирене	< 30	-	< 50	-	Мляко	< 5	-	< 10	-	Айран	< 5	-	< 5	-
Кис. мляко	< 5	-	< 5	-	Хляб с лютеница	< 20	-	1700	80	Салата домати	11	1	11	1
Палачинка + мармалад	< 30	-	220	9	Мляко	< 10	-	< 10	-	Месо	< 30	-	< 50	-
Салата домати	18	2	16	2	Ориз	< 30	-	< 50	-	Круша	< 5	-	25	1
Ориз с месо	< 30	-	145	10	Грозде	< 5	-	50	3	Ябълка	6.2	2	81	4
Баклава	< 30	-	< 50	-	Диня	< 5	-	< 10	-	Салата домати чушки	14	1	13	1
Компот	< 5	-	15	2	Компот сливи	6	2	10	1	Картофи	< 30	-	< 50	-
Ястие с домати	129,40	513	9520	316	Месо с картофи	< 35	-	< 50	-	Макарони с сирене	< 15	-	41	3
Ябълка	< 5	-	76	3	Яйца	< 20	-	< 40	-	Дом. сок	< 15	-	< 10	-
Царев. брашно	< 30	-	390	20	Кюфте	< 30	-	< 50	-	Ориз + домат	< 20	-	< 50	-
Изсушени яйца	< 20	-	160	15	Картофено кюфте	38	4	< 50	-	Айран	< 5	-	< 10	-
Изсушен праз	164	13	138	12	Мляко	9	2	11	2	Яйца със салата	20	3	< 50	-
Айран	< 5	-	< 5	-	Брашно	< 30	-	< 50	-	Кашкавал	< 20	-	140	10
Салата зеле и моркови	48	5	2800	112	Баница	< 30	-	66	5	Компот праскови	< 5	-	< 10	-
Компот череши	< 5	-	< 10	-	Брашно	< 30	-	< 50	-	Ориз	< 30	-	92	8

INCO-COPERNICOS
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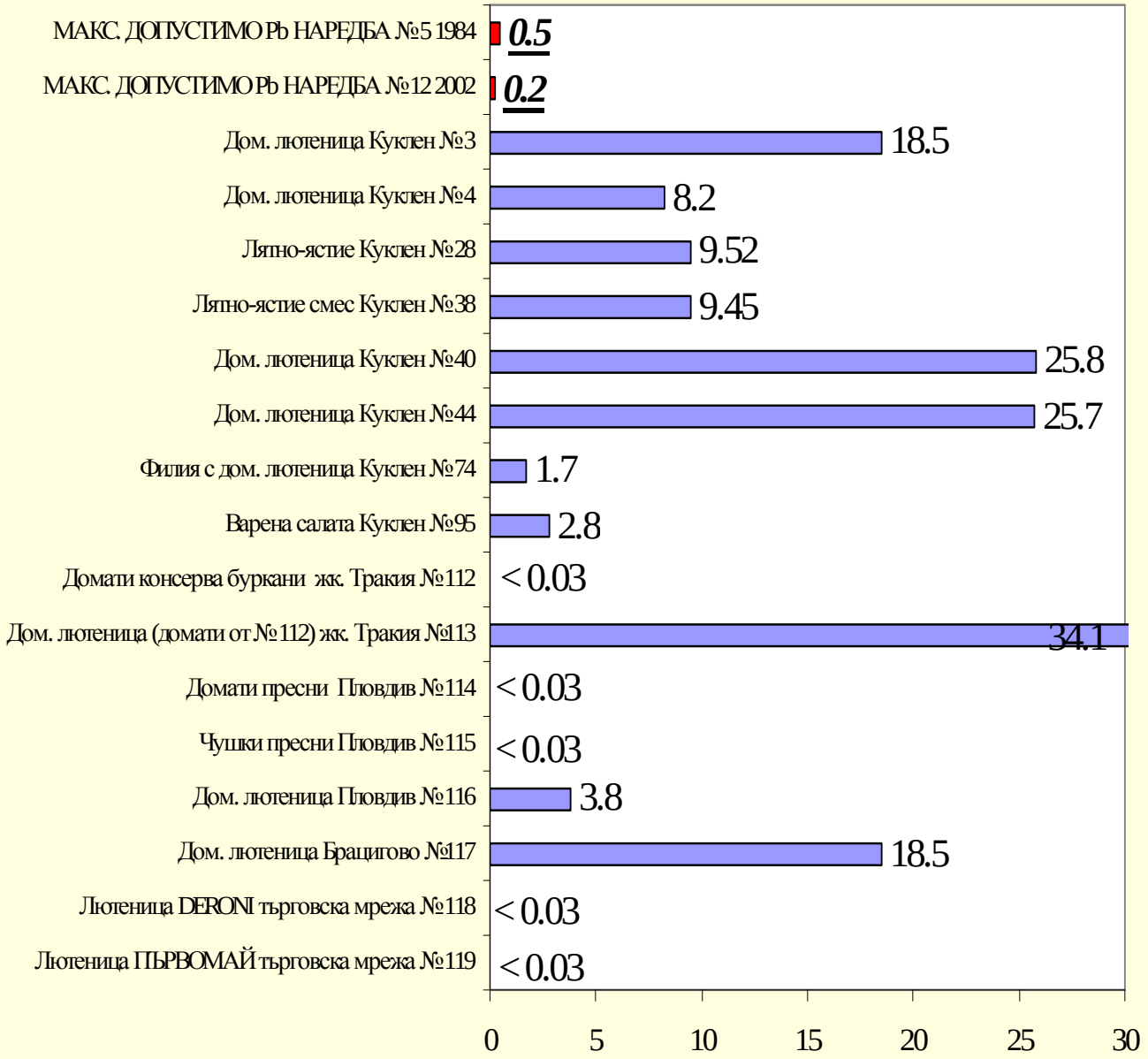
University of Giessen

АГРАРЕН УНИВЕРСИТЕТ
ПУ “П. Хилендарски”

Съдържание на Pb (mg/kg) в хранителни продукти



КОЙ Е ВИНОВНИКЪТ ЗА ВИСОКОТО СЪДЪРЖАНИЕ НА Pb в ДОМАШНАТА ЛЮТЕНИЦА!!!

FBA ЛАБОРАТОРИЯ BioSupport

Аграрен Университет анализ на съдържание на тежки метали в почви и подвижни форми на фосфор

Проф. Красимир Иванов

Comparison of ICP-MS and colorimetric determination of total and extractable phosphorous in soils

Krasimir Ivanov[a], Violeta Stefanova[b], Milena Petkova[a], Veselin Kmetov[b], Penka Zaprjanova[c], Deyana Georgieva[b] and Violina Angelova[a]

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Аграрен Университет

Проф. Красимир Иванов

Sample Na		blank	Bl c.v.	Bl HCLO4	PC1 MWc.v.	PC1 c.v.	PC1 HCLO4	PC2 MWc.v.	PC2 c.v.	PC2 HClO4	PC3 MWc.v.	PC3 c.v.	PC3 HClO4	303 MWc.v.	303 c.v.	303 HClO4	386 MWc.v.	386 c.v.	386 HClO4	113 CRM
Be	mg/l	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	mg/l	< 1	< 1	15.57	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
	SD	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Na	mg/l	0.19	21.4	2.8	5.5	20.5	6.6	3.7	36.8	5.0	4.2	34.9	7.1	34.9	54.0	31.7	3.7	31.7	7.0	6.0
	SD	0.003	0.64	0.07	0.19	0.82	0.36	0.25	1.18	0.23	0.14	0.72	0.28	1.61	0.89	0.96	0.13	0.81	0.18	0.18
Mg	mg/l	0.04	0.18	1.66	65.3	21.5	70.3	24.9	29.7	31.0	42.3	43.8	47.5	75.5	84.5	86.7	6.3	11.2	12.0	30.6
	SD	0.004	0.01	0.09	3.05	0.66	1.83	0.45	0.35	0.30	0.52	0.51	0.32	2.56	3.35	3.49	0.25	0.23	0.34	0.41
Al	mg/l	0.01	0.16	0.50	76	39	130	61	98	117	87	105	141	128	159	172	199	363	451	139
	SD	0.001	0.01	0.04	1.98	1.20	2.08	1.10	2.22	3.57	2.01	3.52	2.81	5.91	3.33	4.05	4.72	9.19	22.15	4.05
P	mg/l	0.10	0.04	0.23	2.96	1.45	2.77	2.23	2.09	2.26	3.01	2.86	2.81	5.12	5.06	4.88	0.96	1.15	1.29	4.82
	SD	0.03	0.03	0.15	0.36	0.24	0.36	0.32	0.28	0.26	0.27	0.25	0.37	0.48	0.34	0.42	0.21	0.09	0.28	0.24
S	mg/l	< 0,5	0.80	7.62	0.95	8.74	< 0,5	0.62	17.95	< 0,5	< 0,5	15.85	< 0,5	5.63	20.10	< 0,5	1.00	15	< 0,5	23.3
	SD	0.000	0.22	1.71	0.11	0.74	0.00	0.37	1.11	0.19	0.09	0.63	0.00	0.78	1.62	0.77	0.58	0.62	0.34	1.40
Ca	mg/l	0.20	0.98	12.94	370	118	379	42	54	57	174	179	183	123	125	129	3.35	15	9	90
	SD	0.028	0.071	0.797	32.3	8.9	37.0	3.2	4.9	4.0	11.0	12.4	12.8	8.7	10.1	9.5	0.8	1.5	0.9	7.2
Cr	mg/l	0.01	0.00	0.02	0.39	0.14	0.36	0.14	0.18	0.15	0.26	0.27	0.20	0.14	0.20	0.14	0.35	0.41	0.22	1.27
	SD	0.001	0.0002	0.004	0.05	0.02	0.05	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.01	0.03	0.04	0.02	0.13
Fe	mg/l	0.04	0.48	1.25	92	48	100	86	97	99	109	108	117	244	244	238	333	354	364	141
	SD	0.004	0.07	0.12	8.1	4.8	5.6	7.7	7.9	9.9	7.0	10.7	9.5	25.8	20.6	23.8	27.0	27.3	31.7	14.7
Mn	mg/l	0.00	0.01	0.08	2.8	1.4	2.9	2.3	2.5	2.6	2.5	2.5	2.8	37	37	37	4.9	5.3	5.5	1.4
	SD	0.0001	0.001	0.006	0.24	0.12	0.18	0.27	0.24	0.18	0.14	0.15	0.16	2.6	1.9	1.6	0.37	0.42	0.41	0.13
Co	mg/l	< 0,001	< 0,001	0.00	0.05	0.02	0.05	0.04	0.04	0.04	0.05	0.05	0.16	0.05	0.05	0.05	0.04	0.05	0.05	0.08
	SD	-	-	0.0003	0.004	0.002	0.005	0.003	0.002	0.005	0.004	0.004	0.016	0.004	0.004	0.004	0.003	0.004	0.004	0.006
Ni	mg/l	0.00	0.00	0.07	0.26	0.11	0.29	0.14	0.14	0.16	0.22	0.21	0.24	0.09	0.09	0.10	0.15	0.16	0.18	1.11
	SD	0.0008	0.0003	0.008	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.06
Cu	mg/l	< 0,002	0.00	0.06	0.21	0.08	0.21	0.31	0.28	0.30	0.24	0.20	0.23	0.27	0.26	0.28	0.54	0.60	0.64	0.41
	SD	-	0.000	0.005	0.015	0.007	0.015	0.024	0.018	0.027	0.021	0.015	0.015	0.023	0.023	0.027	0.034	0.046	0.054	0.026
Zn	mg/l	< 0,004	0.04	17.76	1.21	0.42	1.12	0.29	0.31	0.32	1.04	0.52	0.60	14.79	14.11	15.55	2.34	2.06	2.07	1.32
	SD	-	0.008	0.93	0.13	0.03	0.08	0.03	0.04	0.03	0.07	0.05	0.05	0.72	0.66	0.80	0.20	0.18	0.18	0.13
As	mg/l	< 0,004	< 0,004	0.00	0.04	0.02	0.04	0.03	0.02	0.03	0.03	0.02	0.03	0.79	0.76	0.80	1.62	1.60	1.69	0.08
	SD	-	-	0.001	0.006	0.003	0.006	0.004	0.003	0.004	0.004	0.004	0.004	0.094	0.087	0.086	0.12	0.13	0.15	0.006
Se	mg/l	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	0.01	0.01	0.01	< 0,004
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.002	0.002	-
Mo	mg/l	< 0,001	< 0,001	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	SD	-	-	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cd	mg/l	< 0,001	< 0,001	0.00	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.11	0.00	0.00	0.00	0.00
	SD	-	-	0.0005	0.0012	0.0004	0.0007	0.0003	0.0003	0.0003	0.0006	0.0004	0.0004	0.0041	0.0046	0.0039	0.0002	0.0004	0.0005	0.0003
Pb	mg/l	< 0,001	0.01	0.07	0.51	0.18	0.55	0.18	0.23	0.22	0.34	0.35	0.37	10.87	10.75	11.49	2.22	2.33	2.43	1.56
	SD	-	0.00	0.02	0.50	0.07	0.06	0.04	0.05	0.03	0.08	0.07	0.07	0.51	0.31	0.37	0.04	0.08	0.09	0.07
Bi	mg/l	< 0,001	< 0,001	0.01	0.01	< 0,001	< 0,001	0.01	< 0,001	< 0,001	0.01	0.01	< 0,001	0.01	0.01	< 0,001	0.16	0.15	0.17	< 0,001
	SD	-	-	0.004	0.005			0.004			0.003	0.004		0.004	0.002		0.016	0.018	0.019	
U	mg/l	< 0,0005	< 0,0005	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.00
	SD	-	-	0.0001	0.0001	0.0001	0.0002	0.0001	0.0003	0.0001	0.0002	0.0002	0.0003	0.0003	0.0003	0.0002	0.0003	0.0007	0.0006	0.0001

Thermo SCIENTIFIC

Аграрен Университет
анализ на съдържание на тежки метали в почви

доц. Аланджийски

1 g – въздушно суха проба

5 ml HNO_3 + 5 ml H_2O

MW E=800W T 600 (R_t=10min H_t=20 min)

Отваряне за едно денонощие

+ 3 ml HNO_3 + 2 ml H_2O_2

MW E=800W T 600 (R_t=10min H_t=20 min)

Аграрен Университет
анализ на съдържание на тежки метали в почви

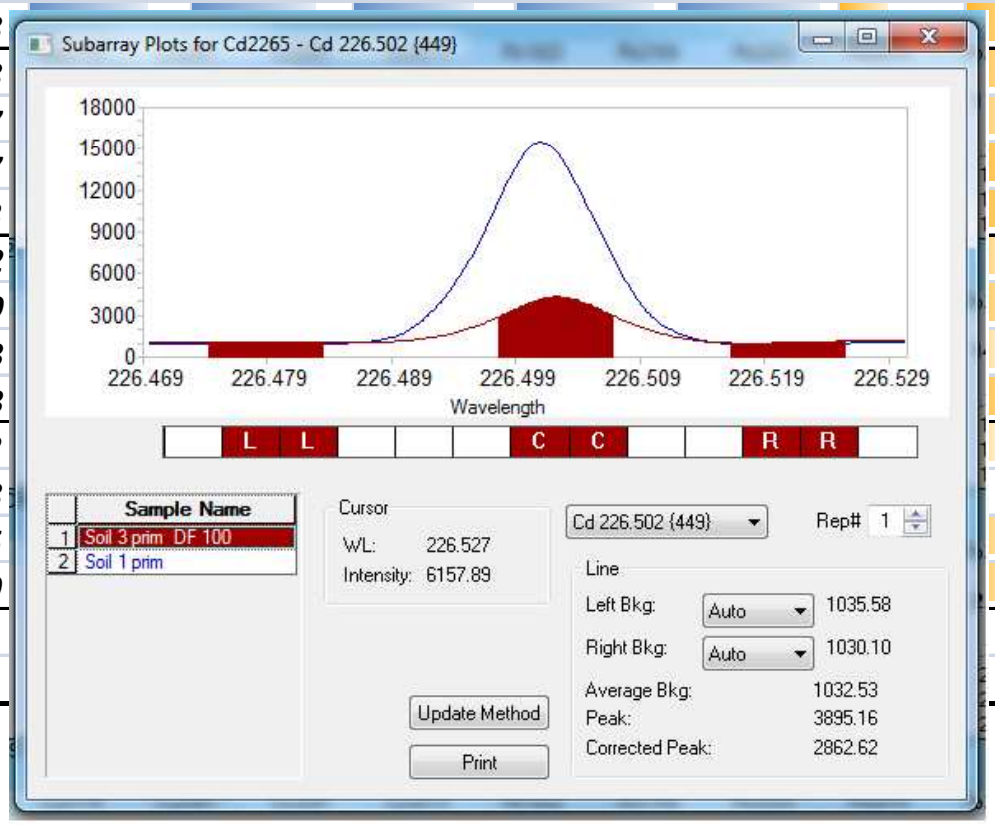
доц. Аланджийски

	Soil 1.1 DF=100	Soil 1.2 DF=100	Soil 2.1 DF=100	Soil 3.1 DF=100	Soil 3.2 DF=100	Soil 1 DF=200	Soil 2.1 + 1 ppm	Solil 2.1 + 5 ppm
						0.5	1.00	5.00
Cd2144	1.00	1.01	1.00	1.00	1.02	0.55	0.78	3.90
Cd2265	0.97	0.99	0.92	0.66	0.67	0.55	0.75	3.85
Cd2288	0.96	0.98	0.96	1.02	1.03	0.54	0.81	4.14
Cu2178	1.00	1.07	1.00	1.00	1.00	0.53	0.77	3.96
Cu2247	0.94	1.01	0.92	0.90	0.90	0.55	0.72	3.74
Cu3247	0.90	0.97	0.91	0.92	0.92	0.52	0.87	4.42
Cu3273	0.90	0.97	0.90	0.90	0.91	0.53	0.86	4.45
Pb1822	1.00	1.01	1.00	1.00	0.95	0.58	0.70	3.65
Pb2169	0.92	0.94	0.91	0.78	0.76	0.54	0.74	3.84
Pb2203	1.03	1.05	1.04	1.04	1.00	0.57	0.68	3.56
Pb2833	0.88	0.90	0.87	0.78	0.76	0.54	0.81	4.05
Zn2062	1.00	1.02	1.00	1.00	1.01	0.57	0.67	3.48
Zn2138	1.04	1.07	0.98	0.93	0.94	0.59	0.61	2.98
Zn3345	1.00	1.03	1.04	1.11	1.13	0.54	0.72	3.77
Zn4810	0.99	1.03	1.02	1.02	1.03	0.53	0.73	3.63
					Aver	0.55	0.75	3.83
					Faktor	0.910	0.75	0.77

Аграрен Университет
анализ на съдържание на тежки метали в почви

доц. Аланджийски

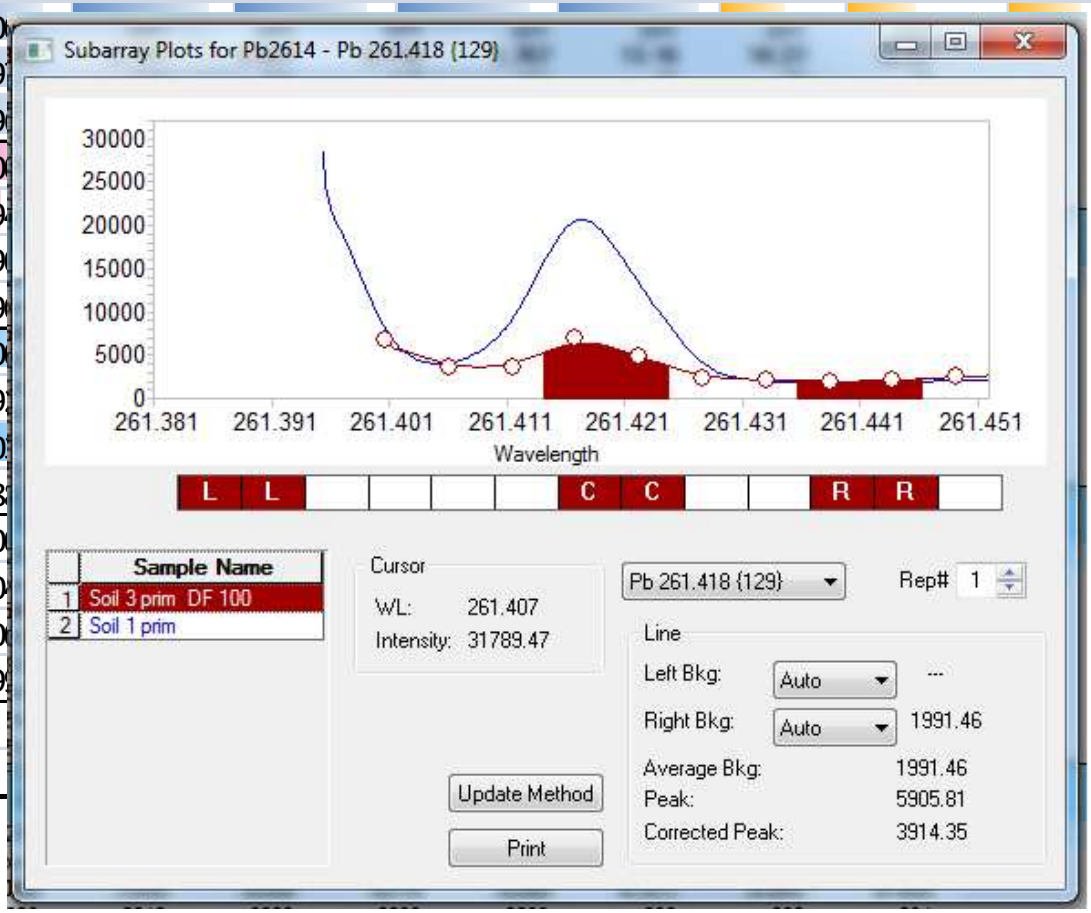
	Soil 1.1 DF=100	Soil 1.2 DF=100	Soil 2.1 DF=100	Soil 3.1 DF=100	Soil 3.2 DF=100	Soil 1 DF=200	Soil 2.1 + 1 ppm	Solil 2.1 + 5 ppm
						0.5	1.00	5.00
Cd2144	1.00	1.01	1.00	1.00	1.02	0.55	0.78	3.90
Cd2265	0.97	0.99	0.92	0.66	0.67	0.55	0.75	3.85
Cd2288							0.81	4.14
Cu2178							0.77	3.96
Cu2247							0.72	3.74
Cu3247							0.87	4.42
Cu3273							0.86	4.45
Pb1822							0.70	3.65
Pb2169							0.74	3.84
Pb2203							0.68	3.56
Pb2833							0.81	4.05
Zn2062							0.67	3.48
Zn2138							0.61	2.98
Zn3345							0.72	3.77
Zn4810							0.73	3.63
							0.75	3.83
							0.75	0.77

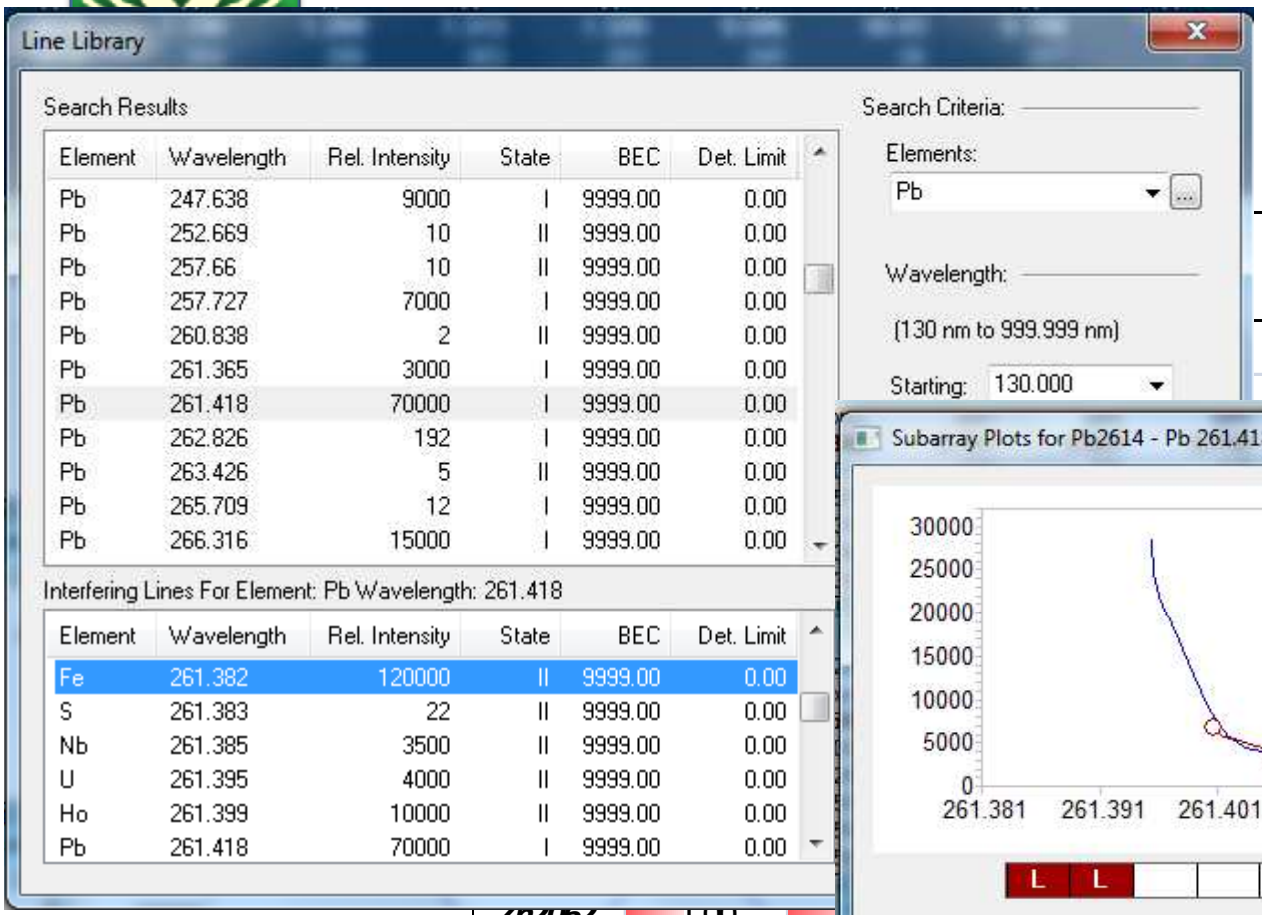


Аграрен Университет
анализ на съдържание на тежки метали в почви

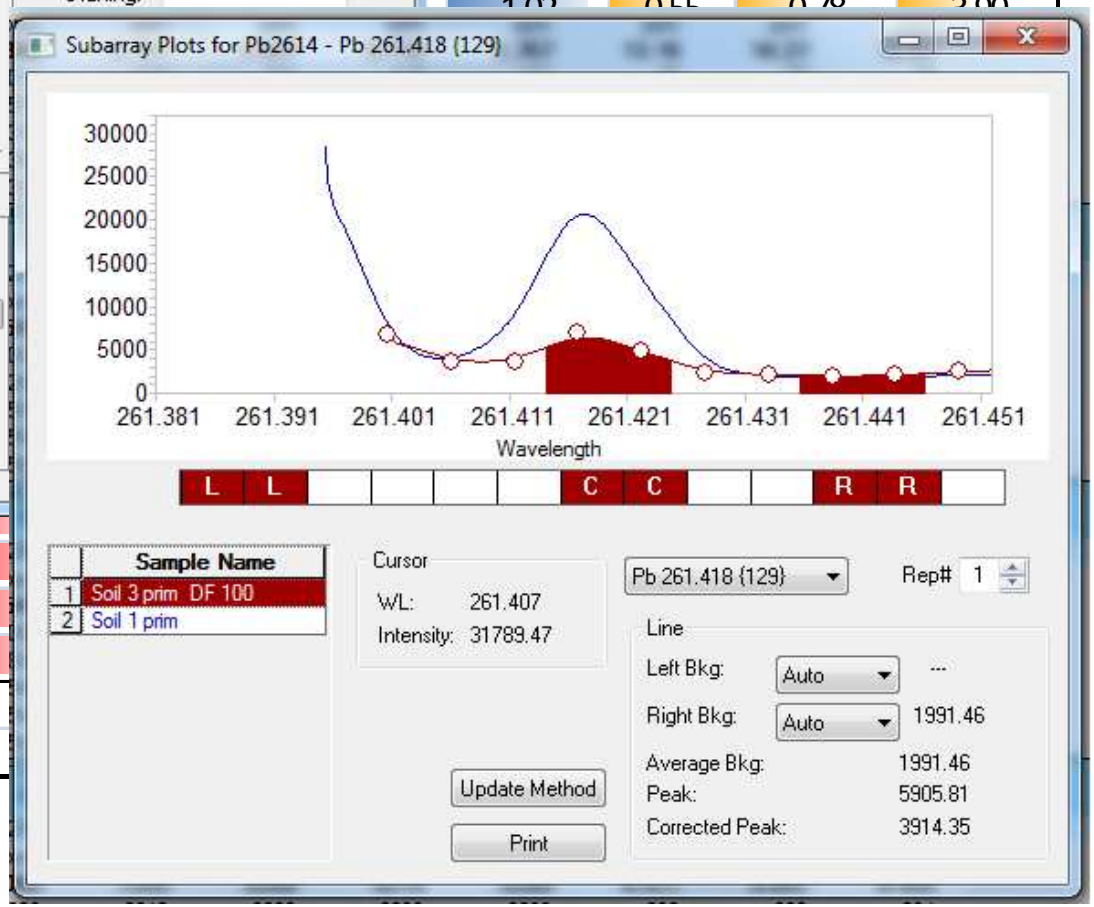
доц. Аланджийски

	Soil 1.1 DF=100	Soil 1.2 DF=100	Soil 2.1 DF=100	Soil 3.1 DF=100	Soil 3.2 DF=100	Soil 1 DF=200	Soil 2.1 + 1 ppm	Solil 2.1 + 5 ppm
						0.5	1.00	5.00
Cd2144	1.0							)0
Cd2265	0.9							35
Cd2288	0.9							14
Cu2178	1.0							)6
Cu2247	0.9							74
Cu3247	0.9							12
Cu3273	0.9							15
Pb1822	1.0							55
Pb2169	0.9							34
Pb2203	1.0							56
Pb2833	0.8							)5
Zn2062	1.0							18
Zn2138	1.0							)8
Zn3345	1.0							77
Zn4810	0.9							53
								33
								77





	Soil 3.2 DF=100	Soil 1 DF=200	Soil 2.1 + 1 ppm	Solil 2.1 + 5 ppm
		0.5	1.00	5.00
	1.02	0.55	0.78	3.00
Zn2062	1.00			
Zn2138	1.04			
Zn3345	1.00			
Zn4810	0.99			



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анализ на съдържание на тежки метали в почви

доц. Аланджийски

Проба	Pb ppm	*Pb RSD%*	Cd ppm	*Cd RSD%*	Cu ppm	*Cu RSD%*	Zn ppm	*Zn RSD%*
I Първоначално сито 0.315	**1750**	*6*	**40**	*3*	**160**	*4*	**1800**	*7*
II Първоначално	**1100**	*6*	**27**	*4*	**140**	*5*	**1150**	*7*
I след сито 0.315	**310**	*7*	**6**	*8*	**105**	*5*	**420**	*7*

Thermo SCIENTIFIC

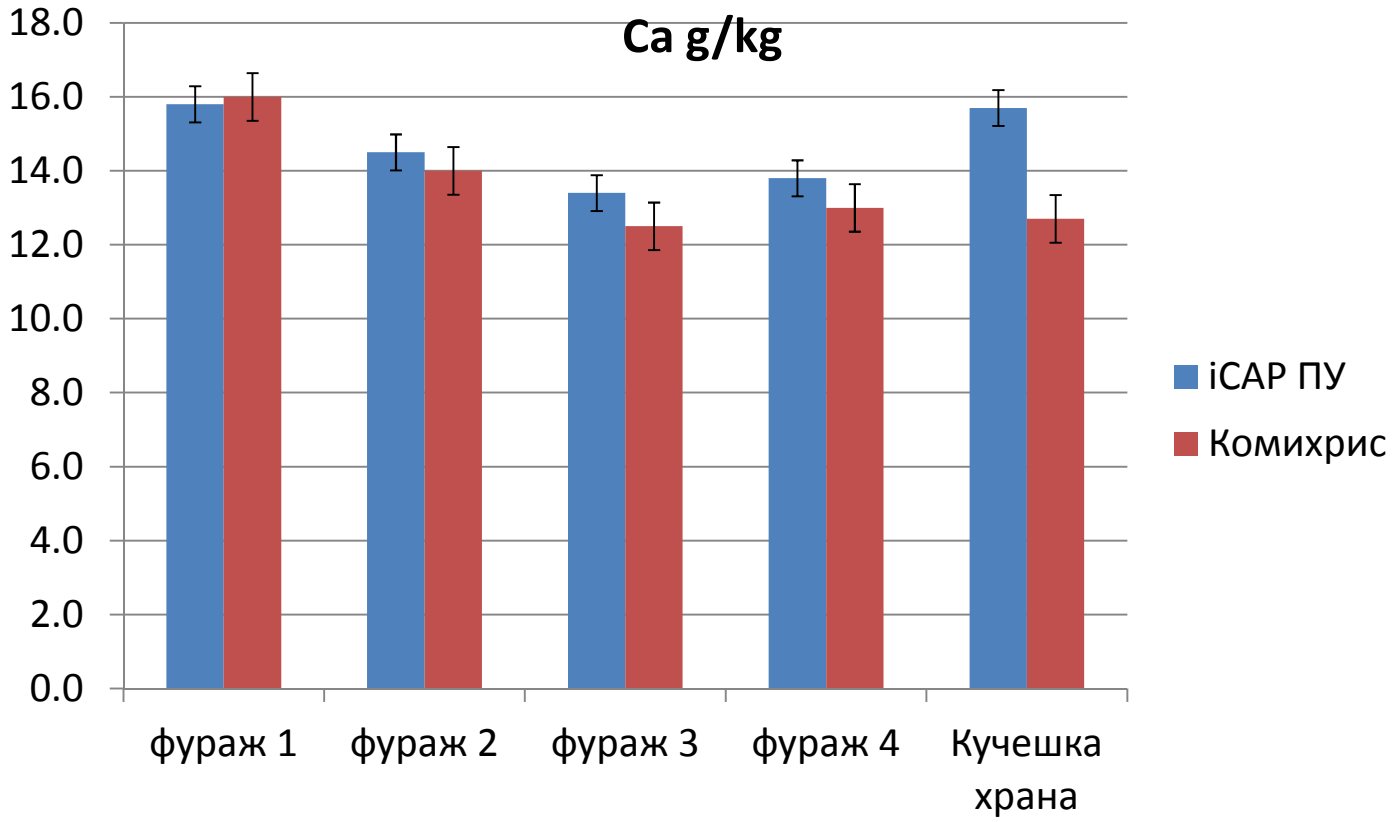
BioSupport

СЕМИНАР 5

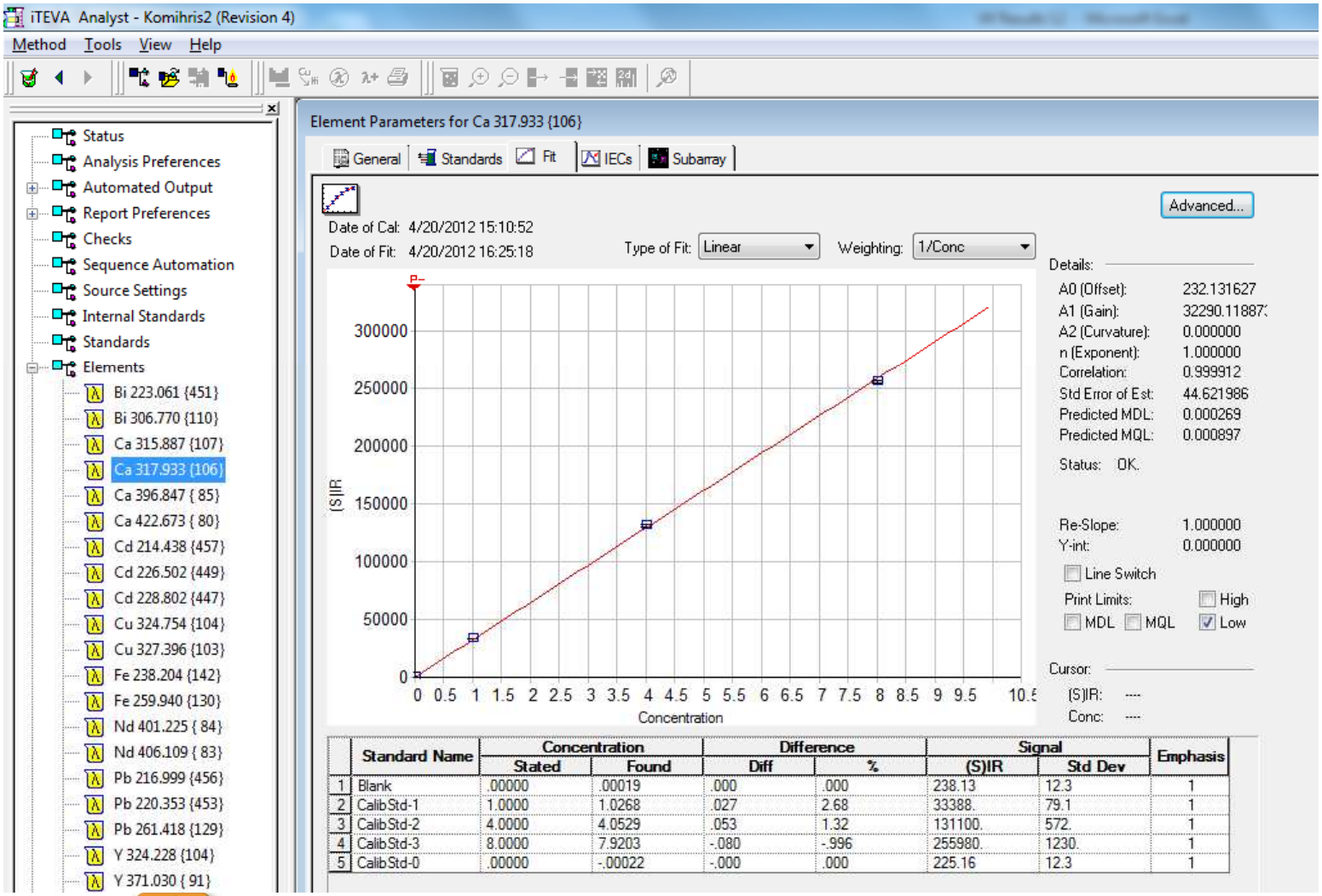
FBA анализ на храни и обекти на околната среда

Междулабораторни сравнения при анализ на храни ПУ и Комихрис

Ca – 317.9 nm

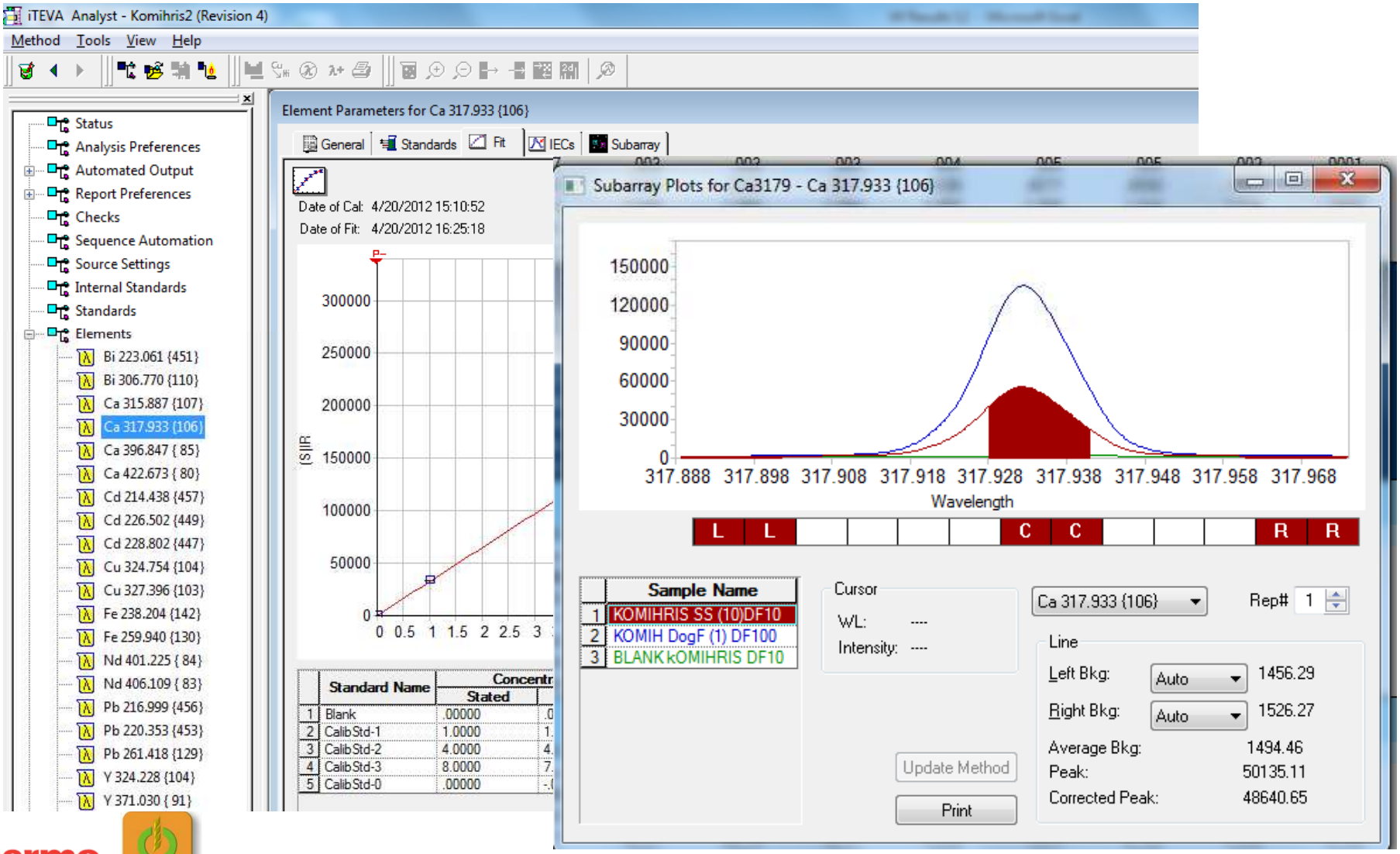


Междулабораторни сравнения при анализ на храни ПУ и Комихрис

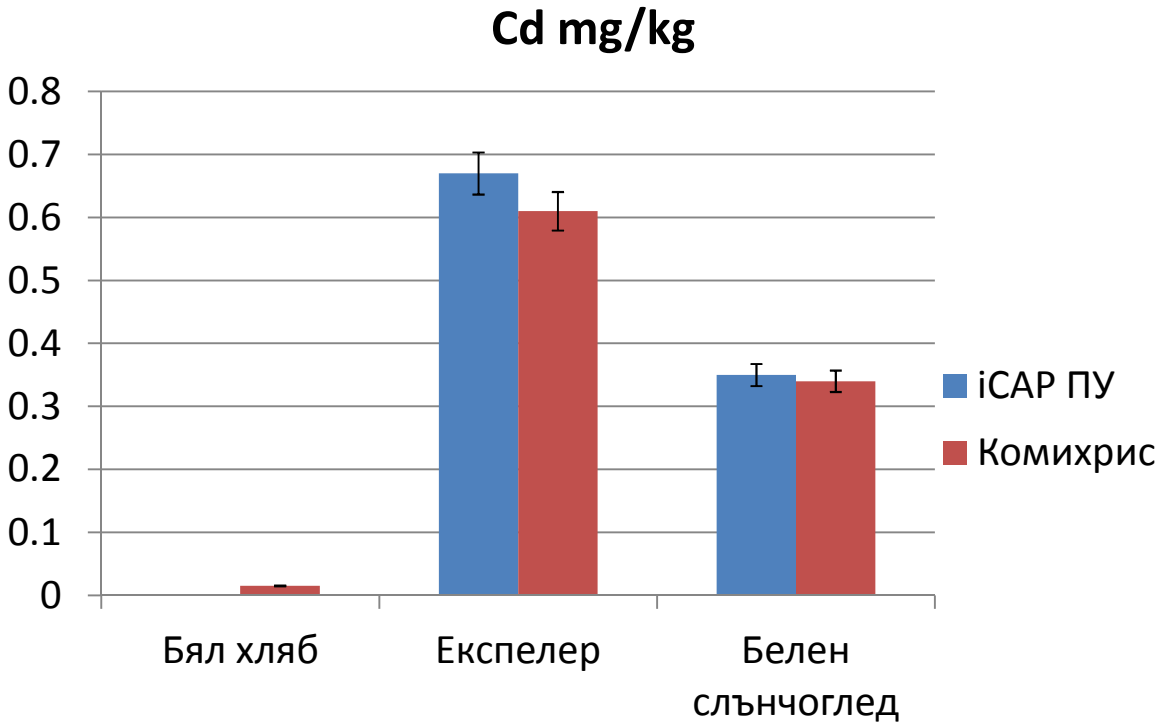


	Standard Name	Concentration		Difference		Signal		Emphasis
		Stated	Found	Diff	%	(S)IR	Std Dev	
1	Blank	.00000	.00019	.000	.000	238.13	12.3	1
2	CalibStd-1	1.0000	1.0268	.027	2.68	33388.	79.1	1
3	CalibStd-2	4.0000	4.0529	.053	1.32	131100.	572.	1
4	CalibStd-3	8.0000	7.9203	-.080	-.996	255980.	1230.	1
5	CalibStd-0	.00000	-.00022	-.000	.000	225.16	12.3	1

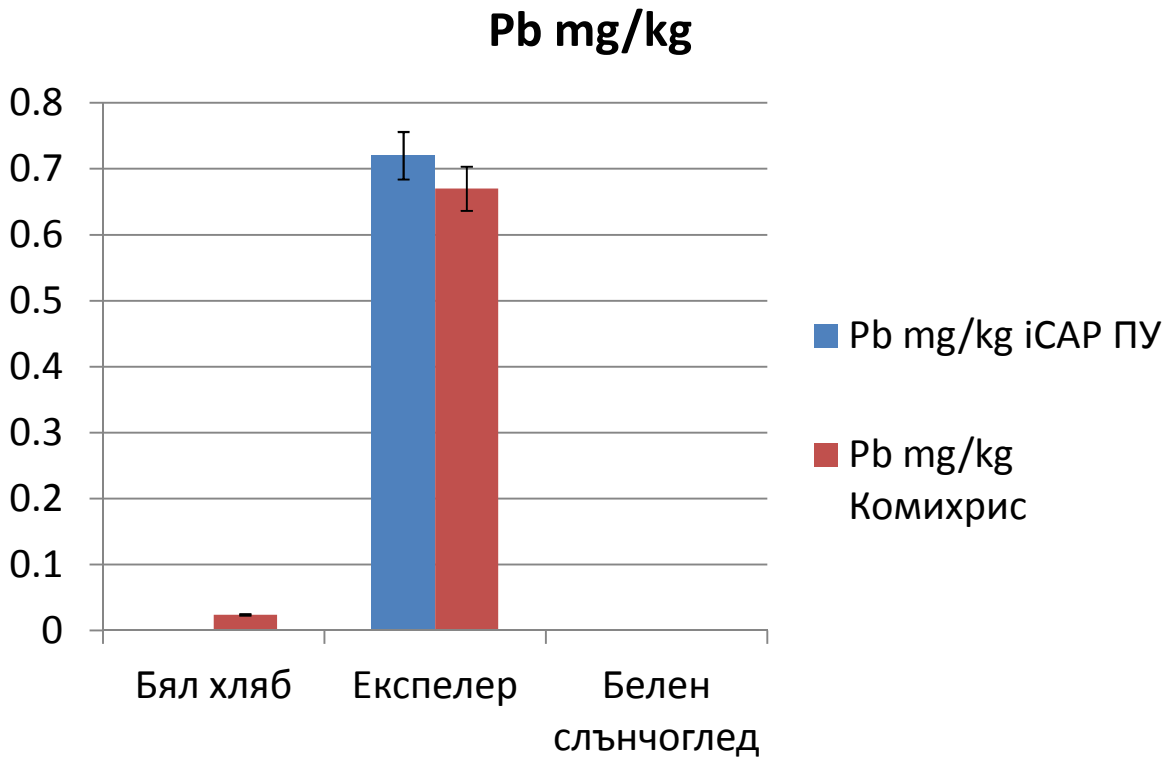
Междулабораторни сравнения при анализ на храни ПУ и Комихрис



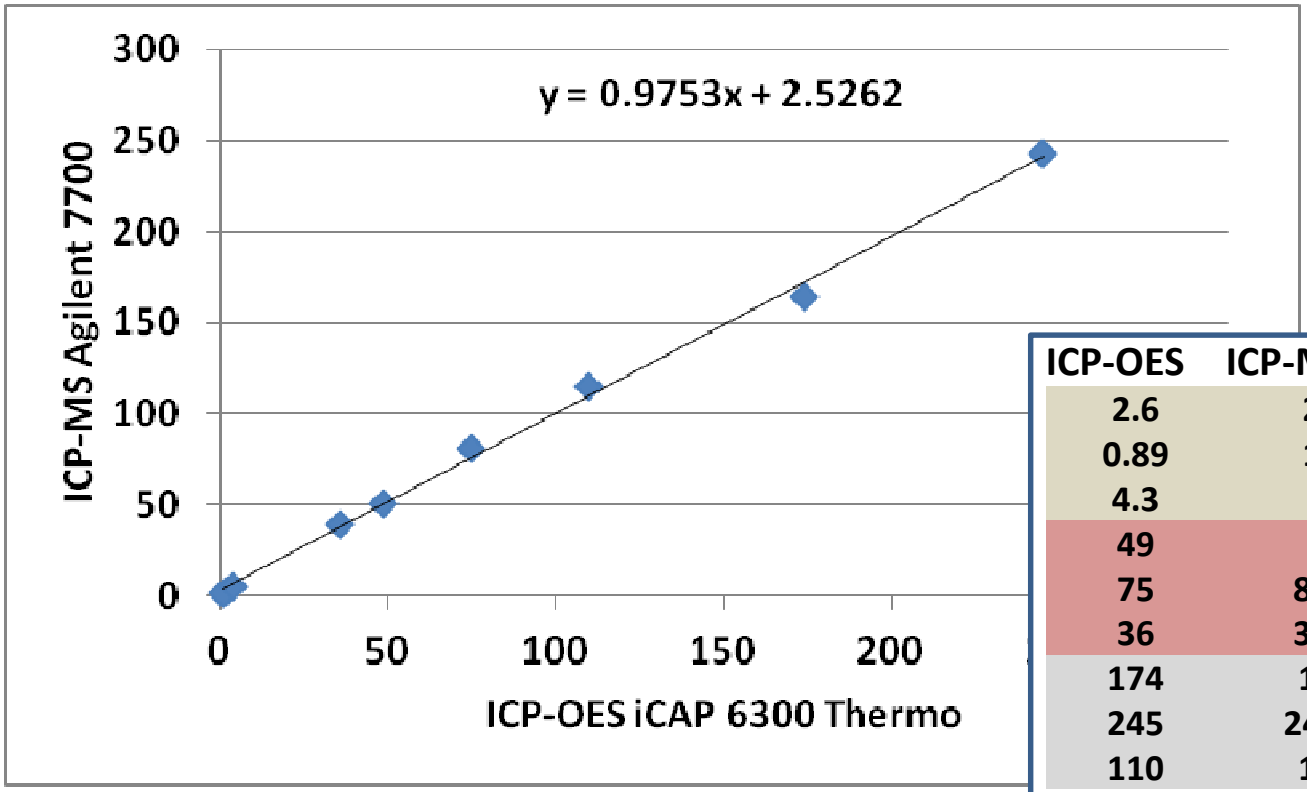
Междулабораторни сравнения при анализ на храни ПУ и Комихрис



Междулабораторни сравнения при анализ на храни ПУ и Комихрис



Междулабораторни сравнения при анализ на храни ПУ и Комихрис



ICP-OES	ICP-MS	ppb	
2.6	2.8	Cd	Бел. Слънчоглед 1
0.89	1.0	Cd	Бел. Слънчоглед 13
4.3	5	Cd	Бял хляб
49	51	Cu	Бел. Слънчоглед 1
75	81.0	Cu	Бел. Слънчоглед 13
36	39.5	Cu	Бял хляб
174	164	Zn	Бел. Слънчоглед 1
245	243.0	Zn	Бел. Слънчоглед 13
110	115	Zn	Бял хляб

Y Rh IS дрейф

< 5 % < 5 %

Анализ на алуминиево фолио за опаковъчни капачки за храни

	ICP OES		ICP MS		FAAS	
Елемент	Conc., ppm	RSD, %	Conc., ppm	RSD, %	Conc., ppm	RSD %
Cu	**43**	0.9	**45**	1.6	NA	
Fe	**1.19E+04**	1.4	**1.21E+04**	3.4	**1.12E+04**	3.6
Mg	**70**	0.5	**78**	4.1	**67**	4.4
Zn	**104**	0.3	**102**	2.9	NA	

On-line въвеждане на вътрешен стандарт чрез смесени потоци

FBA ЛАБОРАТОРИЯ BioSupport

Благодаря за
вниманието
и успех на
семинара !!