

Deposits in Diesel Engines

Deposit mechanism of PPO fuels with focus on ashes,
a practical approach

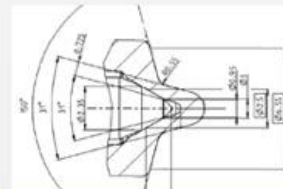
regineering GmbH

S. Innerhofer, T. Wunderlich

regineering GmbH, Denkendorf

Technical development & engineering

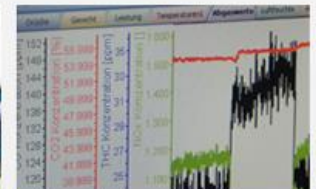
- ➔ Engine application
- ➔ Vehicle field testing
- ➔ Engine test bench
- ➔ Testing fuels and injectors
- ➔ Development and testing of injector nozzles for PPO
- ➔ Prototyping



Düsenentwicklung



Spezialprüfstand



Abgasmessung



Felderprobung



Ablagerungsbildung



2ndVegOil



Cetanzahlmotor



Versuchsmesstechnik



Kraftstoffprobung

Motivation

GLOBAL - WHY Pure Plant Oil (PPO)?

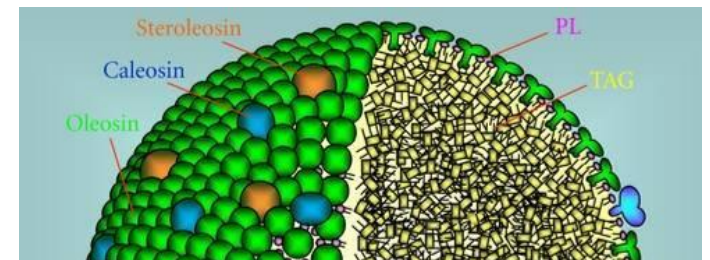
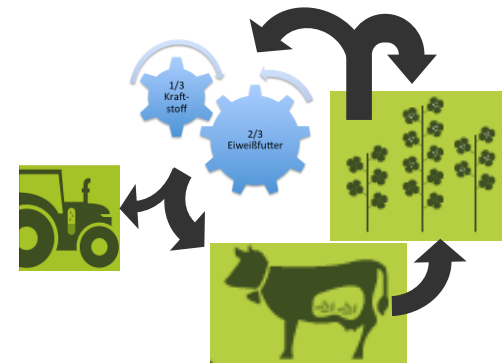
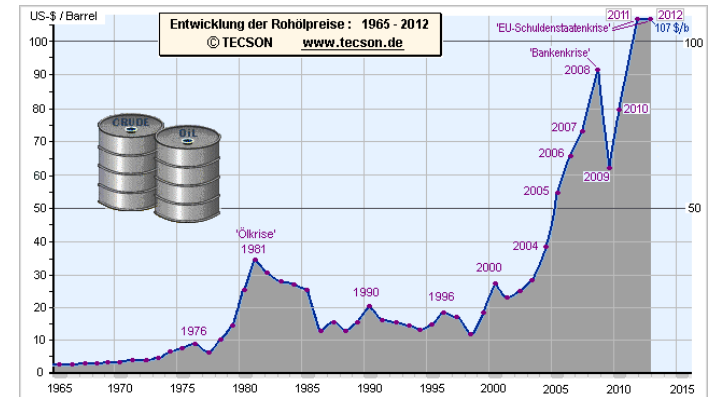
- peak oil
- lack of protein
- capability as protein co-product
- energy efficiency

LOCAL

- niche product for farming & regional economy
- sustainable, closed loop
- self provision for german agriculture possible

STATE OF THE ART

- understanding Diesel deposits
- new deposit mechanism due to blends
- new phenomena of high boiling hydrocarbons
- less research on PPO deposits
- proof of PPO-concept for EU stage 4
- DIN 51605:2010-09 for PPO (rape only)



ABM project

INITIAL SITUATION

- German „100 Traktoren Pogramm“ (2002-2005)
- EU project „2ndVegOil“ (2008-2011)

➔ Focus on ash-forming elements (alkali/ alkaline earth metals and phosphorus)

ABM – AblagerungsBildungsMechanismen

Joint RTD project, supported by:
(scheduled 2011-2014)



Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages

“Determination of the basic mechanisms of deposit formation in a rape seed oil-powered research engine and associated transfer of the results to a complete engine”

Project partners:



ABM project - work packages



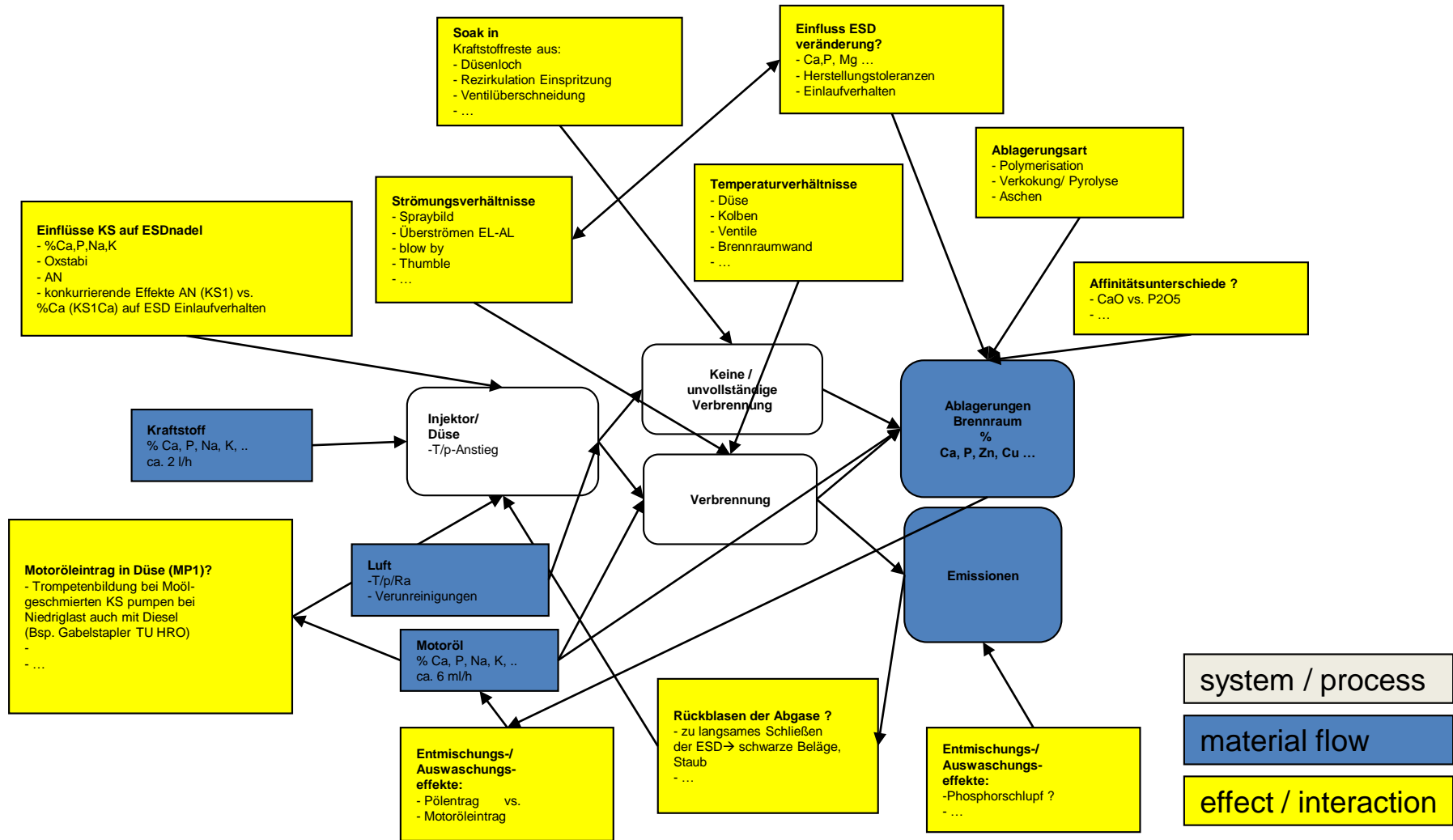
- single-cylinder test engine
- basic research fuels
- basic research OP-points

- simulation/ deposit theory
- engine test bench, JD EU stage 3B six-cylinder engine

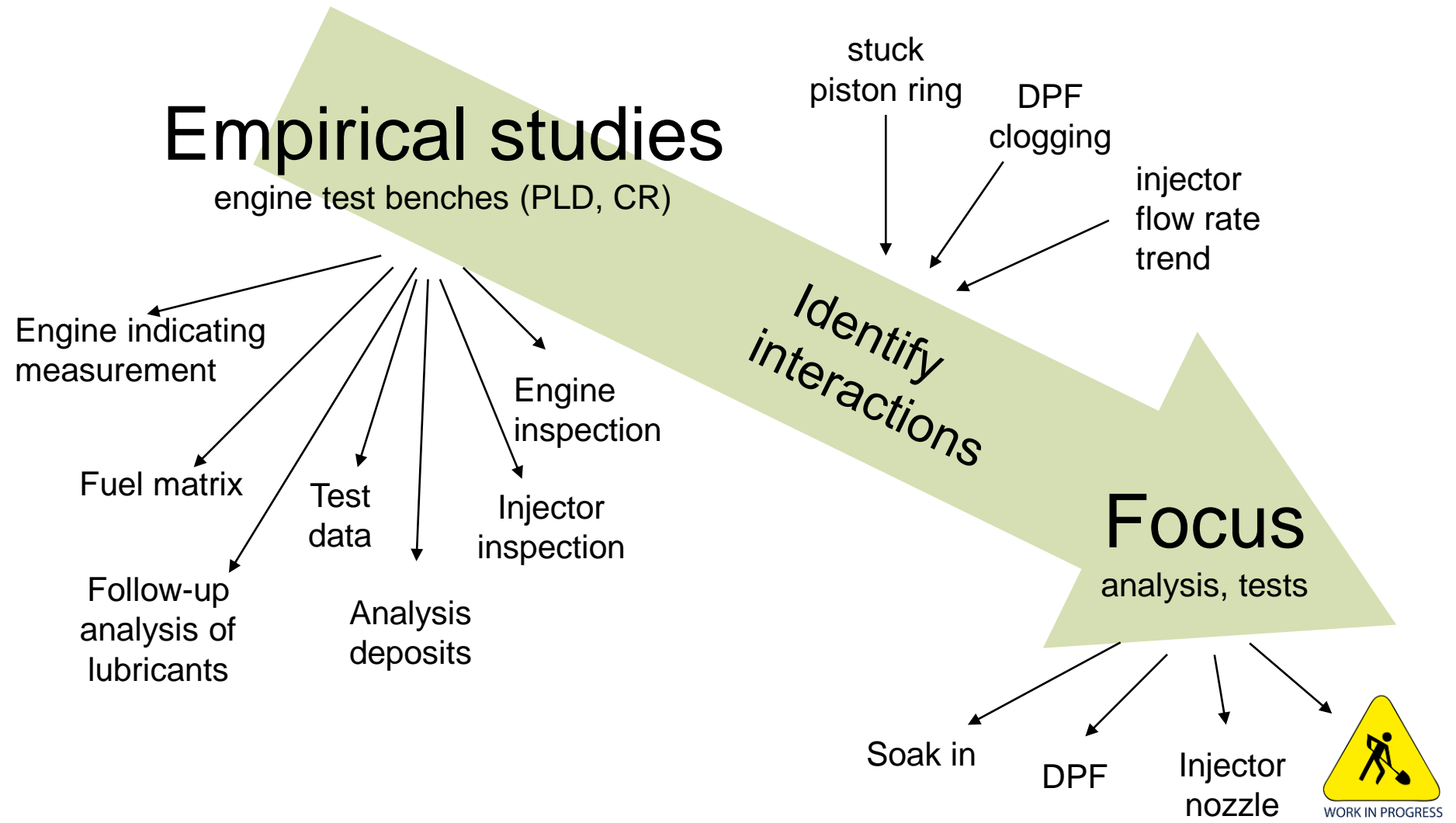
- support
- ECU mapping

- influence of ash content in PPO-fuels on deposits
- interaction and deposit mechanism
- validation of adapted ECU set up (JD engine)
- specify DIN limits for PPO-fuels

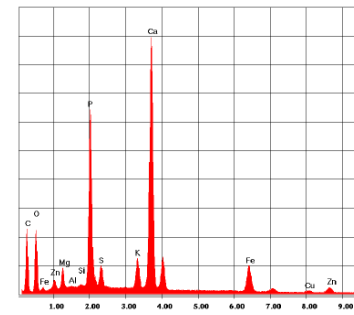
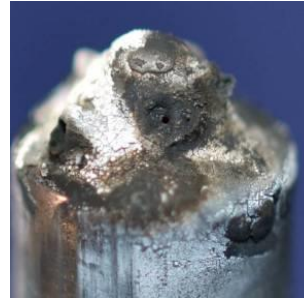
The trouble is ...



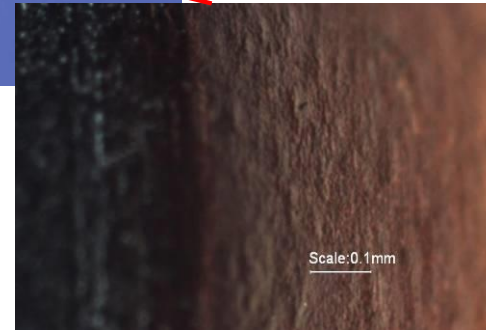
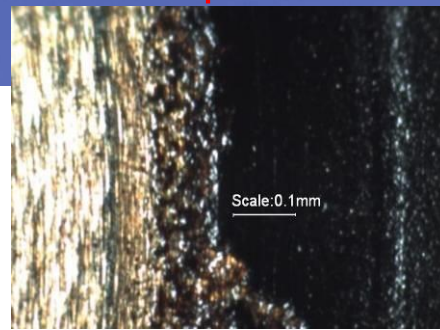
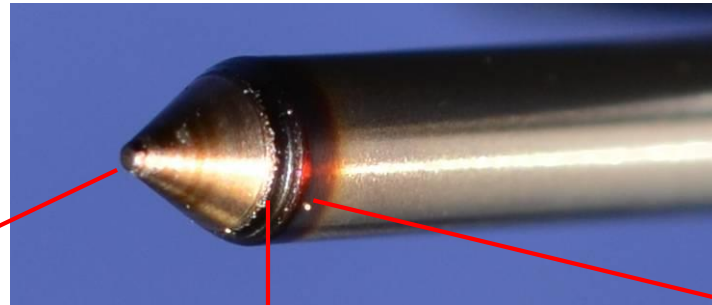
The practical approach is ...



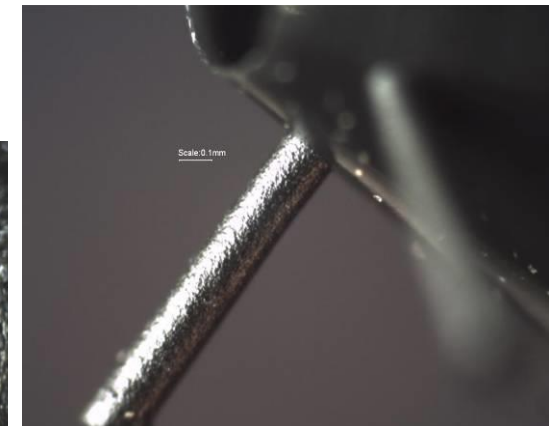
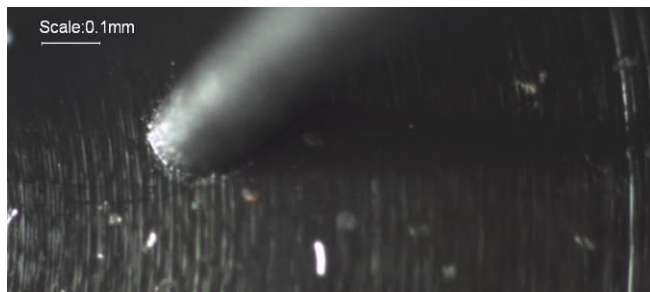
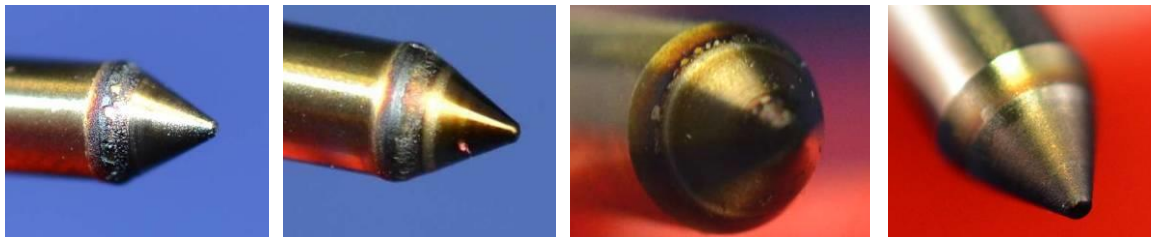
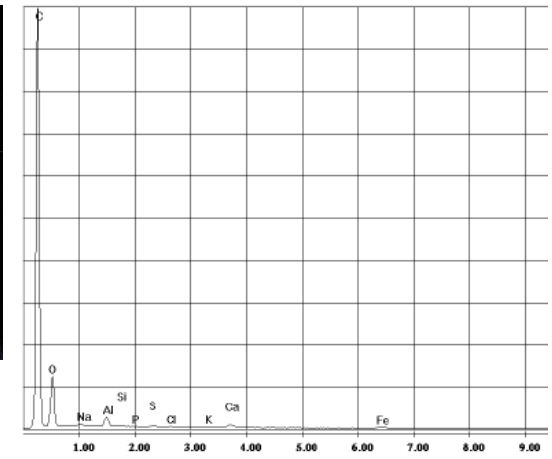
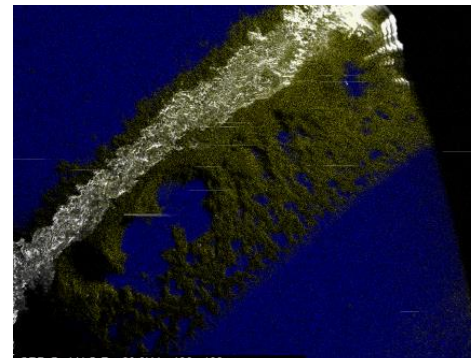
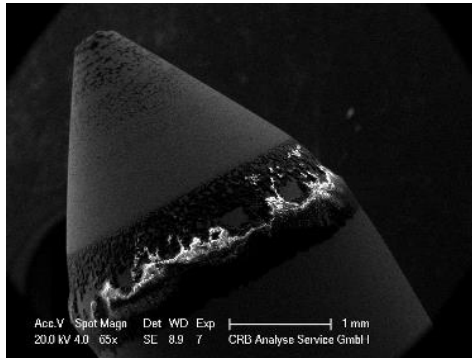
Searching for ashes



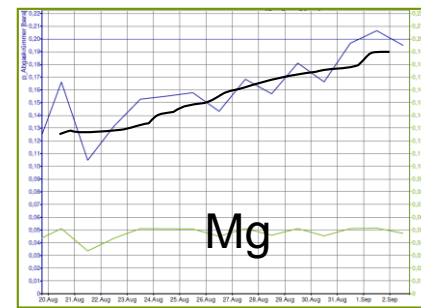
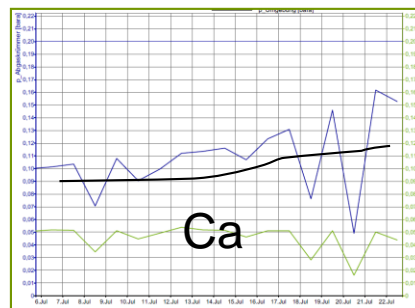
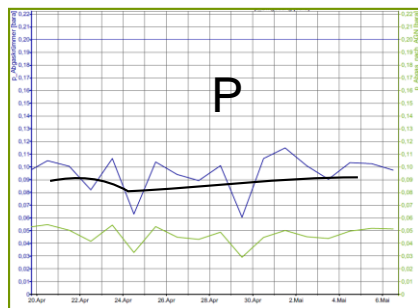
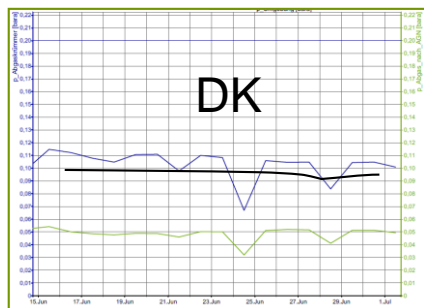
Elem	Wt %	Mol %
MgO	3.39	6.73
Al2O3	0.19	0.15
SiO2	0.40	0.53
P2O5	31.26	17.64
SO3	4.48	4.48
K2O	3.65	3.10
CaO	39.09	55.82
Fe2O3	11.91	5.97
CuO	1.08	1.09
ZnO	4.55	4.48
Total	100.00	100.00



Focus on needle



Focus on DPF



Element/ Wellenlänge [nm]	Einheit	7458 nach Aufschluss
Al_167,0	mg/kg	1220
Ca_315,8	%	15,4
Cr_205,5	mg/kg	241
Cu_324,7	mg/kg	2,1
Fe_259,9	mg/kg	6260
K_766,4	mg/kg	2080
Mg_285,2	%	1,1
Na_818,3	mg/kg	5200
Ni_221,6	mg/kg	235
P_213,6	%	13,2
Pb_220,3	mg/kg	1380
S_182,0	%	1,7
Si_288,1	mg/kg	3390



The PPO Concept – „Agrarantrieb“

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



Active partners



ASG
Analytik-Service
Gesellschaft



JOHN DEERE

eurONATUR



EGON KELLER GMBH & CO. KG



Rpfälzer
NaturEnergie
GmbH & Co. KG



Associated partners



P.R.O.e.V.

WALDLAND



Thank you for your kind attention!

Graduate? Student? Trainee? Co-op?
+ Curiousness?

www.regineering.com/jobs