



VIJAY KUMAR VEMURI

SpectraFlow Online Analyzer

NIR based Analyzer for Coal & AFR application



SpectraFlow Online Analyzer

Solid Fuels



Coal



Pet coke

Solid fuels of different grades and qualities available for use in cement plants



SpectraFlow Online Analyzer

Alternative Fuels in Cement Industry



RDF



Wood Chips



Rice husk



Tyre Chips



Palm waste



Sewage sludge



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Challenges faced while using solid fuels and AFR

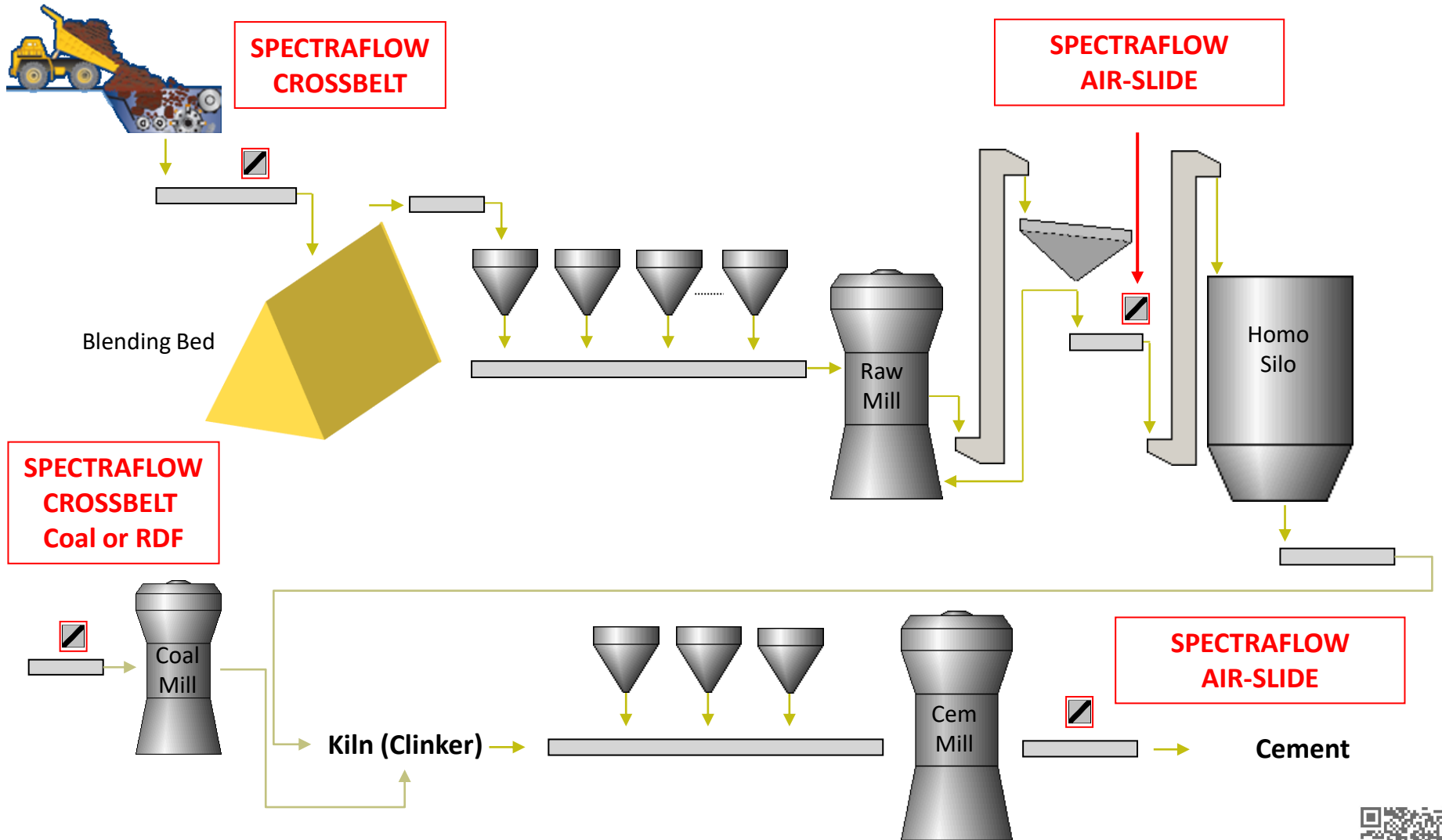
- High variability in quality
- Continuous supply of required quantities
- Some material is seasonally available
- High range of bulk densities
- High moisture content

Online analysis will facilitate handling of some of the challenges



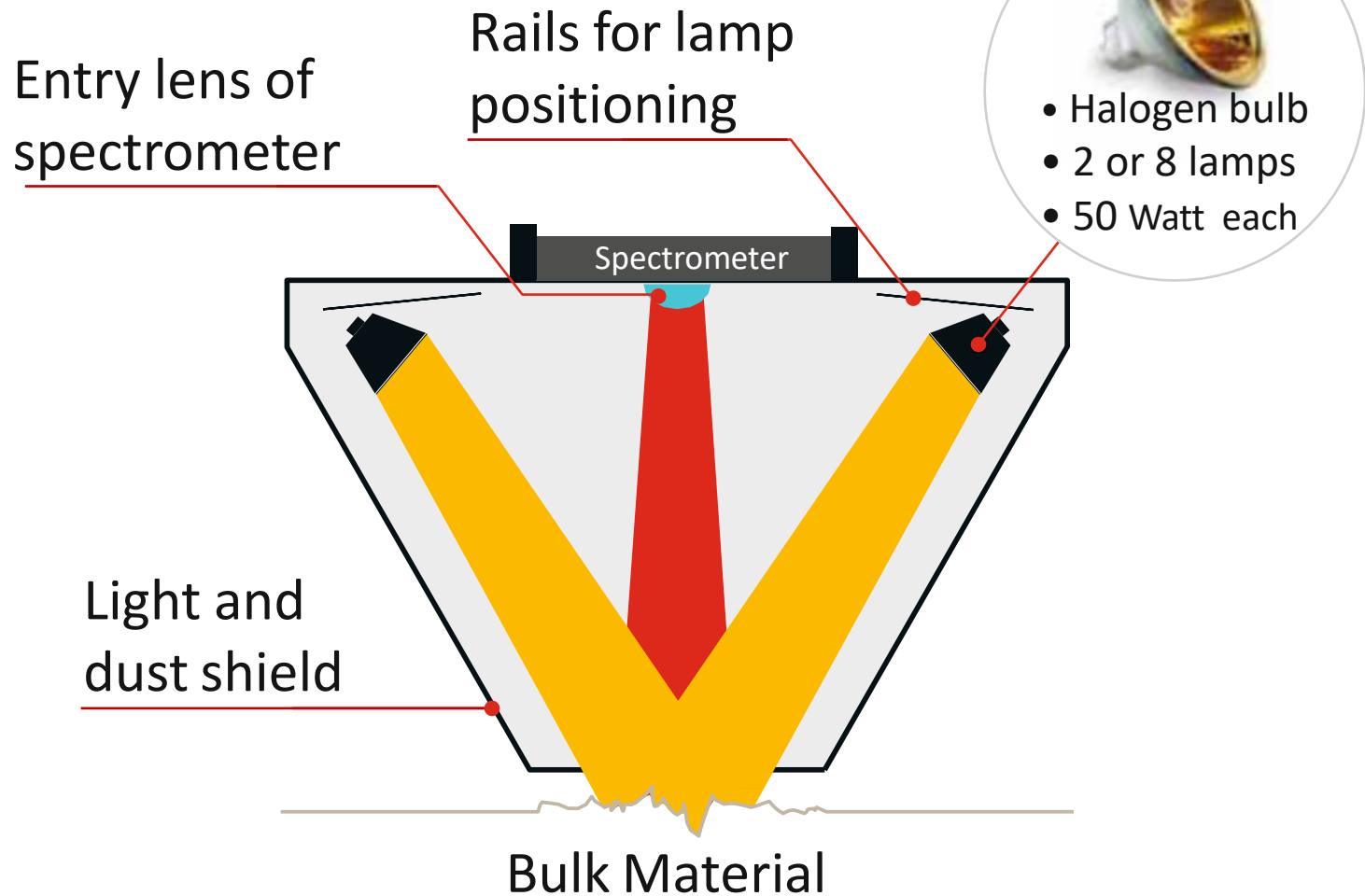
SpectraFlow Cement Analyzer

Position in Cement Production Process



SpectraFlow Cement Analyzer

NIR Analysis Technology



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Minerals have a NIR signature

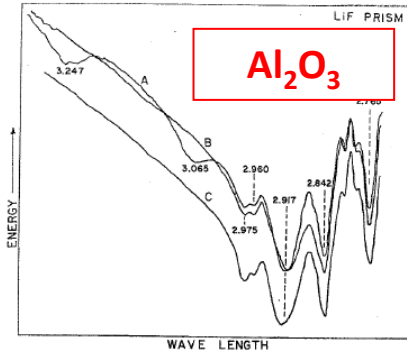
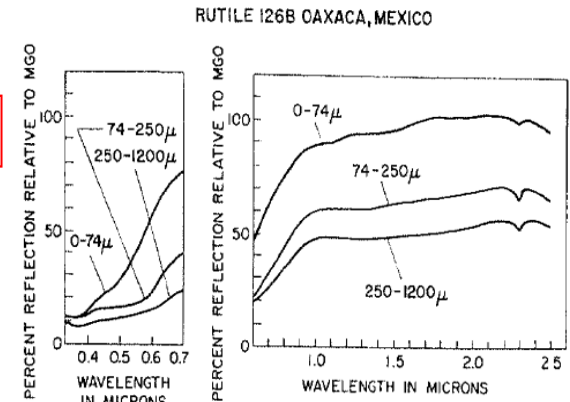
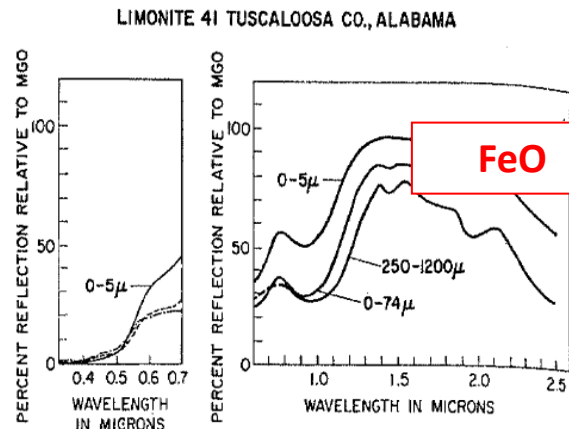
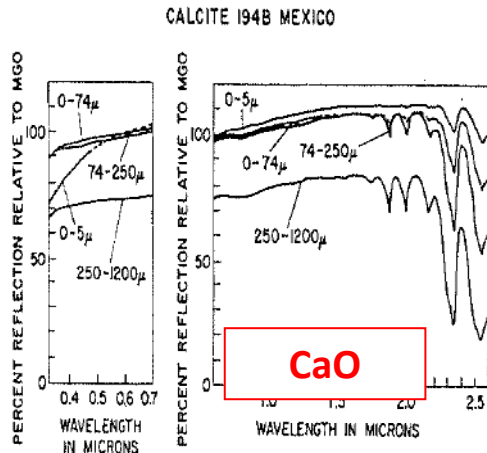
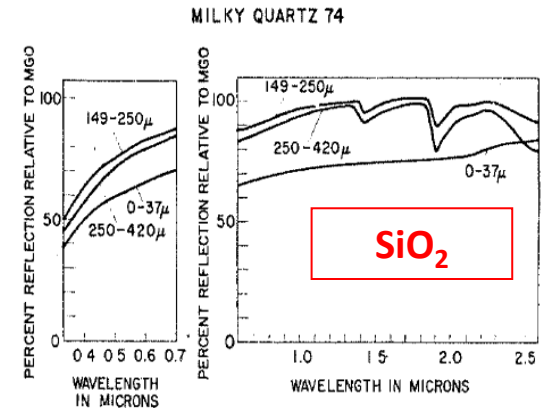
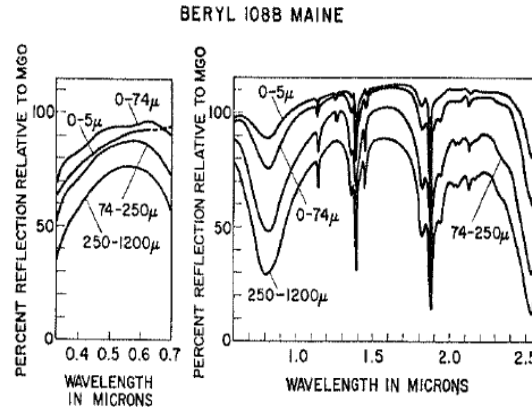


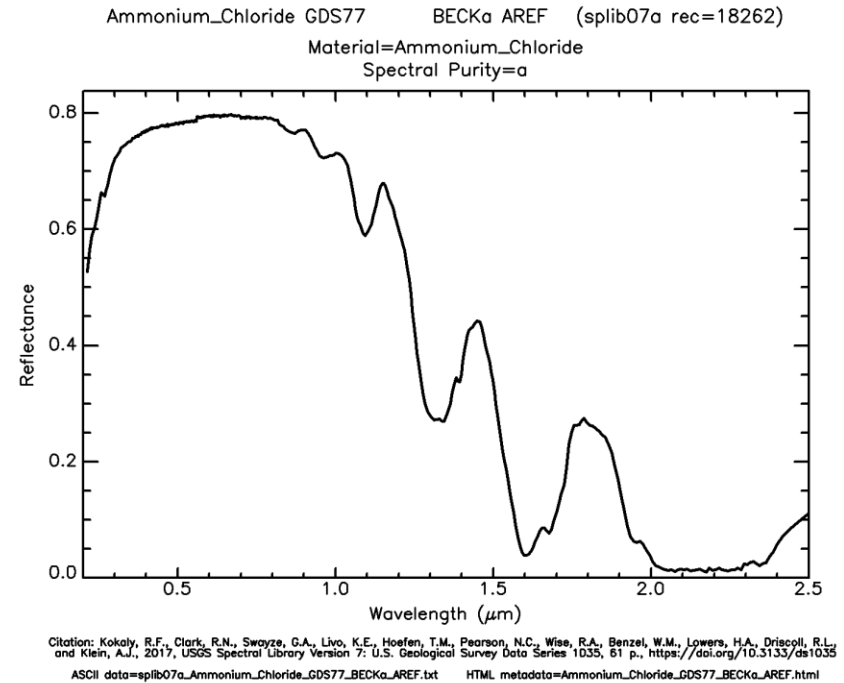
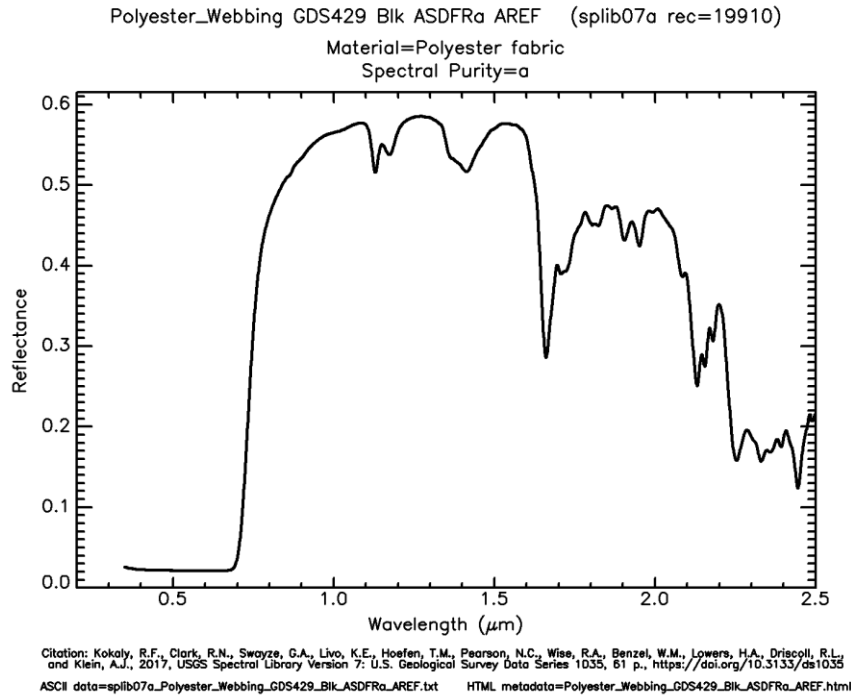
Figure 5. O-H Spectra, Aluminas in Bauxite Ore, Stretching Region, Lithium Fluoride Prism

A. Arkansas No. 3
B. Arkansas No. 2
C. Arkansas No. 1



Hunt, Salisbury: Visible and Near Infra Red Spectra of Minerals and Rocks 1970

SpectraFlow Analyzer



USGS SpectraLib

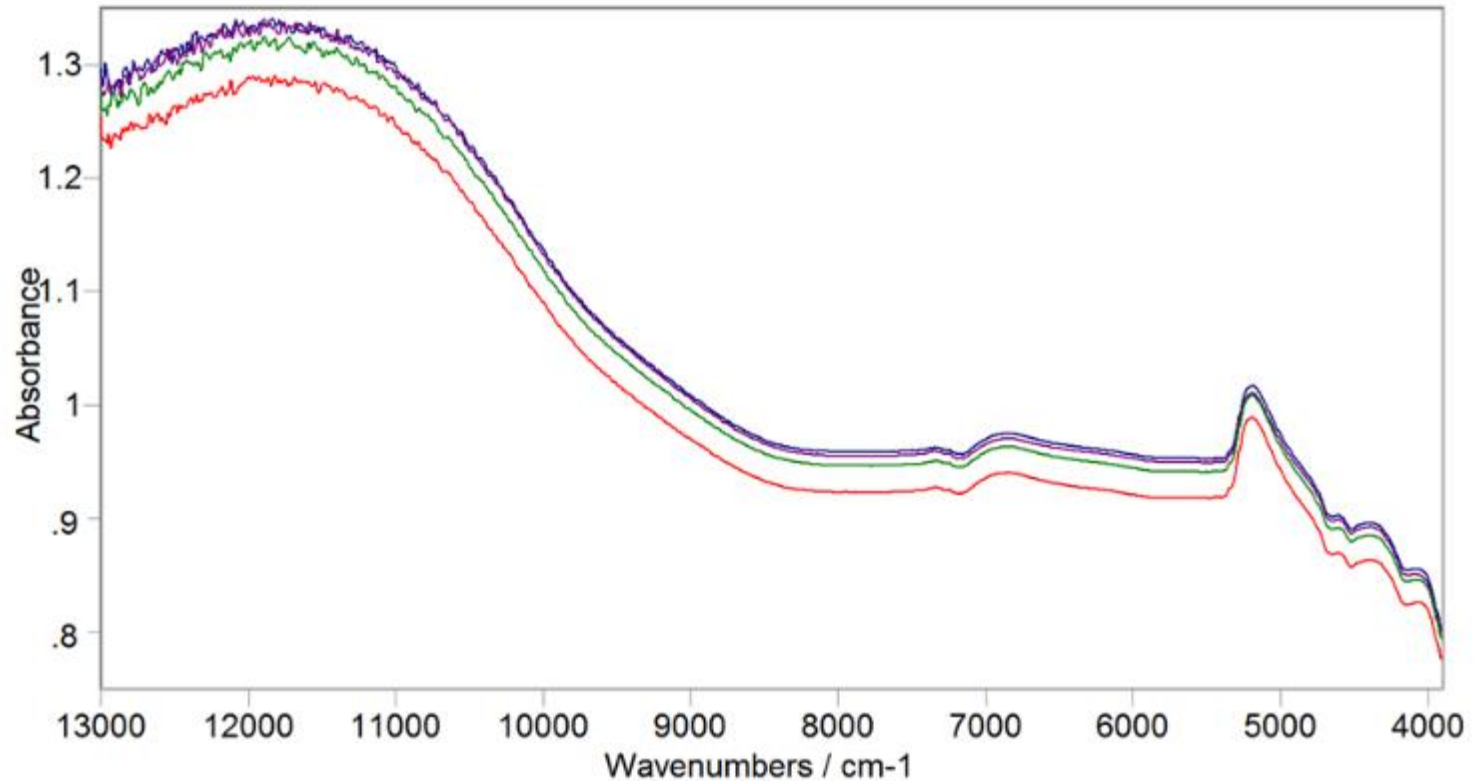


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SpectraFlow Minerals Online Analyzer

NIR Analysis Technology



Typical Wide-NIR Spectra of Iron Ore from samples



SpectraFlow Cement Analyzer Laboratory set-up





SpectraFlow On-Line Analyzer Crossbelt Application



SpectraFlow Cement Analyzer

Crossbelt Application – Analyzer Installation



Spectrometer
compartment

Illumination
unit and dust
protection
cover

Electronic
cabinet and
communication
unit

Mounting frame
supplied by the
customer



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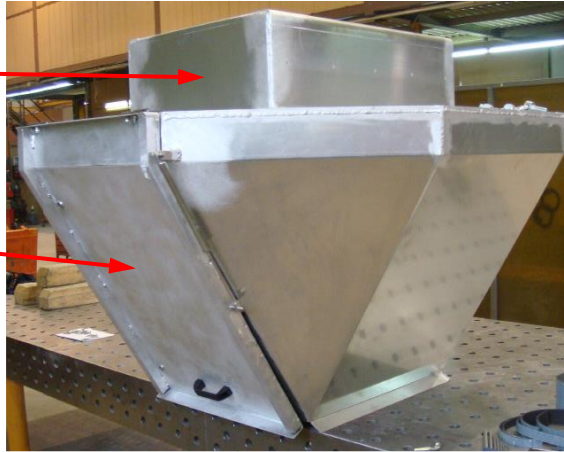


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Crossbelt Application – Analyzer Pictures

Spectrometer
Compartment

Service
Flap which
can be
opened to
access the
lights



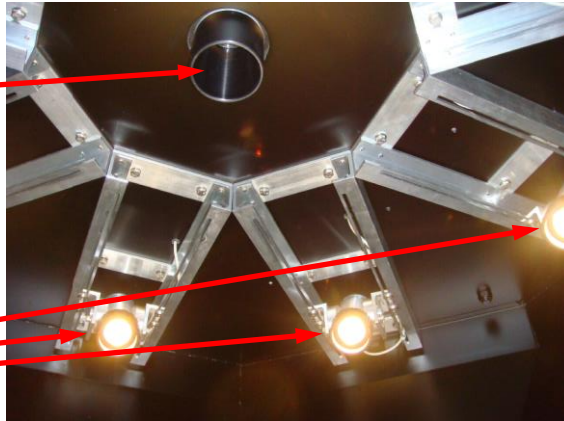
Overall view



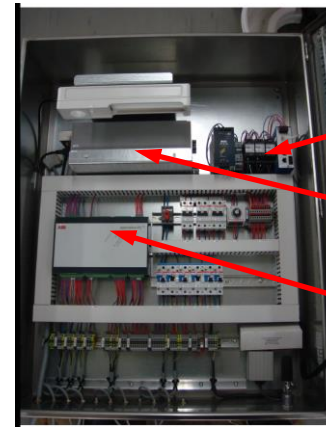
Inside view during operation

Entry for the
reflected
Infrared into
Spectrometer

Spots as
Infrared
Sources



View on rails and lamps



Interfaces

Power Supply
for the spots

Industrial PC (IPC)

Electronic cabinet



SpectraFlow Cement Analyzer Installation Example – AirSlide Analyzer



SpectraFlow Cement Analyzer Installation Example – CB for Carbon material



SpectraFlow Cement Analyzer Installation Example – CBA on RDF



SpectraFlow Cement Analyzer Installation Example – ASA





SpectraFlow On-Line Analyzer RDF Application



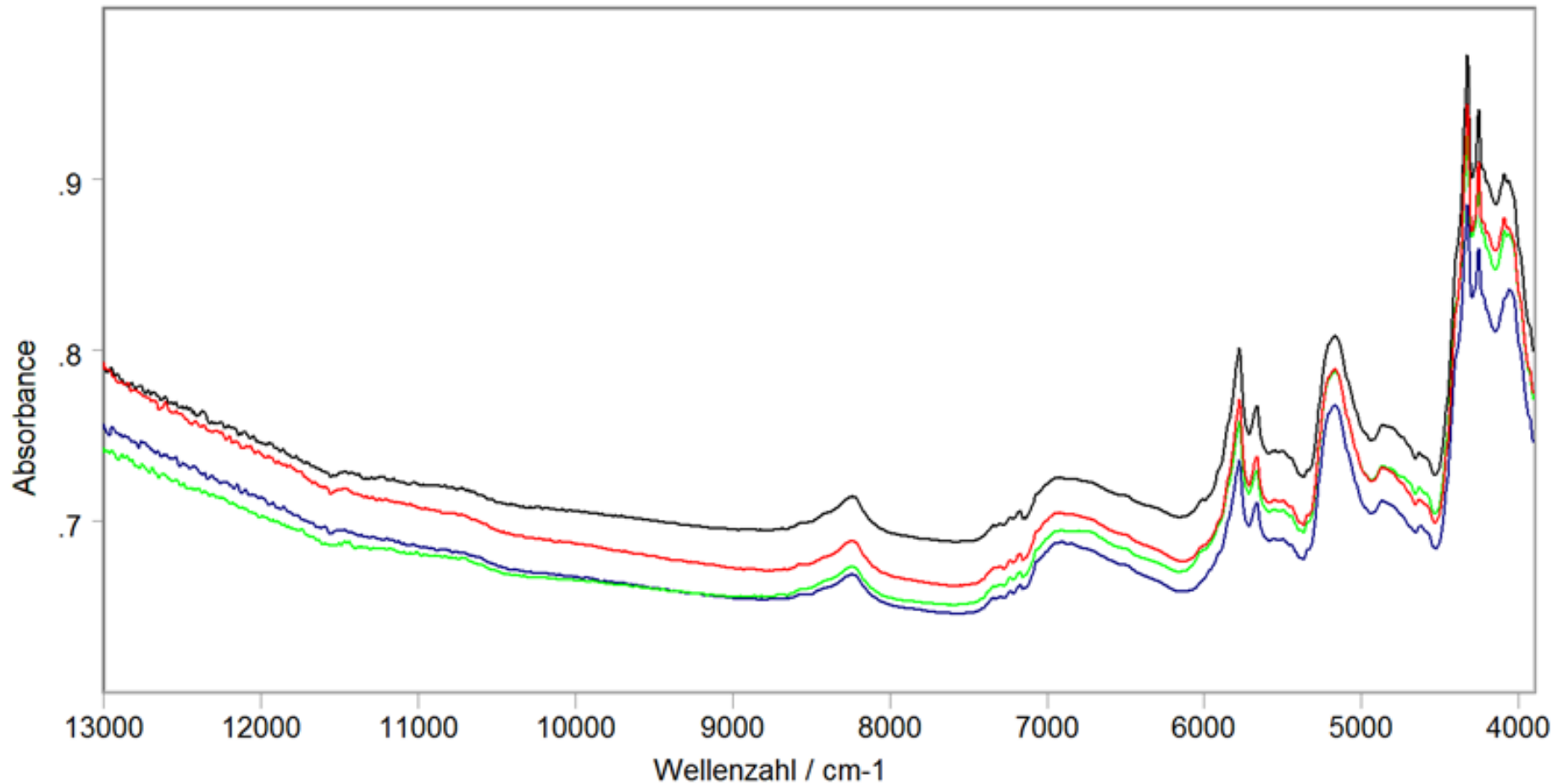
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RDF Samples

Labor-Nr.		30562-15	30563-15	30564-15	30565-15	30566-15	30644-15	30645-15	30646-15	30647-15
Vers.		1	1	1	1	1	1	1	1	1
Probenbez.	Einheit	Probe 1 Kunststoffreste	Probe 2 Kunststoffreste 0,86 % Cl	Probe 3 Kunststoffreste 0,98 % Cl	Probe 4 Kunststoffreste 1,55 % Cl	Probe 5 Kunststoffreste 0,64 % Cl	Probe 6 Kunststoffreste	Probe 7 Kunststoffreste	Probe 8 Kunststoffreste	Probe 9 Kunststoffreste
Störstoffe (nichtbrennbar)	%	1.32	keine				0.12	keine	0.33	0.32
Grobe Feuchte	%	10.5	14.6	17.8	11.1	10.3	13.6	23.5	16.6	14.5
Cl (i.an.) - Brennstoffe	%			0.98	1.55	0.64	0.61	0.36	1.82	1.59
Schwefel (CS-Analysator)	%	0.30	0.08	0.09	0.07	0.85	0.66	0.10		
Cd-ICP	mg/kg	3.58		0.51	0.29	0.24	2.81	0.50	3.48	
Cr-ICP	mg/kg		21	58		9	105	21	35	112
Hg-AMA	mg/kg	0.151	0.042	0.049		0.029	0.170	0.030		0.180
P-ICP	mg/kg	422			319	17	434	197	305	401
TI-ICP	mg/kg	<0,740	<0,750	<0,730	<0,720	<0,710	<0,730	<0,750	<0,740	<0,740
Bemerkung		ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze	ICP: TI-Wert unterhalb der Nachweisgrenze

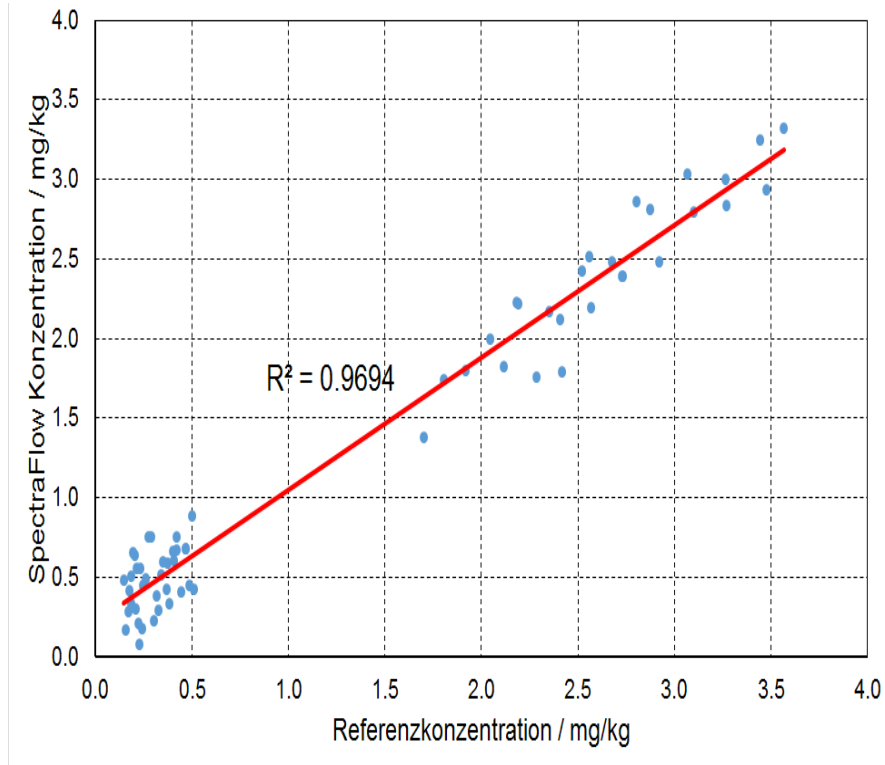
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RDF Samples – 4 Spectra of a sample

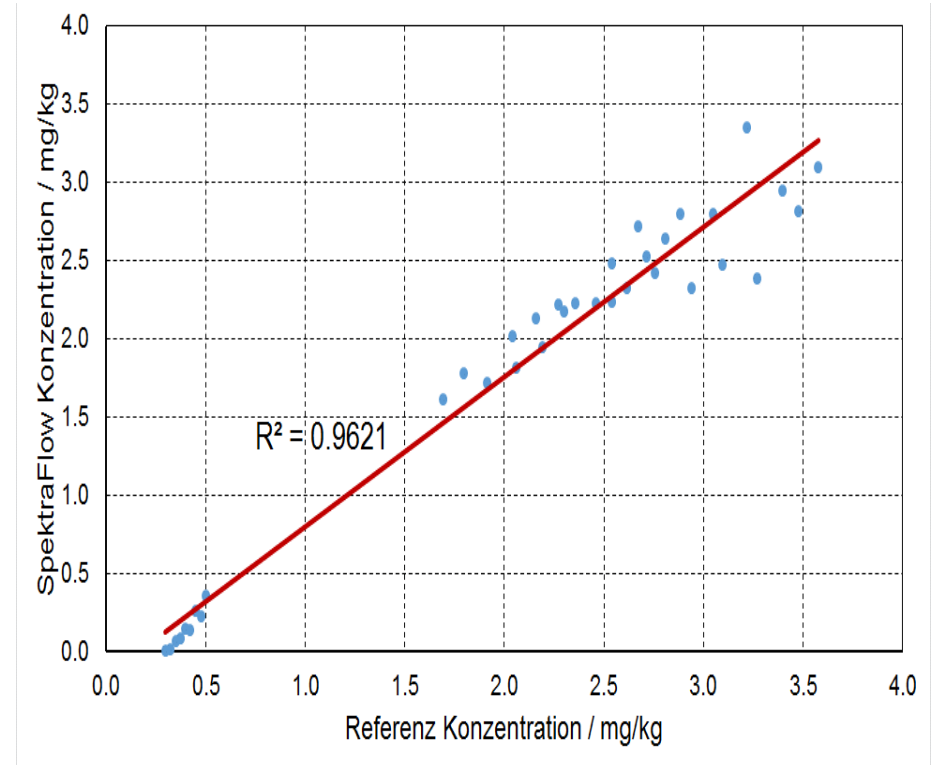


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RDF Samples – Calibration for Cadmium



Calibration curve

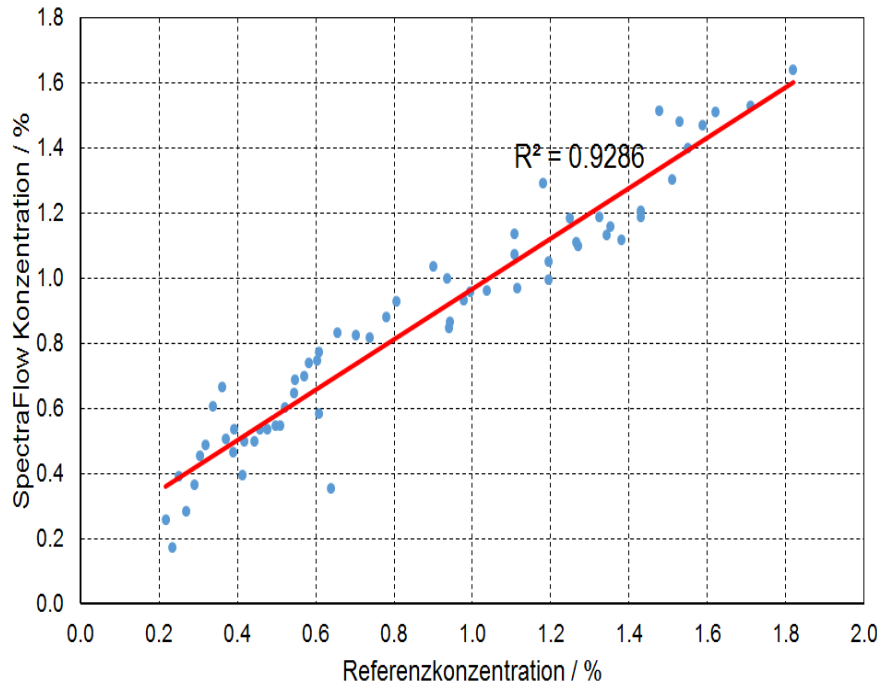


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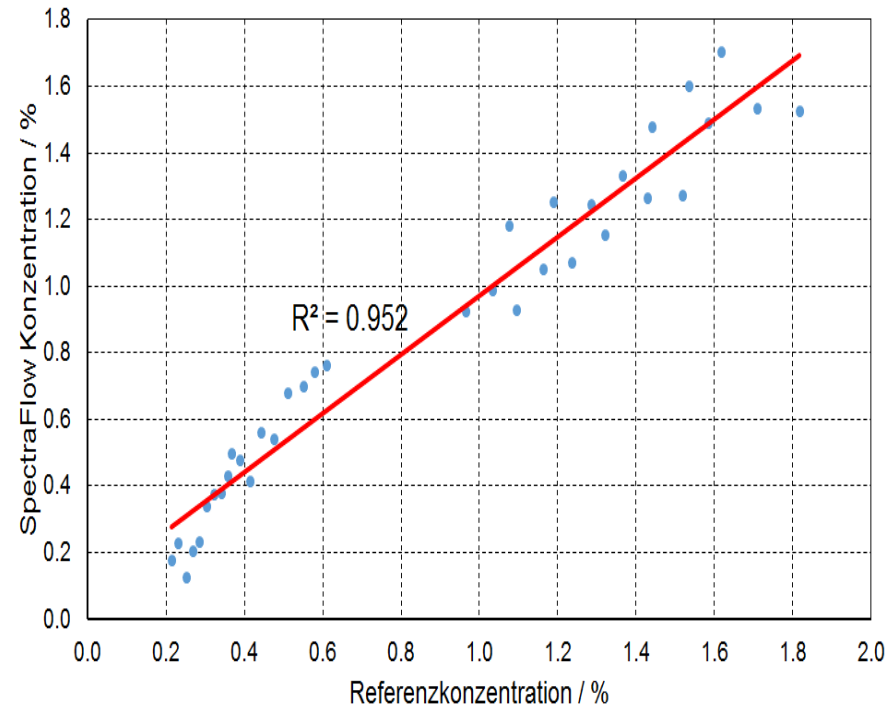


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RDF Samples – Calibration for Chlorine



Calibration curve

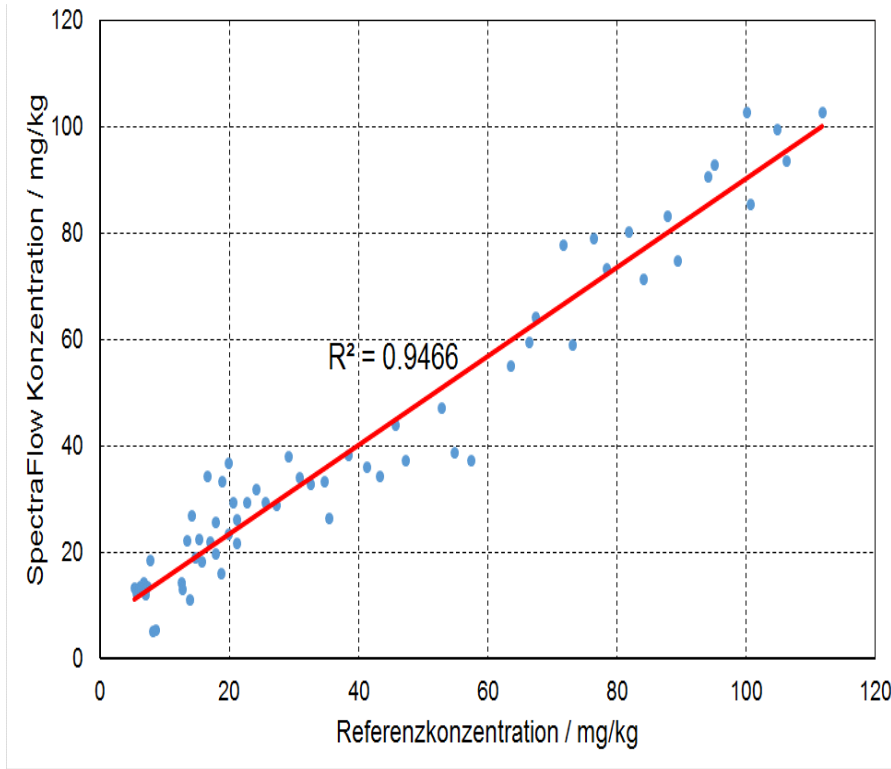


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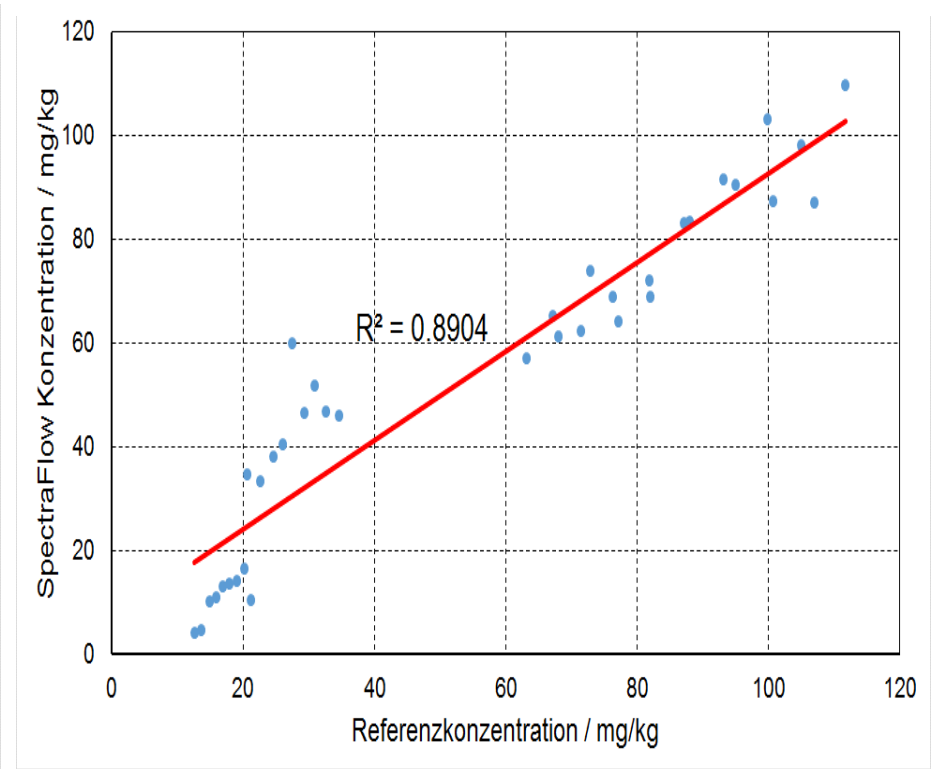


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RDF Samples – Calibration for Chromium



Calibration curve

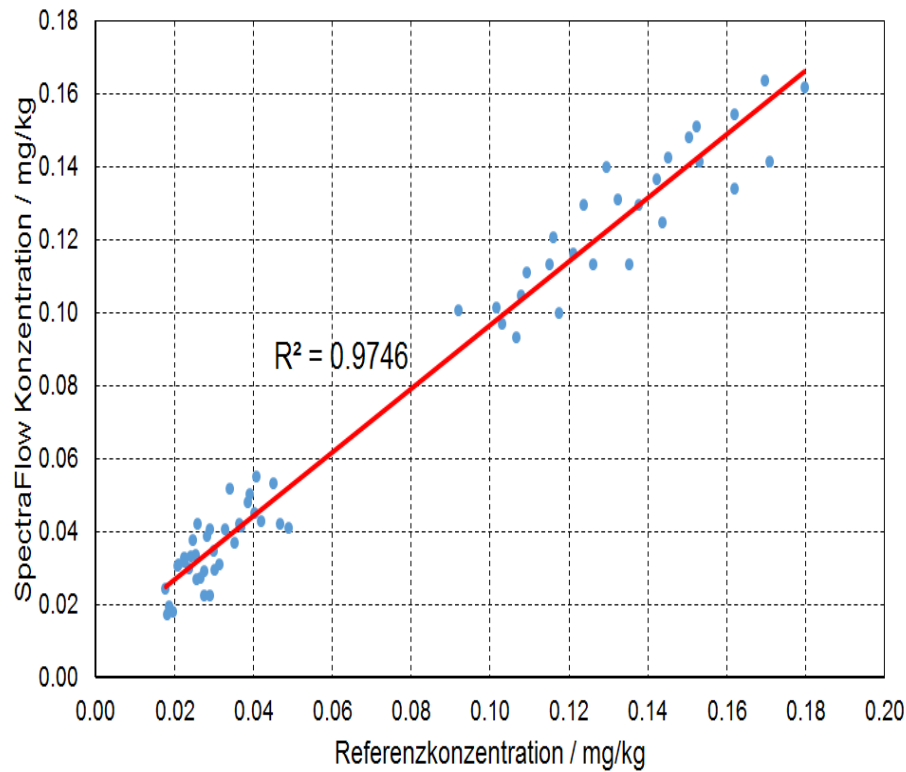


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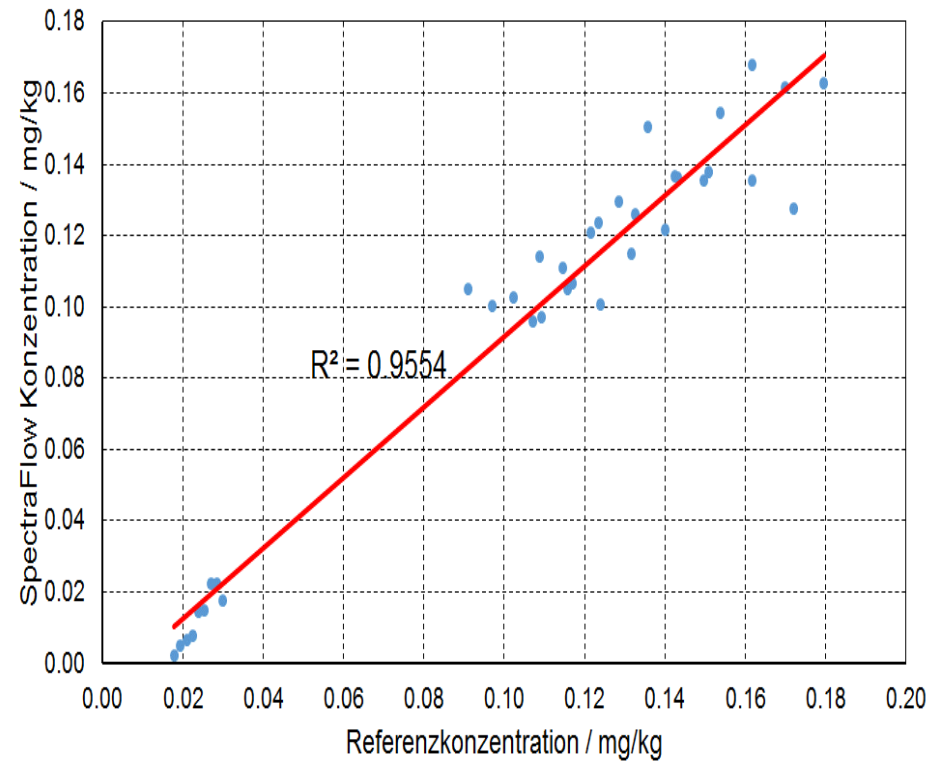


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RDF Samples – Calibration for Mercury



Calibration curve

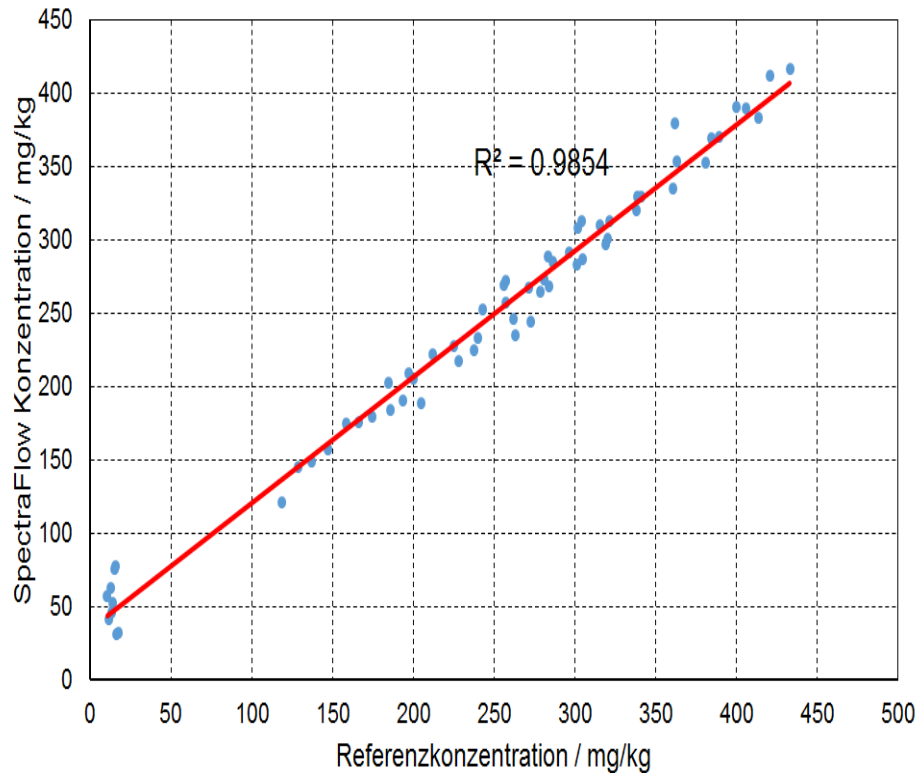


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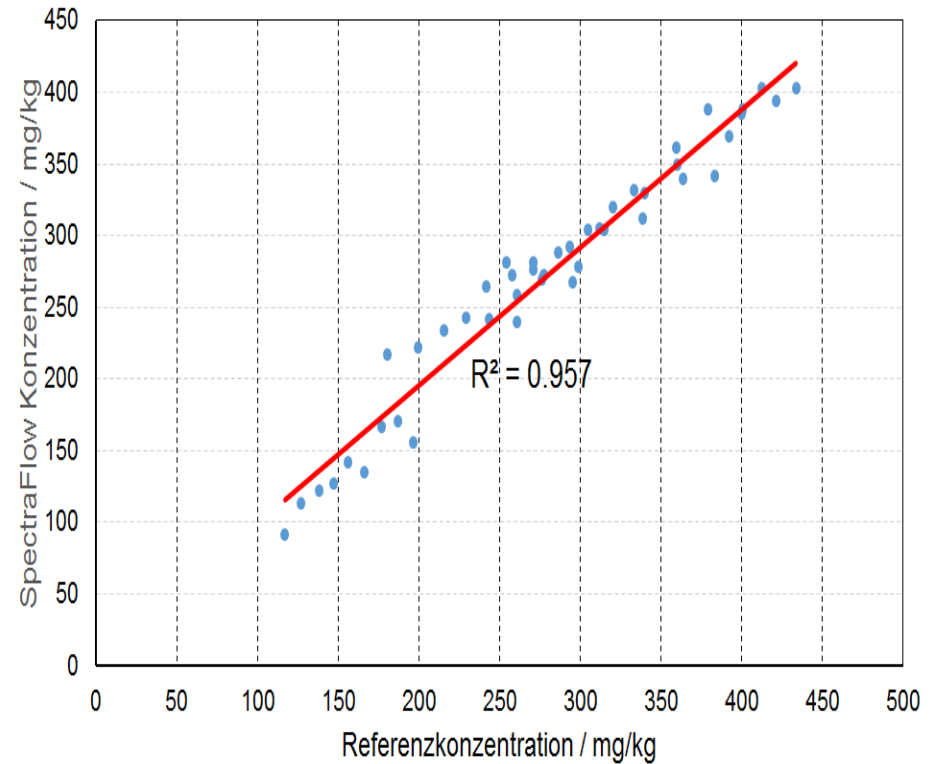


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RDF Samples – Calibration for Phosphorus



Calibration curve

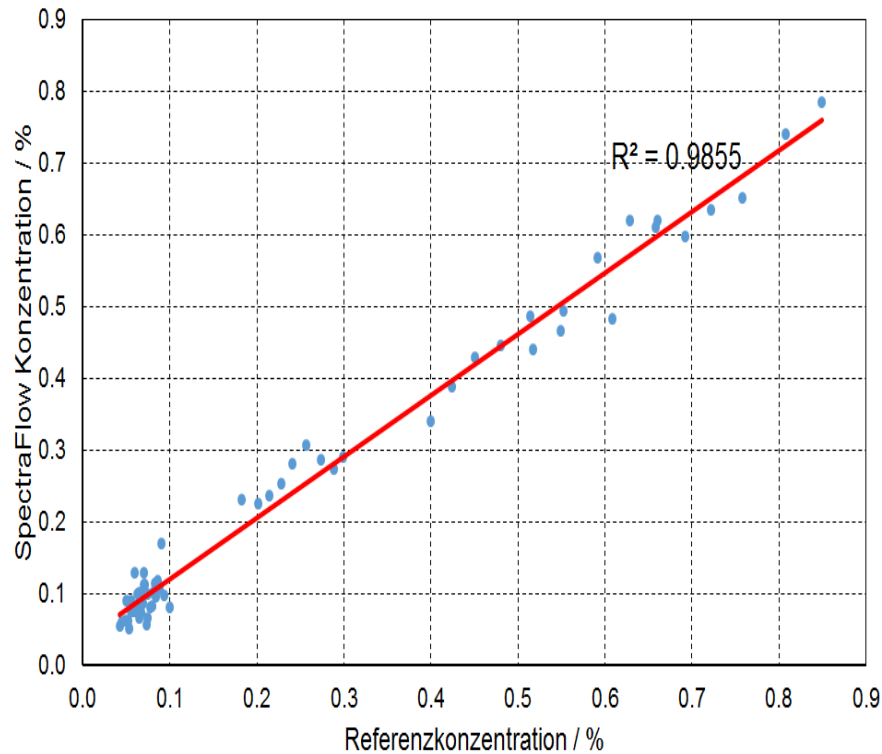


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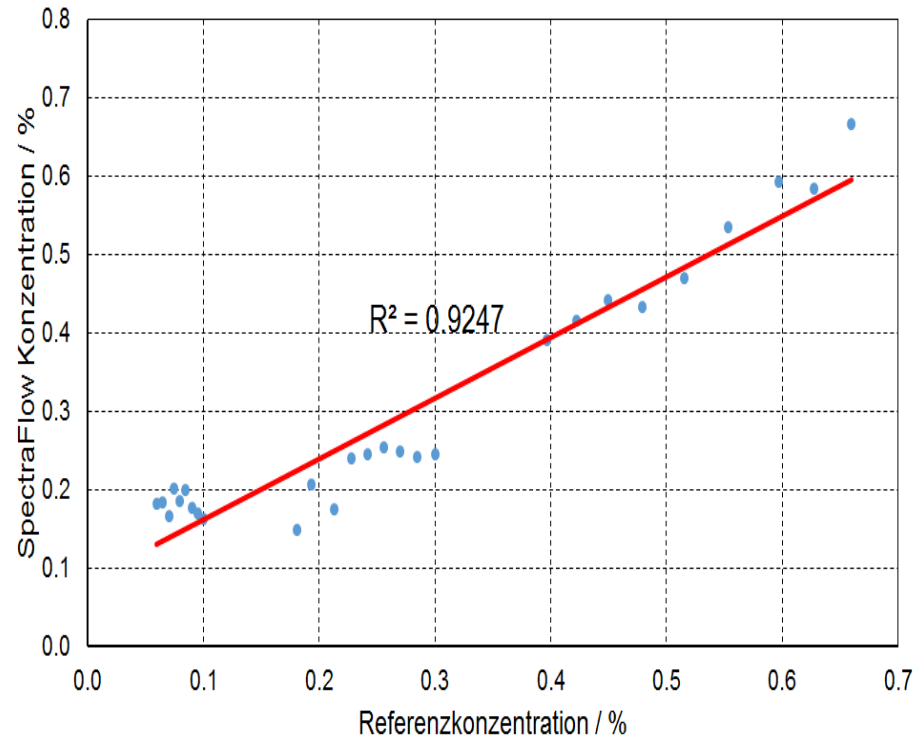


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RDF Samples – Calibration for Sulphur



Calibration curve

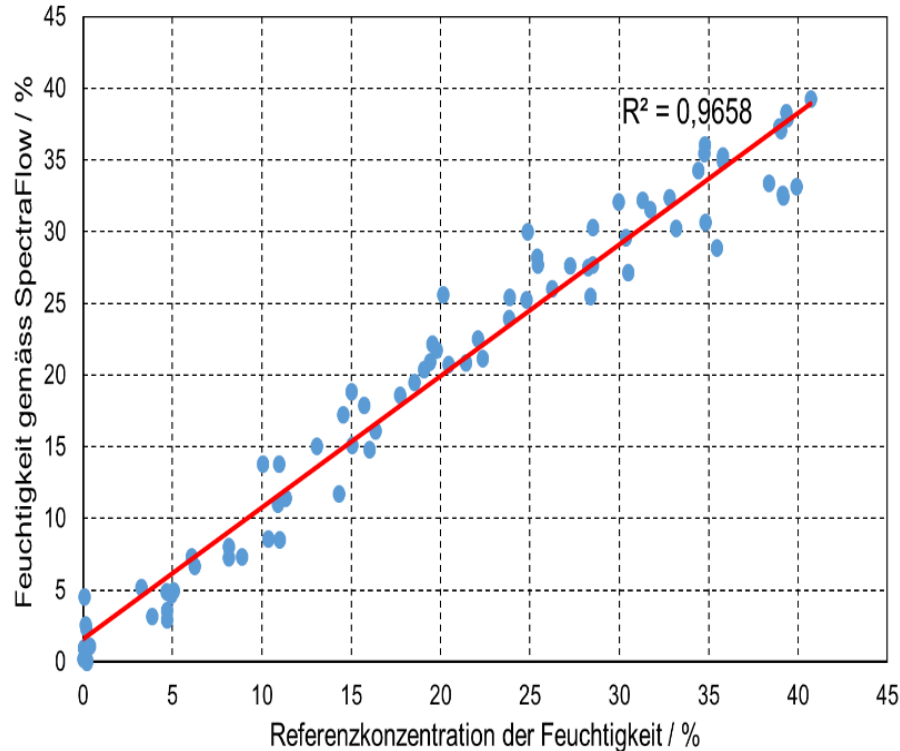


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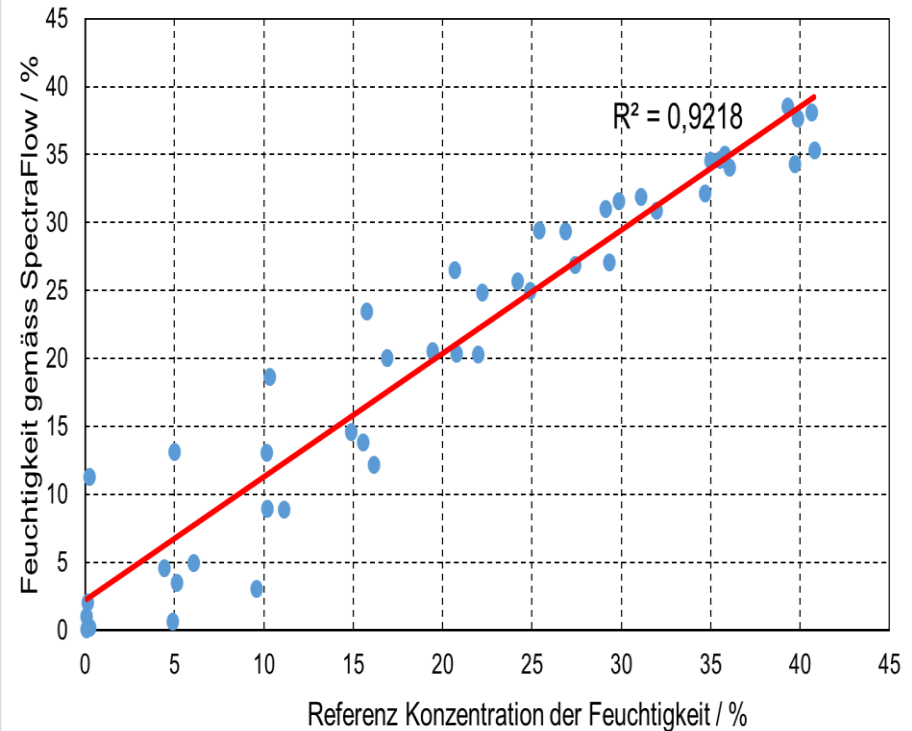


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RDF Samples – Calibration for Moisture



Calibration curve



Validation set



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RDF Samples – Results of Blind samples

Probe	Cd / mg/kg	Cl / %	Cr / mg/kg	Hg / mg/kg	P / mg/kg	S / %
Probe 1_1		1.126	104.48			
Probe 1_2		1.079	92.91			
Probe 2	0.564	1.066			323.36	
Probe 3					280.16	
Probe 4			39.47	0.072		
Probe 8_1				0.08		0.083
Probe 8_2				0.089		0.085
Probe 9_1	1.805					0.219
Probe 9_2	1.75					0.279

Vorhersage
mittels dem
SFA Modellen

Probe	Cd / mg/kg	Cl / %	Cr / mg/kg	Hg / mg/kg	P / mg/kg	S / %
Probe 1_1		1.24	84			
Probe 1_2		1.24	84			
Probe 2	0.86	0.86			267	
Probe 3					359	
Probe 4			34	0.070		
Probe 8_1				0.13		0.15
Probe 8_2				0.13		0.15
Probe 9_1	1.98					0.32
Probe 9_2	1.98					0.32

Customer data



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RDF Samples – Re-Analyse der Blindproben

Sample		Probe 2				Probe 3				Probe 4			
Laboratory		Client	SFA	Client	Client	Client	SFA	Client	Client	Client	SFA	Client	Client
Analysis		A	B	C	D	A	B	C	D	A	B	C	D
Cl (i.an.)	%	0,86	1,07	1,40	0,50								
Cd-ICP	mg/kg	0,86	0,56	0,66	0,80								
Cr-ICP	mg/kg									33,80	39,50	40,40	15,90
Hg-AMA	mg/kg									0,05	0,07	0,11	0,08
P-ICP	mg/kg	267	323	1045	223	359	280	259	425				



SpectraFlow Online Analyzer

RDF Installation example @ UPM Germany



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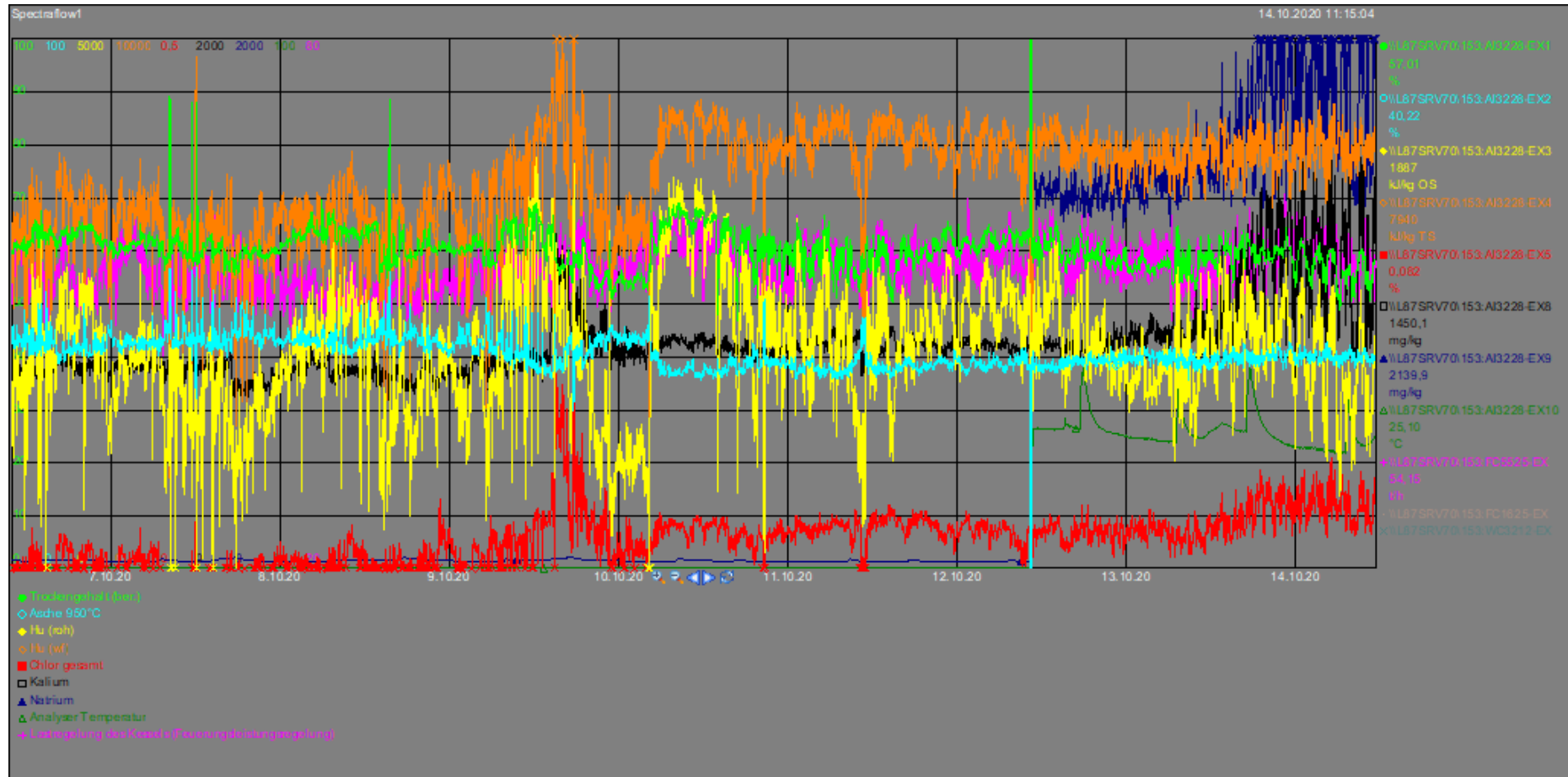






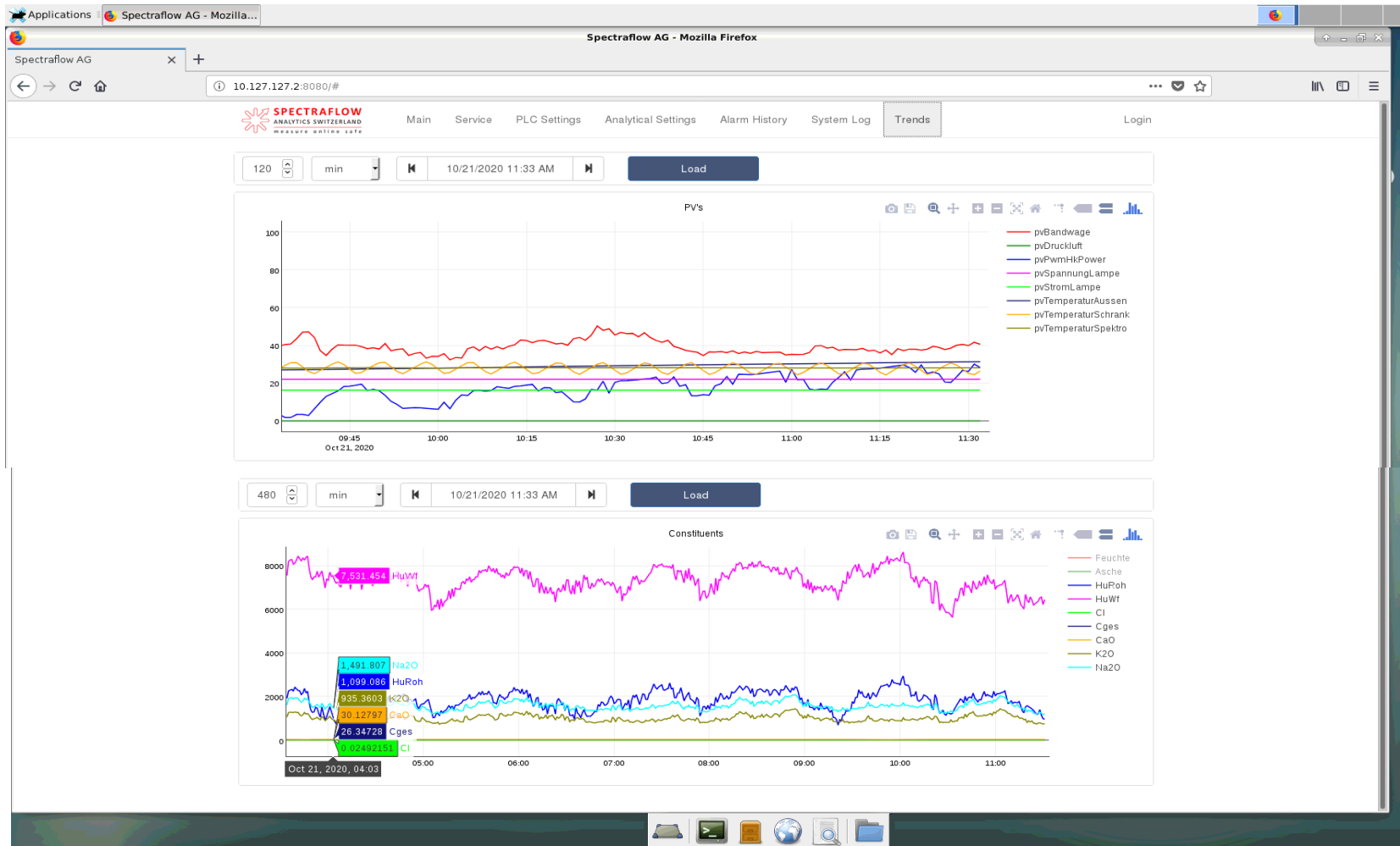
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RDF Installation example @ UPM Germany



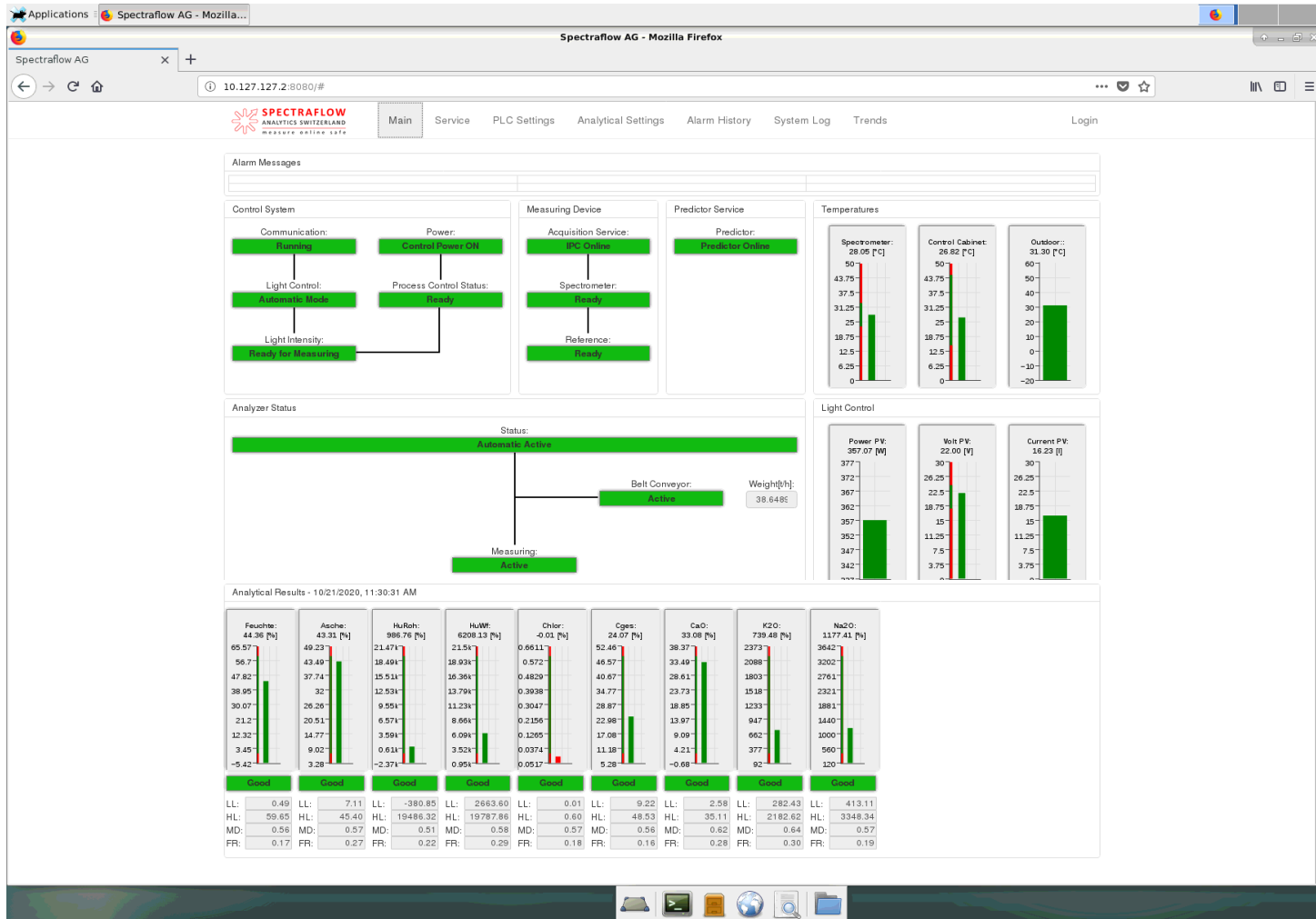
SpectraFlow Online Analyzer

RDF Installation example @ UPM Germany



SpectraFlow Online Analyzer

RDF Installation example @ UPM Germany



SpectraFlow Online Analyzer

UPM Germany – Technical paper

International Cement Review – March 2023

Real-time AF analysis

The wider range of alternative fuels (AFs) used has led to an increased need for real-time online fuel analysis, both by cement plants and AF suppliers. To help balance AF variations, UPM Schongau Paper Mill installed a SpectraFlow near-infra red crossbelt analyser.

■ by **Katrin Sturm**, UPM Schongau, Germany, and **Petra Mühlen**, SpectraFlow Analytics Switzerland

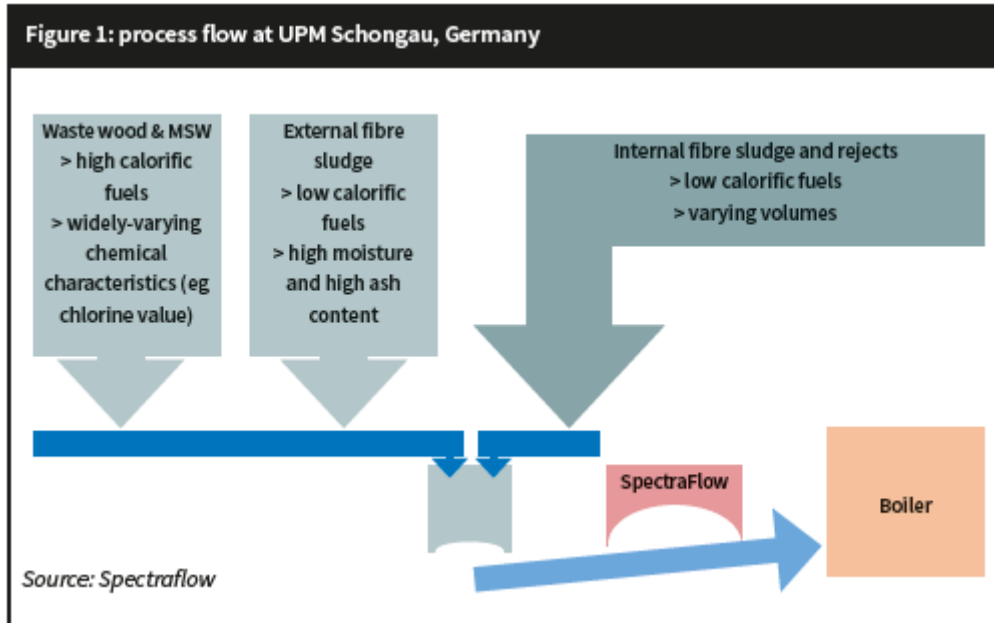


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SpectraFlow Online Analyzer

UPM Germany – Technical paper



SpectraFlow Online Analyzer

UPM Germany – Technical paper

Figure 5: ash measurement during the on-off alternation of waste wood supply



Figure 8: online heating value measurement during increased waste wood supply



SpectraFlow Online Analyzer

Conclusion

- SpectraFlow analytics provides safe online analysis of fuels
- Real time analysis with updates every minute will be available
- This will enable processes to improve consistency of fuel quality and operation stability

Thank You!



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m e a s u r e o n l i n e s a f e

