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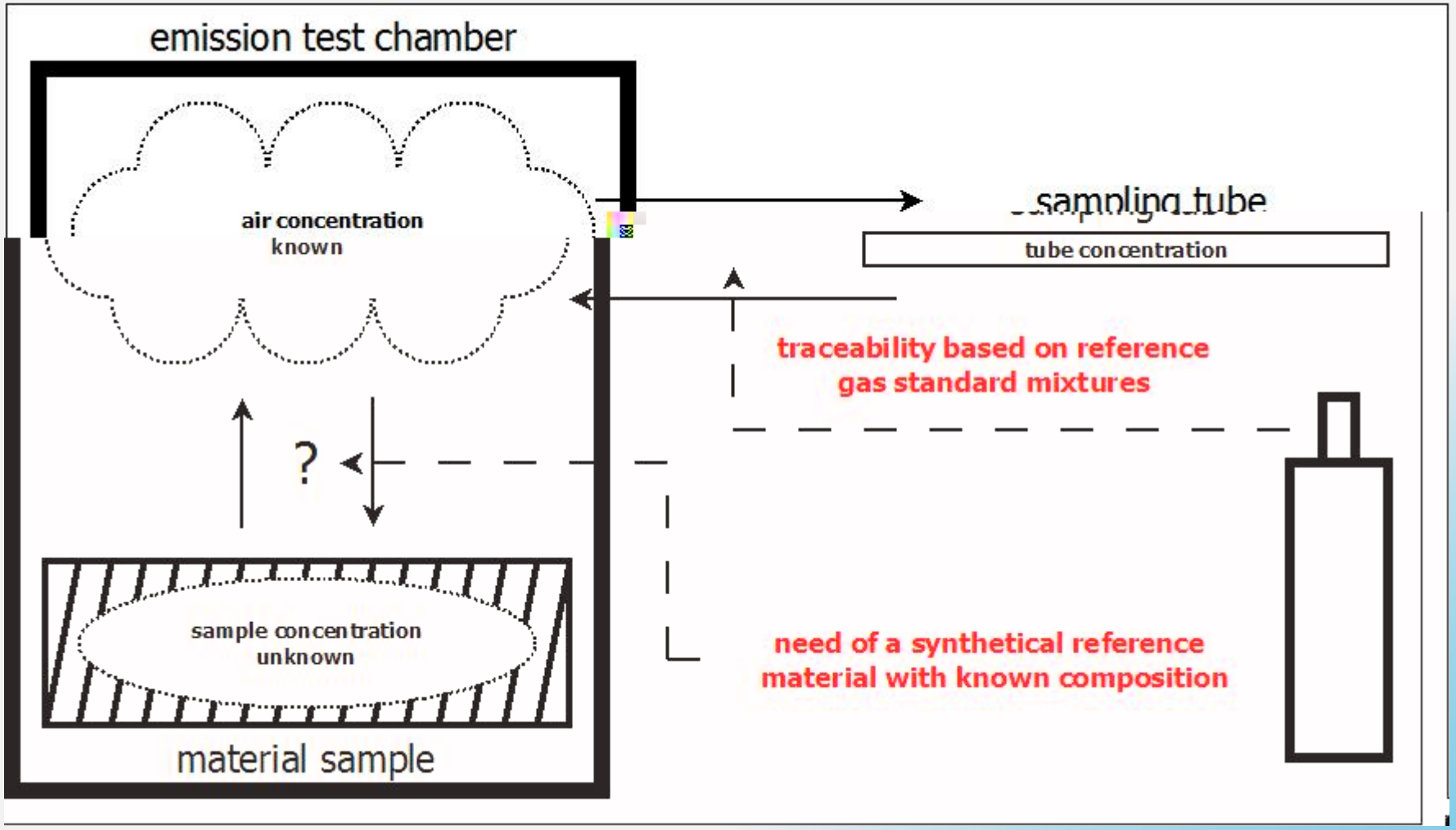
Approach to a reference material for emission testing

Michael Nohr

BAM
Federal Institute for Materials Research and Testing


emission test chamber
air concentration
known
sampling tube
tube concentration
traceability based on reference
gas standard mixtures
?
sample concentration
unknown
need of a synthetical reference
material with known composition
material sample

Building and Environment 46

→ **reference materials for emission testing of building products are commercially not available (only two approaches for toluene/formaldehyde published)**

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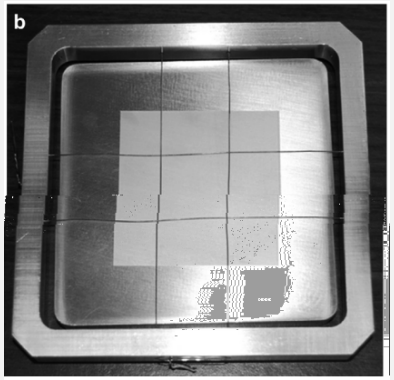
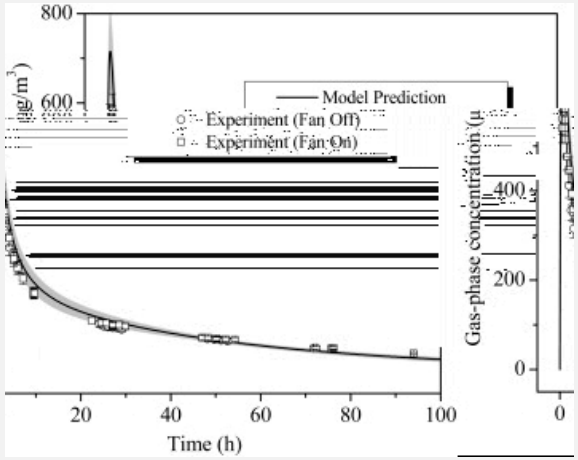
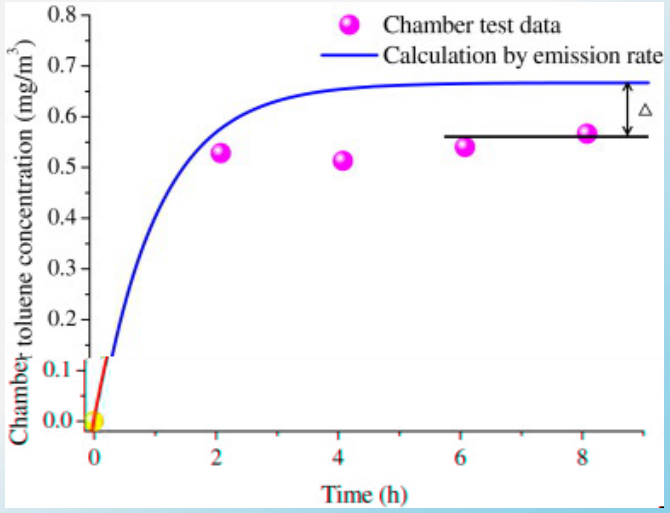

b


800
600
400
200
0
20
40
60
80
100
0
Time (h)
Model Prediction
Experiment (Fan Off)
Experiment (Fan On)
Gas-phase concentration (μ


0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
2
4
6
8
Time (h)
Chamber test data
Calculation by emission rate
Δ
Chamber toluene concentration (mg/m3)

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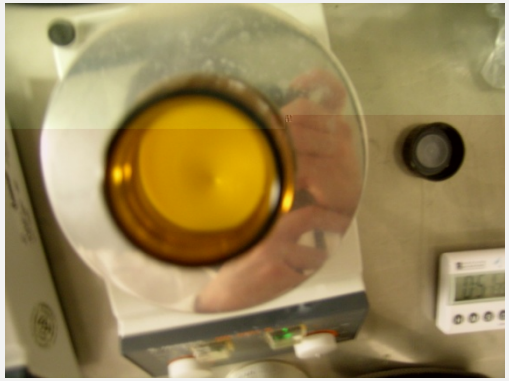
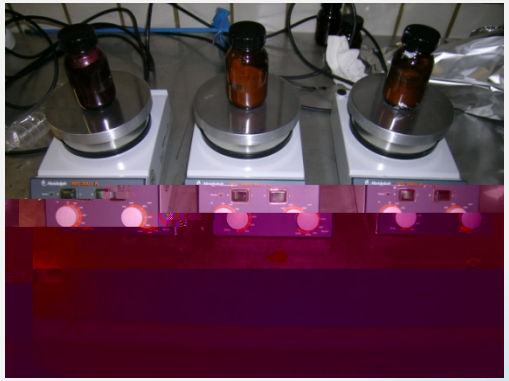


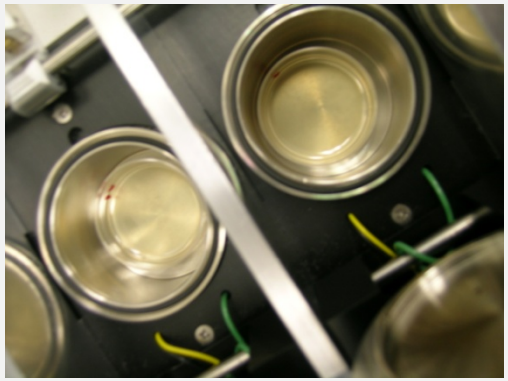
opening of lacquer-can and stirring with glass rod

filling 55 g of lacquer into 100 ml screw cap bottles and adding of a magnetic stirrer

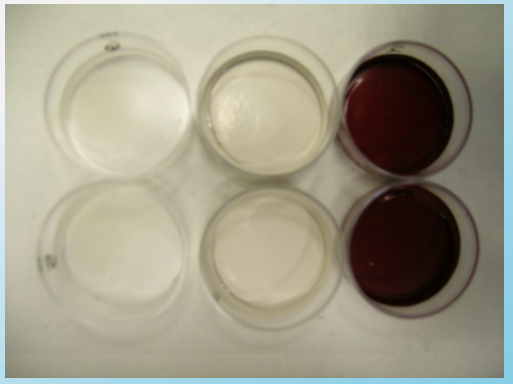


analyte-addition into the magnetic stirred lacquer at (750-1250) 1/min

stirring for 1 h at (750-1250) 1/min with closed cap



decanting of the lacquer into diverse Petri dishes:
µ-CTE: 2 g in 35-mm-dishes
desiccator: 16 g in 94-mm-dishes



loading into emission test chambers

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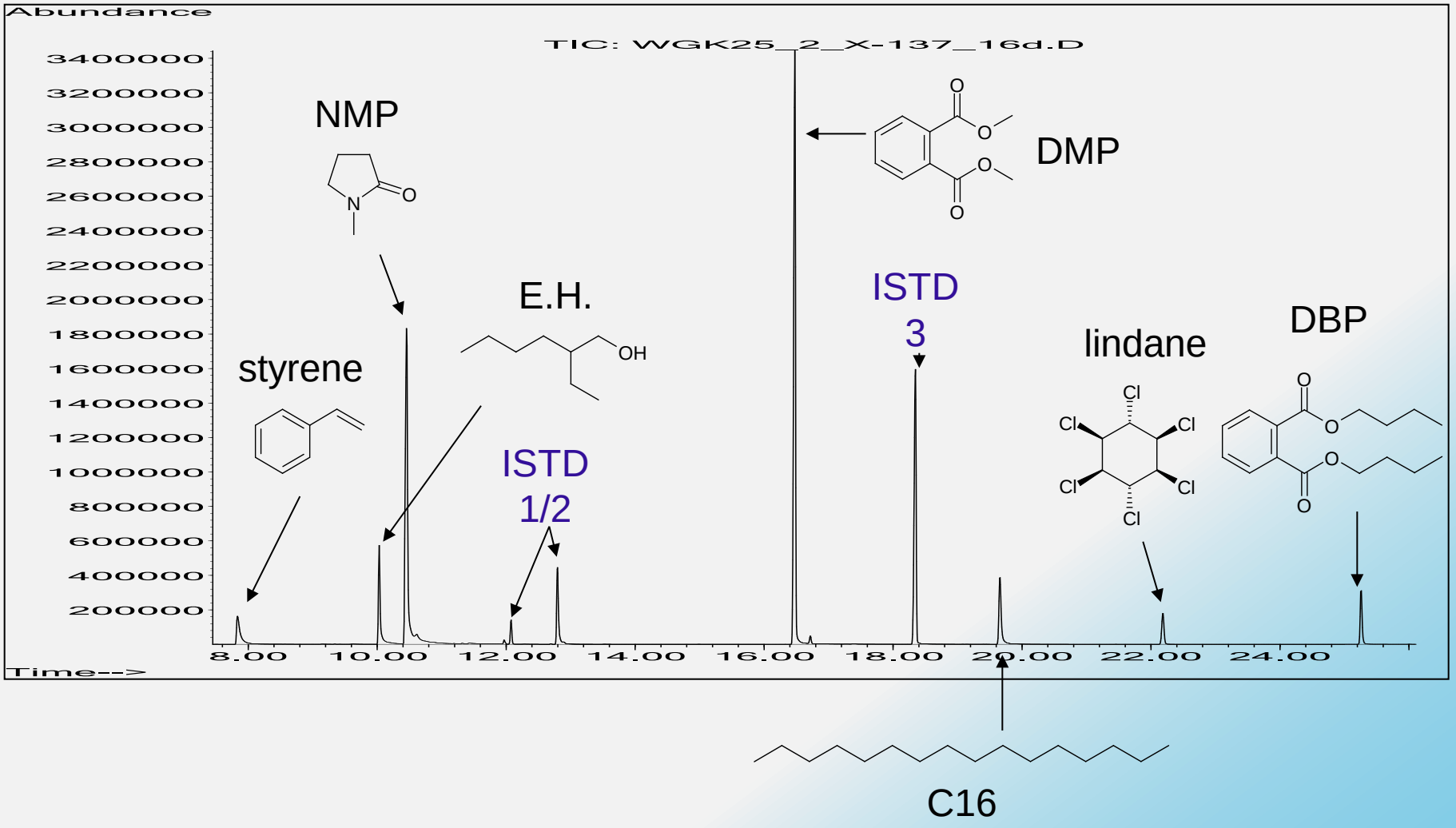
Abundance
TIC: WGK25_2_X-137_16d.D
3400000
3200000
3000000
2800000
2600000
2400000
2200000
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
Time-->
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
NMP
DMP
E.H.
styrene
ISTD
1/2
ISTD
3
lindane
DBP
OH
Cl
O
N
C16

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- **No humidifaction!**

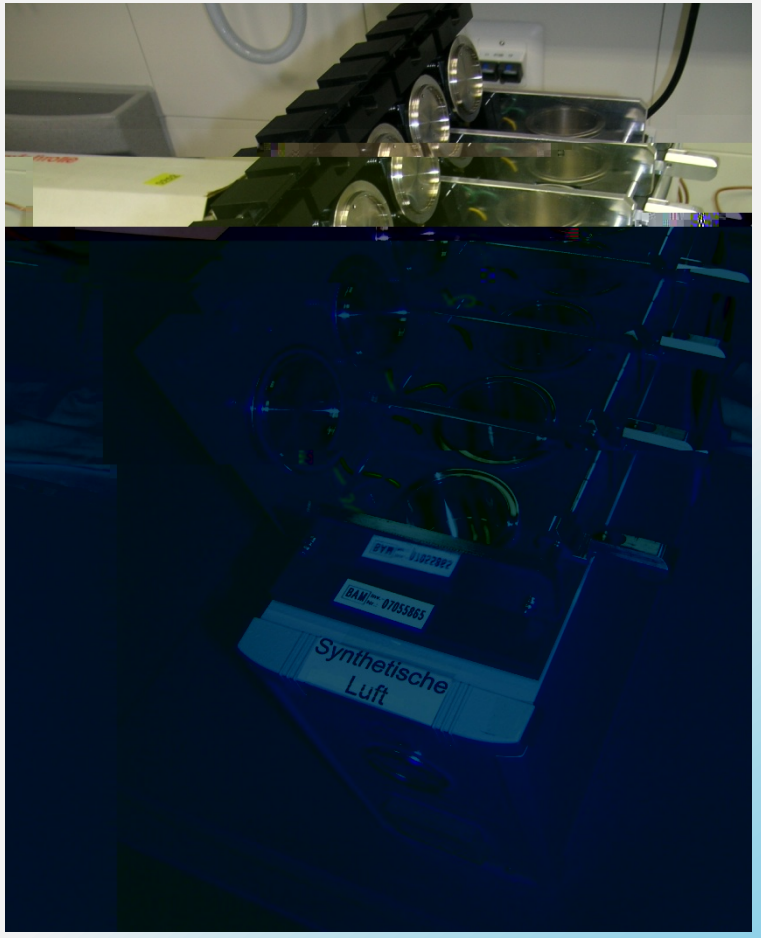

Fig.: Micro-Chamber/Thermal Extractor™ (µ-CTE, 44 ml)

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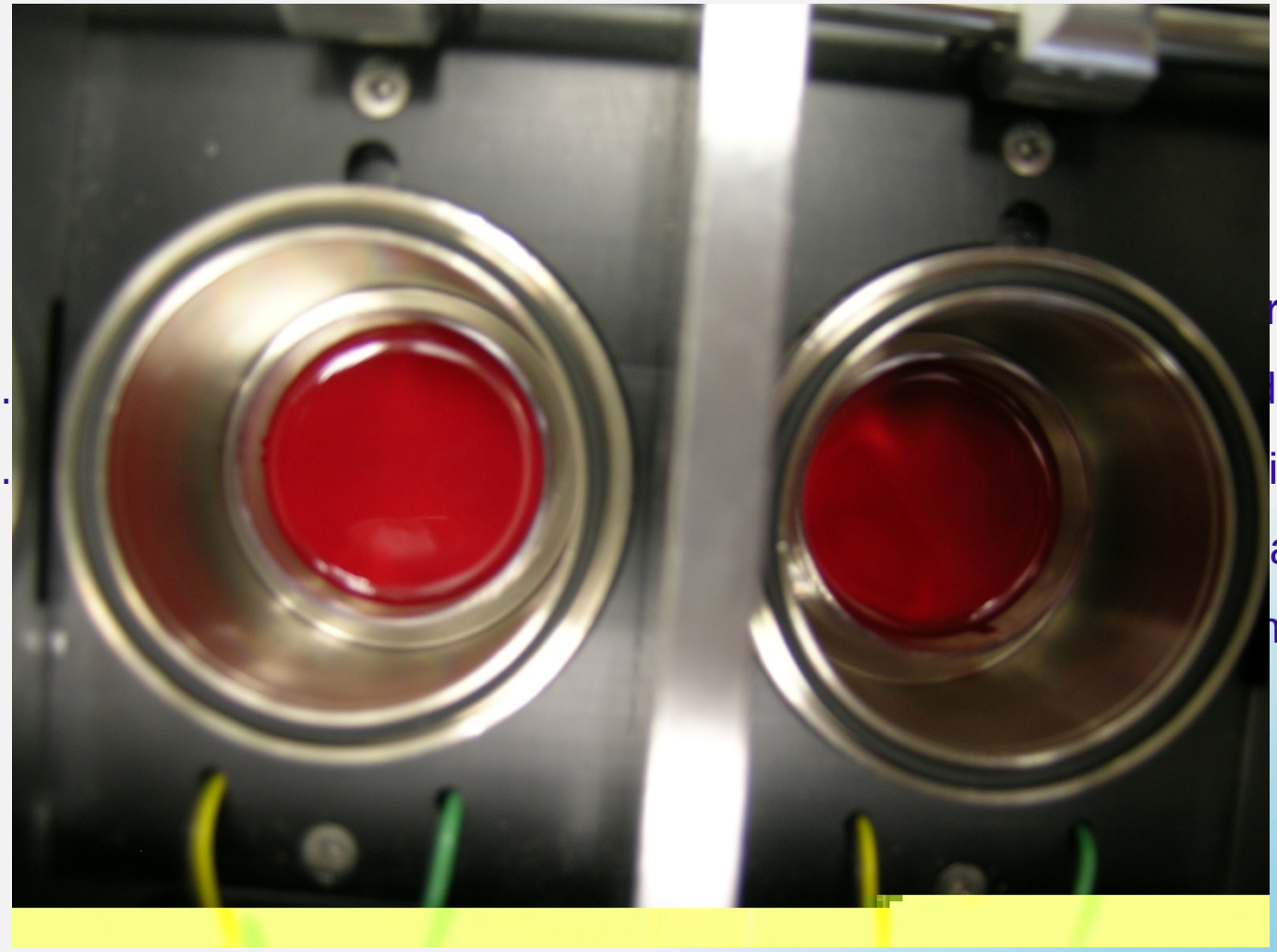
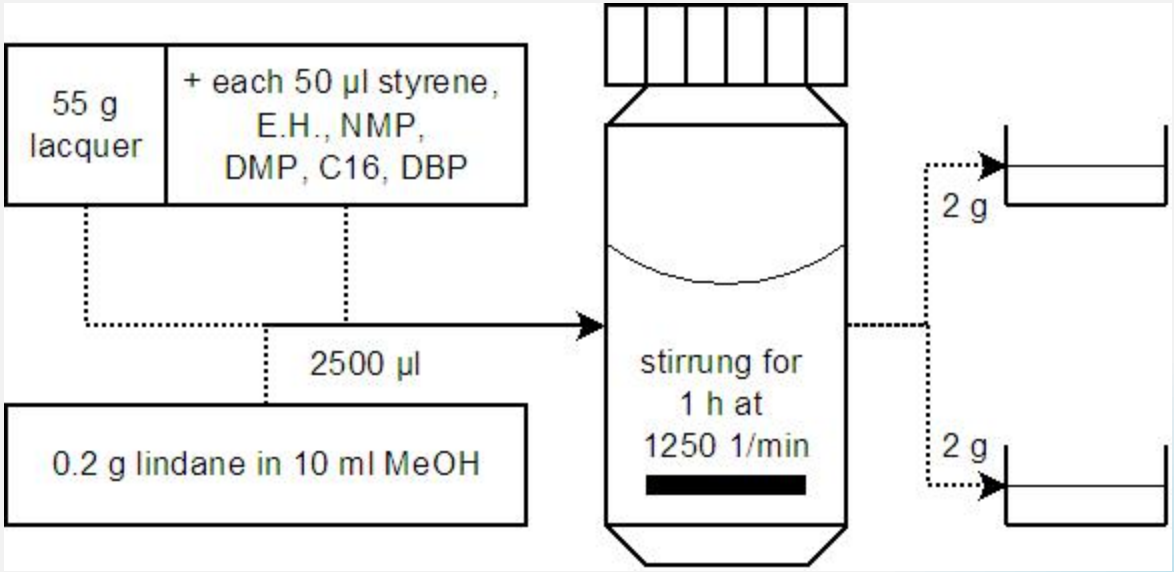
- W .. r
- O .. ite



ar

nt-ivory



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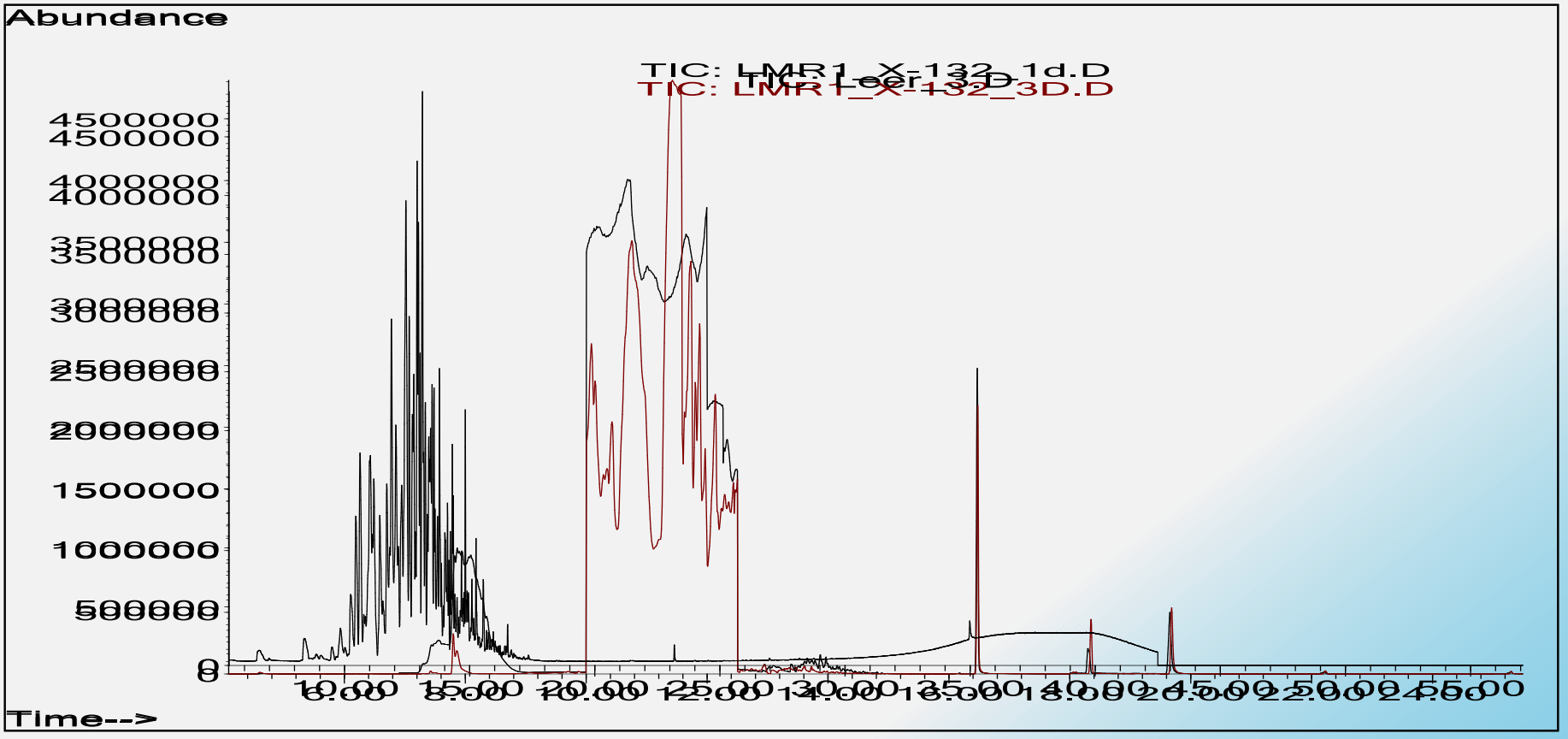

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sp
WMC
WMR
WMW
WGC
WGR
WGI

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		lindane	DBP
LOQ [µg/m³]		1.24	2.12
spiking [mg/g]		4.08	6.72
WGC25_2	Min [µg/m³]	37	13
	Max [µg/m³]	63	22
spiking [mg/g]		0.84	0.90
WGC55_2	Min [µg/m³]	6	< LOQ
	Max [µg/m³]	13	1.40
WGC55_4.5	Min [µg/m³]	6	< LOQ
	Max [µg/m³]	13	1.28

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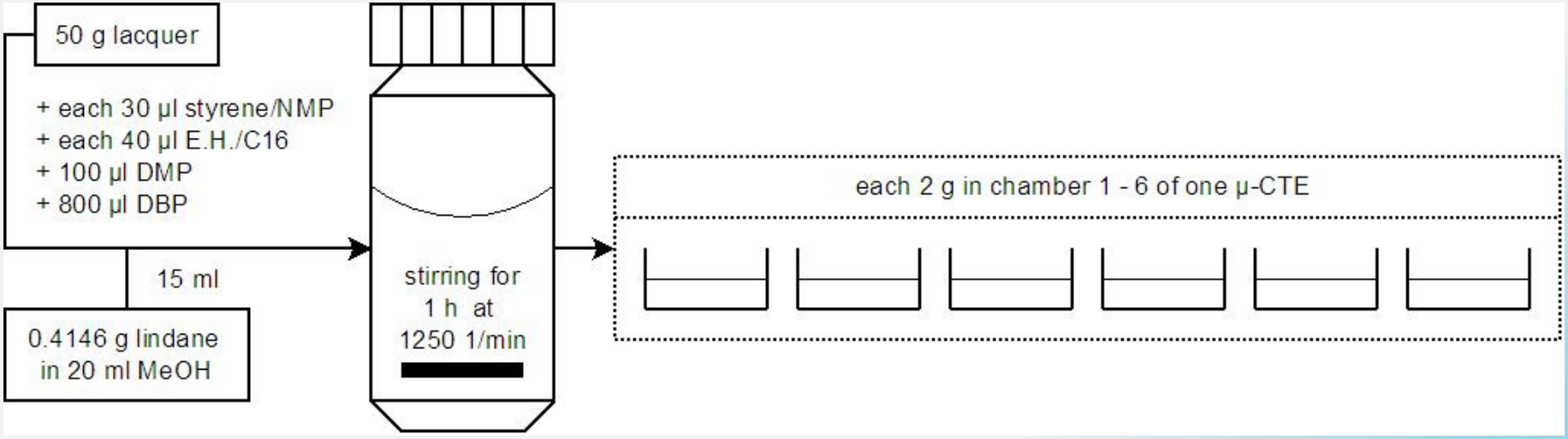
- **reproducibility:**



n = 3 lacquer-batches		styrene	E.H.	NMP	DMP	C16	lindane	DBP
spiking [mg/g]		0.430	0.523	0.488	1.864	0.482	4.801	13.022
2	Mean [µg(m²h)]	1478	999	4817	853	974	103	20
	RSD [%]	5	26	15	4	7	5	27
4	Mean [µg(m²h)]	408	159	1912	720	743	92	21
	RSD [%]	3	35	16	5	7	3	39
7	Mean [µg(m²h)]	105	77	1044	755	711	105	35
	RSD [%]	1	34	17	5	9	5	13
9	Mean [µg(m²h)]	32	75	668	700	633	93	27
	RSD [%]	2	20	18	3	9	3	18
11	Mean [µg(m²h)]	< LOQ	44	464	674	574	91	25
	RSD [%]	< LOQ	9	18	7	12	11	14

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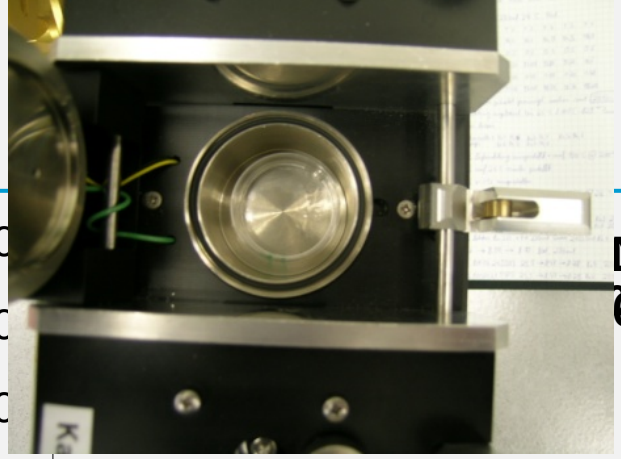
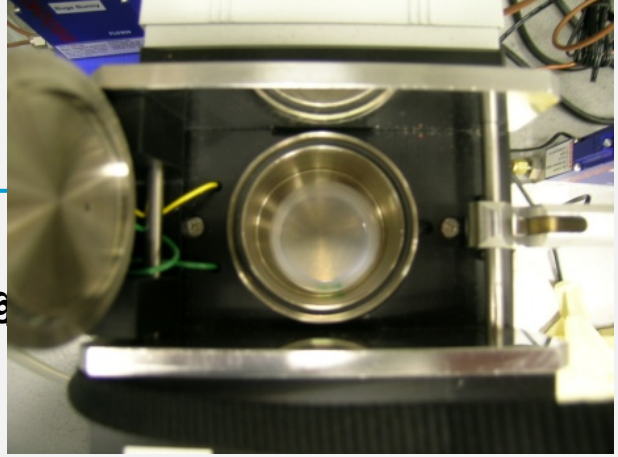
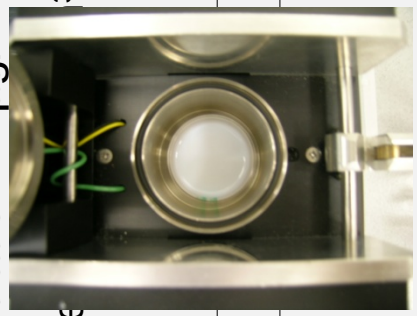
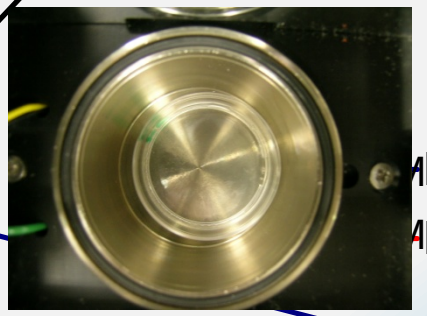
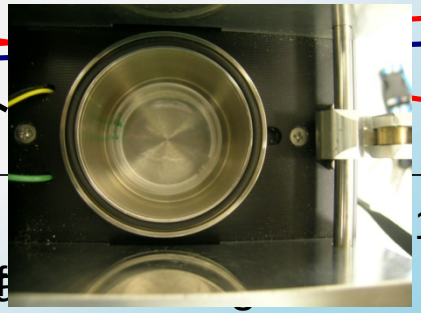


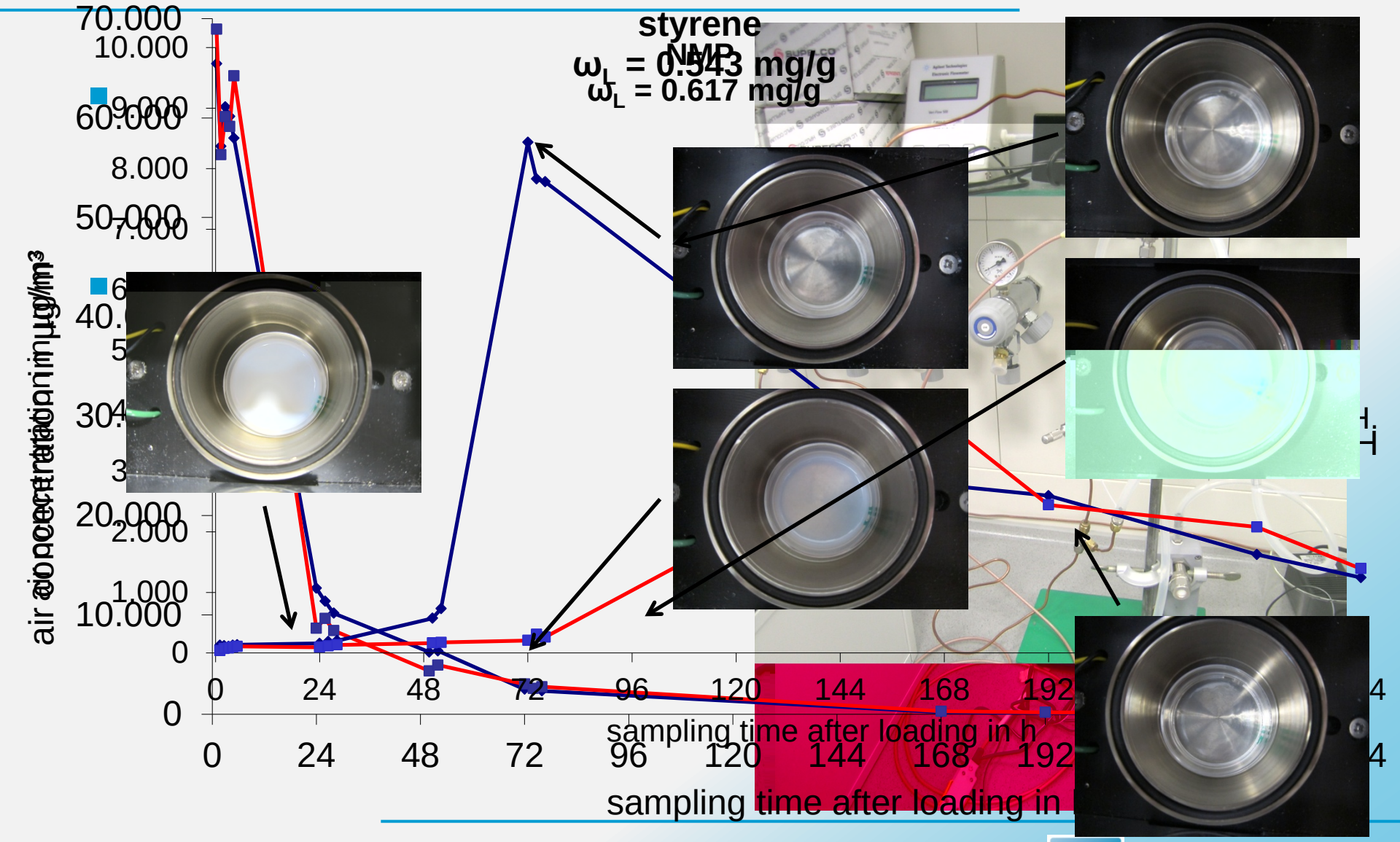








air concentration in µg/m³
sampling time
DBP 15 ml/min
DBP 30 ml/min



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n = 3 lacquer-batches		styrene	E.H.	NMP	DMP	C16	lindane	DBP
spiking [mg/g]		0.643	0.579	0.720	1.443	0.534	7.000	12.605
5	Mean [µg(m²h)]	230	1300	4600	270	360	75	61
	RSD [%]	6	13	11	5	4	4	6
7	Mean [µg(m²h)]	67	580	2100	200	260	61	50
	RSD [%]	2	13	7	4	7	1	9
11	Mean [µg(m²h)]	13	150	130	130	150	39	34
	RSD [%]	5	11	3	5	9	3	5
14	Mean [µg(m²h)]	10	110	120	120	150	36	29
	RSD [%]	2	10	9	10	11	6	10

- **30 ml/min → 15 ml/min; no humidification**

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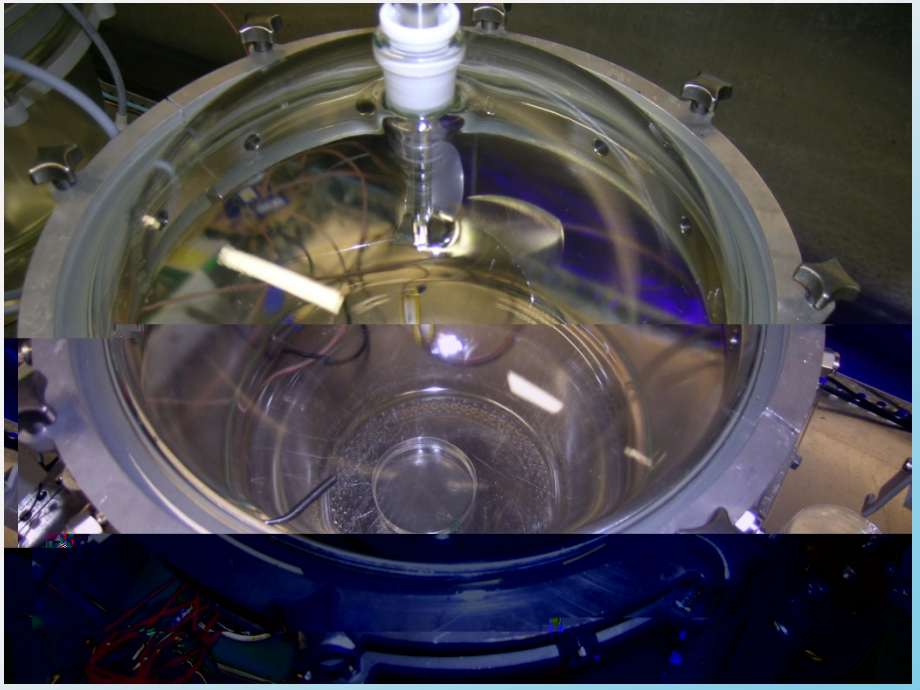
sampling day [d]	sampling volume [l]	styrene [µg/m³]	E.H. [µg/m³]	NMP [µg/m³]	DMP [µg/m³]	C16 [µg/m³]	lindane [µg/m³]	DBP [µg/m³]
3	1	86	56	53	108	98	55	22
7	1	35	40	31	100	72	61	34
Spiking	**[mg/g]**	0.45	0.41	0.26	1.18	0.38	12.9	17.5

- **24-l-chamber (desiccator):**

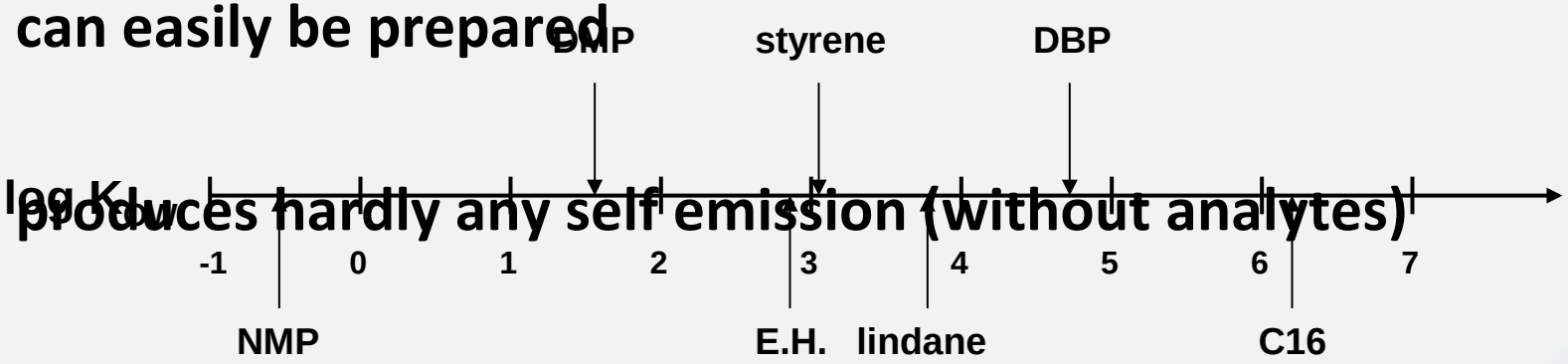
  T = 23 °C; RH = 50 %;

  n = 4.4 h^{-1} ; q = 15 $m^3/(m^2\ h)$

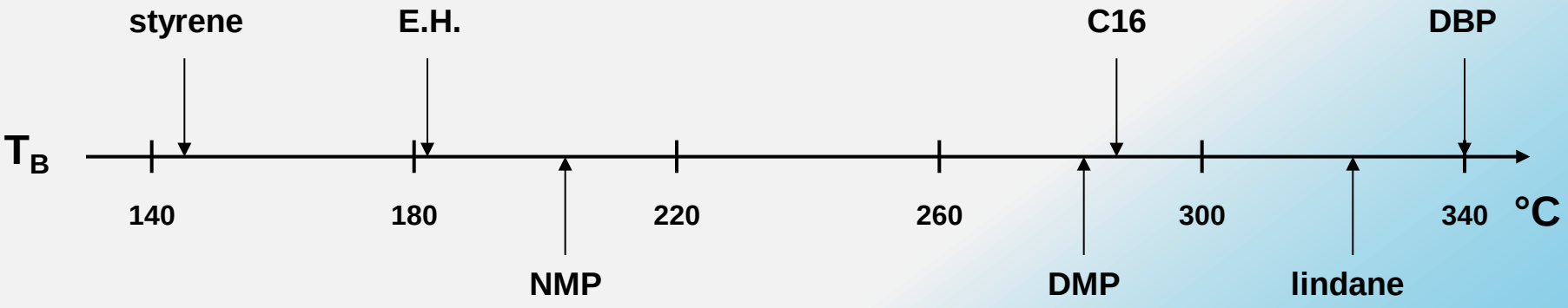


… can easily be prepared

… produces hardly any self emission (without analytes)



… emits a wide range of analytes



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