OxiTop®-IDS BOD and more

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SALES GMBH & CO KG

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WTW Webinar Series

June 25
How to monitor BOD
with OxiTop
(Part #1)

July 7
Online Wastewater
Monitoring of COD/BOD
With Spectral Sensors

July 9
How to monitor BOD
with OxiTop
(Part #2)

July 14
Photometry basics
& Automated Chemistry
Analyzers

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CV

Dr. Klaus Reithmayer
- Born and living in Munich/Bavaria/Germany
- Married, two (adult) daughters
- Mineralogist (Diploma) (Ludwig-Maximilians-Universität Munich)
- PhD thesis in high-pressure crystallography (Ludwig-Maximilians-Universität Munich)

- More than 20 years experience in electrochemistry (lab and process), since 15 years also respirometry
- Since 2001 with WTW/Xylem Analytics
- Senior Product Manager for Lab Echem products and OxiTop®

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Poll Question #1
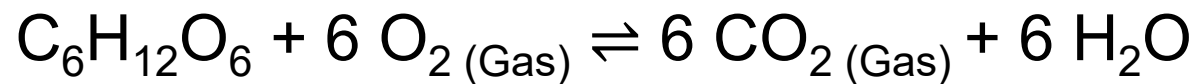
What is your professional background?
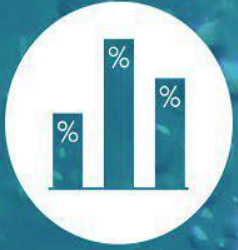
Poll Question #2

What is your professional focus?

Respirometry – Basic principle of degradation of organic carbons

Micro organisms need oxygen for their metabolism.

When digesting carbons they produce carbon dioxide

CO_2

$C_{org} + O_2$

$$C_6H_{12}O_6 + 6\ O_{2\ (Gas)} \rightleftharpoons 6\ CO_{2\ (Gas)} + 6\ H_2O$$

Principle of respirometry

The absorption of carbon dioxide in a closed vessel leads to a pressure decrease.

$$CO_{2\,(Gas)} + 2NaOH \rightleftharpoons Na_2CO_{3\,(solid)} + H_2O$$
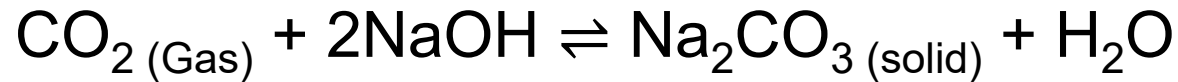
Since 1997 – a unique product

OxiTop® Control
- BOD and degradation tests

OxiTop® Control

IR Interface

OC 100: **"BOD-Routine":** **Single bottles, GLP, AutoTemp Function**

"BOD-Standard": **administration of maximum 12 parallel samples with GLP-statistics/averaging, AutoTemp Function selectable**

OC 110: **"BOD-Routine" / "BOD-Standard" as OC 100**

"BSB-Special": **Administration of parallel samples Parameter V_{tot}, V_{pr}, $p_{at,}$ T freely selectable**

"Pressure-p": **Pressure measurement 500 - 1350 hPa**

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But now:

OxiTop® goes IDS: OxiTop®-IDS – more than BOD

OxiTop®-IDS

OxiTop®-IDS/B

More than BOD…

Enhanced Firmware (update) Multi 3620 or 3630 IDS

- Integration of old controller functions with new user interface
- Adjustment to menu structure of 36x0
- Switching between EChem applications and OxiTop®
- Comprehensive functions: BOD standard, BOD Special, Pressure
- Data acquisition via USB memory stick, MultiLab® Importer (without USB adapter!)

OxiTop®- IDS: Now with the Multi 36x0 IDS

Overview

Measuring mode		Explanation
BOD		• Measurement of up to 12 parallel sample processes per overall sample for a BOD_x (x = 0.5h ... 180d) • Automatic sample statistics with averaging • The *AutoTemp* function can be switched on
	BOD standard	• The measuring range and sample volume can be selected from seven fixed combinations. • The incubation temperature is 20 °C
	BOD special	• *Measuring range, Dilution 1 +, Sample volume* and *Bottle volume* can be freely adjusted • The incubation temperature (5 °C to 40 °C) can be set up

Pressure p		• Pure pressure measurement
		• Measuring range:
		   – 500 ... 1250 hPa (OxiTop® i/OxiTop®-IDS)
		   – 500 ... 1500 hPa (OxiTop®-IDS /B)
		• A *Warning difference pressure* can be set

OxiTop®- IDS: Now with Multi 36x0 IDS

Basic Hierarchy

- **Set:** Upper level including definition of measurement mode (BOD, BOD Special, Pressure, measurement period, AutoTemp, availability etc.) of one or more samples which belong together, physically e.g. a stirring platform with 6 or 12 bottles
- **Sample:** Sub part of a set, e.g. samples of inlet or outlet samples, measuring parameters (e.g. measuring range) can be defined individually
- **Head:** Measuring unit belonging to a sample! Values among one sample will be used for statistical averaging.

Advantage: Programming of all heads before starting the measurement, then doing the final sample preparation.

OxiTop®- IDS: Now with Multi 36x0 IDS

OxiTop Set Administration: A maximum of 100 heads can be managed

- Maximum 12 sets
- A set consists of maximum 12 samples
- Each samples has maximum 12 IDS heads

Set name: Default is date and an index, could be changed
(figures and letters, max. 8 characters):

1	2	3	4

OxiTop set management

190216-1	✓	5/5	BOD5	21.05.2019
190216-2		360/360	BOD5	21.05.2019
190216-3		6/7	BOD7	23.05.2019
190217-1		4/4	BOD4h	17.05.2019
190220-1		4/20	BOD20	12.06.2019
190220-2		360/360	BOD5	21.05.2019
RED_F113-1		1/5	p5	25.05.2019
190223-1		137/360	BOD30m	23.05.2019

79 Free measuring heads

5 → | New | 28.05.2019 08:00 | Delete | ← 6

1 *Set name*
  - Check mark (✓ = finished):
    when the data of the measuring head have been transmitted to
    the meter at the end of the specified *Duration*
2 Status of the set
  Number of measured values / maximum number of measured values
3 *Type (Measuring mode, Duration)*
4 *End date* of the measurement
5 **<F1>**/[*New*] (creates a new set)
6 **<F2>**/[*Delete*] (deletes the highlighted set)

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OxiTop®- IDS: Now with Multi 36x0 IDS

Sample

Determination on maximum 12 samples (simultaneous determination with averaging)

Sample description

Measure mode

Individual settings (range, settings for BOD Special)


```
1 →  | Set 190216-1                              |
2 →  | A-1   ✓   4000 mg/l      BOD5      1/1    |
     | A-2       357 mg/l       BOD5      2/3    |

3 →  | 79 Free measuring heads                   |
4 →  |  i        28.05.2019 08:00    Delete  | ← 5
```

1 *Set name*
2 *Sample name*, measured value, type, OxiTop®-IDS measuring heads called up/number of OxiTop®-IDS measuring heads in the sample;
   – Check mark (✓ = finished) next to *Sample name* : when the data of the measuring head have been transmitted to the meter at the end of the specified *Duration*
   – Asterisk (* = *Warning difference pressure* exceeded) next to measured value: if the *Warning difference pressure* is exceeded in at least one OxiTop®-IDS measuring head of the sample (only for *Measuring mode*: *Pressure p*)
3 Status line (number of OxiTop®-IDS measuring heads that can yet be registrated)
4 <F1>/[i]: the graphic evaluation of the OxiTop®-IDS measuring heads of the highlighted sample is displayed.
5 <F2>/[*Delete*] (deletes the highlighted sample)

OxiTop®- IDS: Now with Multi 36x0 IDS

Overview of heads in a sample

1 *Sample name*

2 Number of the OxiTop®-IDS measuring head (set at the OxiTop®-IDS measuring head)

  – Check mark (✓ = finished):
  when the data of the measuring head have been transmitted to the meter at the end of the specified *Duration*

3 Series number of the OxiTop®-IDS measuring head

4 Measured value
(last value transmitted by the measuring head in the specified interval)

  – Asterisk (* = *Warning difference pressure* exceeded):
  if the *Warning difference pressure* in the OxiTop®-IDS measuring head is exceeded (only for *Measuring mode: Pressure p*)

5 <F1>/[i]: the LED at the highlighted OxiTop®-IDS measuring head lights up red for a short time

6 <F2>/[*Delete*]: deletes the highlighted OxiTop®-IDS measuring head from the sample

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OxiTop®- IDS: Now with Multi 36x0 IDS

New: Power Saving Mode

Set	
Measuring mode	BOD special
Set name	190228-1
Duration	17 d
Settings	

ℹ BOD5 End date 23.02.2019
AutoTemp, GLP
V_P 432 ml

79 Free meas. heads

| Sample | 15.03.2020 08:00 |

Go to settings and press
MENU-ENTER

Settings	
GLP	on
AutoTemp	on
Alarm diff. pressure	500 hPa
Man. temperature	22°C
LED	on
Number of measured values	Standard
Eco mode (radio)	on
Radio connection from	08:00
Radio connection until	12:00

79 Free meas. heads

15.03.2020 08:00

Eco mode „on":
If desired selct time span
for „radio adverstising"

OxiTop®- IDS: Now with Multi 36x0 IDS

Power Saving Mode

- If Eco mode "off": 100 days continuous battery power
- If availability set to 3 h/day: 2 years continuous power
- If availability set to 0.5 h/day: about 5 years continuous power
- Availability is indicated by magenta flashing LED

- Note: maximum measuring interval is 180 days

OxiTop®- IDS: Now with Multi 36x0 IDS

Example: Programming a set


```
OxiTop set management
190216-1      ✓   5/5       BOD5     21.05.2019
190216-2          360/360   BOD5     21.05.2019
190216-3          6/7       BOD7     23.05.2019
190217-1          4/4       BOD4h    17.05.2019
190220-1          4/20      BOD20    12.06.2019
190220-2          360/360   BOD5     21.05.2019
RED_F113-1        1/5       p5       25.05.2019
190223-1          137/360   BOD30m   23.05.2019


79 Free measuring heads
                28.05.2019 08:00
New                                    Delete
```

Press **<F1>** [New]


```
Set
Measuring mode                 BOD special
Set name                       190228-1
Duration                       17 d
Settings




ℹ BOD5 End date 23.02.2019
AutoTemp, GLP
V_P 432 ml

79 Free meas. heads
                15.03.2020 08:00
Sample
```

Open with **<F1>**/[*Sample*] Adjustments for sample


```
Settings
GLP                            on
AutoTemp                       on
Alarm diff. pressure           500 hPa
Man. temperature               22°C
LED                            on
Number of measured values      Standard
Eco mode (radio)               on
Radio connection from          08:00
Radio connec-                  12:00
tion until

79 Free meas. heads

          15.03.2020 08:00
```

OxiTop®- IDS: Now with Multi 36x0 IDS

Defining the sample

```
┌─ Sample ──────────────────────┐
│ Sample name              A-1   │
│ Calculation         Meas. range│
│ continue                       │
│                                │
│ i Type BOD5, End date 23.02.2019│
│ Mb 395 mg/l, V_P 432 ml        │
│ V_F 510 mg, 1+1, 22 °C         │
│ p = 800 mbar.                  │
│ AutoTemp                       │
│                                │
│ 79 Free measuring heads        │
│                                │
│ Meas. head   28.05.2019 08:00  New │
└────────────────────────────────┘
```

```
┌─ Settings ─────────────────────┐
│ Measuring range        395 mg/l │
│ Bottle volume          510 ml   │
│ Sample volume          164 ml   │
│ Dilution 1 +           1        │
│                                 │
│                                 │
│                                 │
│          28.05.2019 08:00       │
└─────────────────────────────────┘
```

Leave with ESC

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Entering a head

1. Number of the OxiTop®-IDS measuring head (entered at the OxiTop®-IDS measuring head)
2. Series number of the OxiTop®-IDS measuring head

For allocating a head press the right button until the LED flashes green

Repeat until you have all heads for a sample

If desired select a new sample and repeat

OxiTop®- IDS: Now with Multi 36x0 IDS

Example: Set for OECD 301 F, double determination (2 heads in one sample)

- **Sample with substance and seed**

- **Sample without substance but seed**

- **Dilution water**

- **Abiotic control**

Makes at least 8 heads in four samples

OxiTop®- IDS: Now with Multi 36x0 IDS

Starting the Measurement

- Using **<ESC>** or *continue* to change to *Set*
- *Start Measurement* will start all heads
- Time between Meter and head swill be synchronized

When LEDs are on, they start flashing **magenta**, when *AutoTemp* is on, the display shows *AutoTemp*

Attention: When the measurement has been started no change of settings is possible anymore!

OxiTop®- IDS: Now with Multi 36x0 IDS
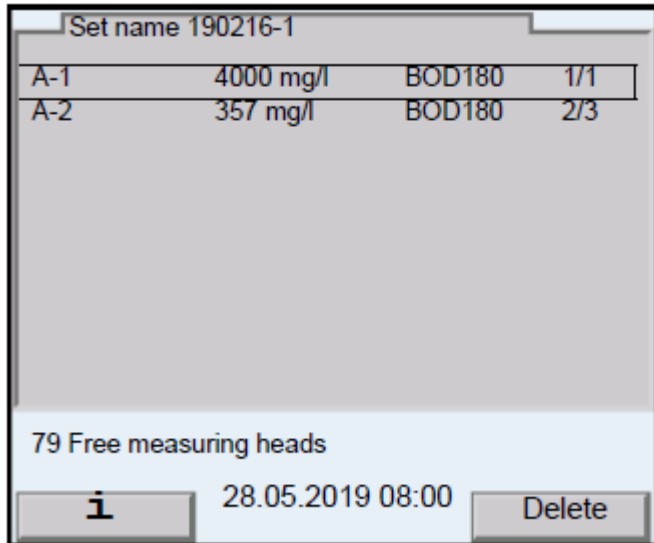
Getting the data

View on sample screen
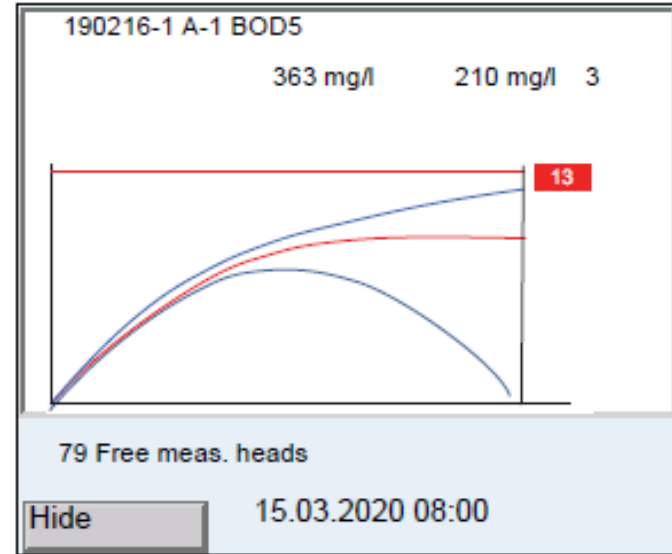
View on curves

Data transfer:
- Sample by sample (averaging(!)), will still be added for pressure mode)
- Via USB Stick as csv data file (fastest way), MultiLab® Importer to a PC

OxiTop®- IDS: Now with Multi 36x0 IDS

Getting the data (print out from MultiLab® Importer)

	A	B	C	D	E	F
1	Set:	200429-1				
2	Sample:	BUSL-1		Current date:	29.04.2020	
3				Finished:	Yes	
4	Type:	BOD5		Measuring range [mg/l]:	800	
5	Start date:	29.04.2020		Start time:	15:05:30	
6	End date:	04.05.2020		Number of measuring heads:	3	
7	GLP:	Off		AutoTemp:	Off	
8	Bottle volume [ml]:	510,0		Sample volume [ml]:	97,0	
9	Target number of measured values:	300		Actual number of measured values:	300	
10	Mean value [mg/l]:	0,0		SD [mg/l]:	0,0	
11	Dilution 1 +:	0		Temperature [°C]:	20	
12	Height [m]:	562		Air pressure [hPa]:	947	
13						
14						
15		Head	1		2	3
16		ID	309		418	1
17		Serial no.	23454377		23454377	23454377
18	No.	Time [sec]	mg/l	mg/l	mg/l	
19	0	0	0,0	0,0	0,0	
20	1	1	0,3	0,0	0,0	
21	2	2	0,0	0,1	0,1	
22	3	3	0,2	0,1	0,0	
23	4	4	0,0	0,0	0,0	
24	5	5	0,2	0,0	0,1	
25	6	6	0,1	0,1	0,1	
26	7	7	0,2	0,2	0,1	
27	8	8	0,2	0,2	0,1	
28	9	9	0,1	0,0	0,0	
29	10	10	0,1	0,0	0,0	
30	11	11	0,2	0,1	0,0	
31	12	12	0,2	0,1	0,0	
32	13	13	0,0	0,1	0,0	
33	14	14	0,2	0,0	0,0	
34	15	15	0,2	0,1	0,1	

BOD and aerobic degradation

All kinds of aerobic degradation (BOD/OECD…):

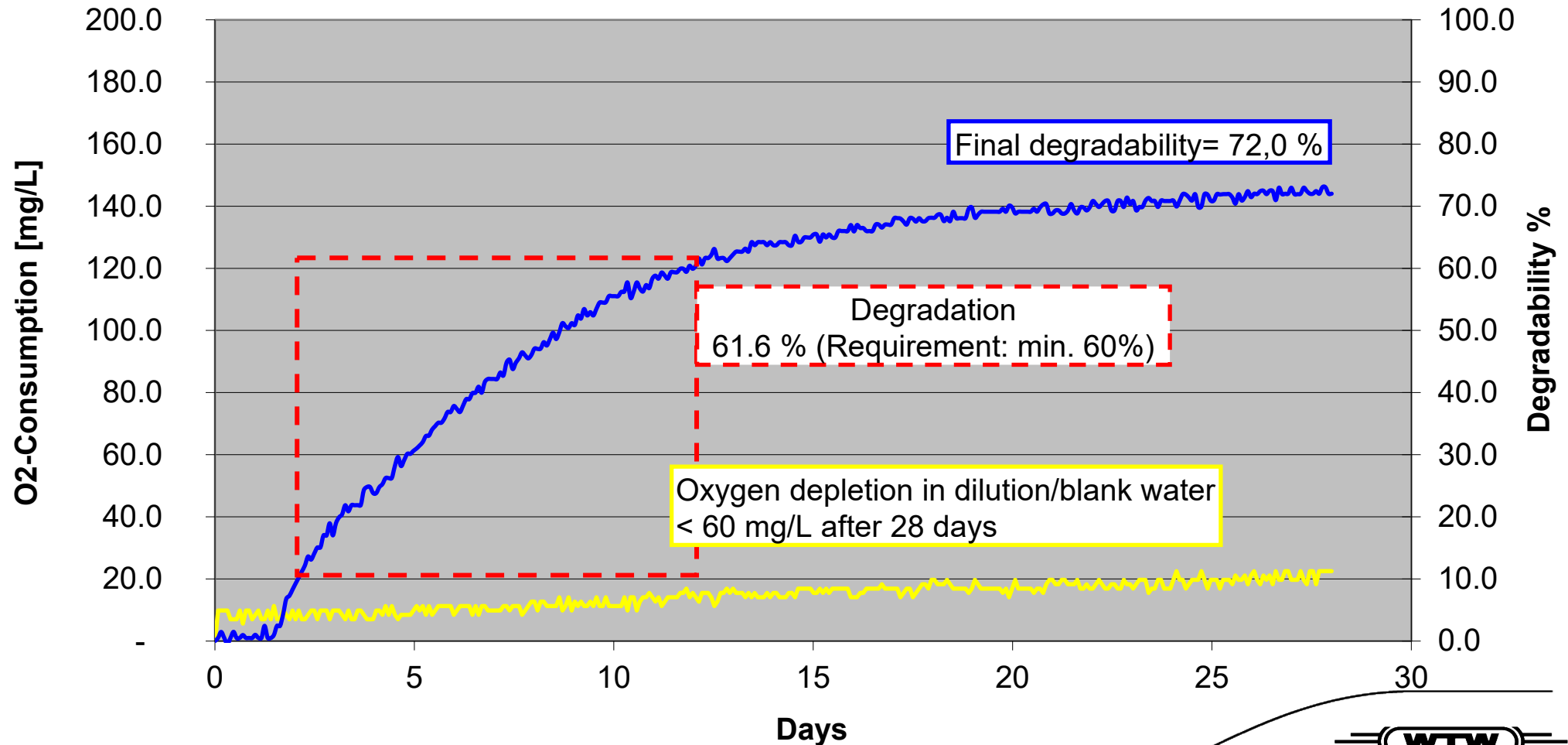Measurement BOD/aerobic tests, OECD (duration up to 180 d)

- OxiTop®-IDS IS 6/IS 12

Measurement (OECD)
- OxiTop®-IDS A 6 (good degradability)
- OxiTop®-IDS A 12 (low degradability)

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Application example: OECD 301F

1-Octanol

Final degradability= 72,0 %

Degradation
61.6 % (Requirement: min. 60%)

Oxygen depletion in dilution/blank water
< 60 mg/L after 28 days

O2-Consumption [mg/L]

Degradability %

Days

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Soil respiration

Soil respairation (soild with low activities up to AT4 (bio-mechanically treated waste):

Low activity
(bottle volume
500 ml)
OxiTop®-IDS B6

Soils with medium to
high activity
OxiTop®-IDS B6M

Bio mechanically
treated waste (AT4)
OxiTop®-IDS B6M 2.5

Soil respiration

Soil respiration
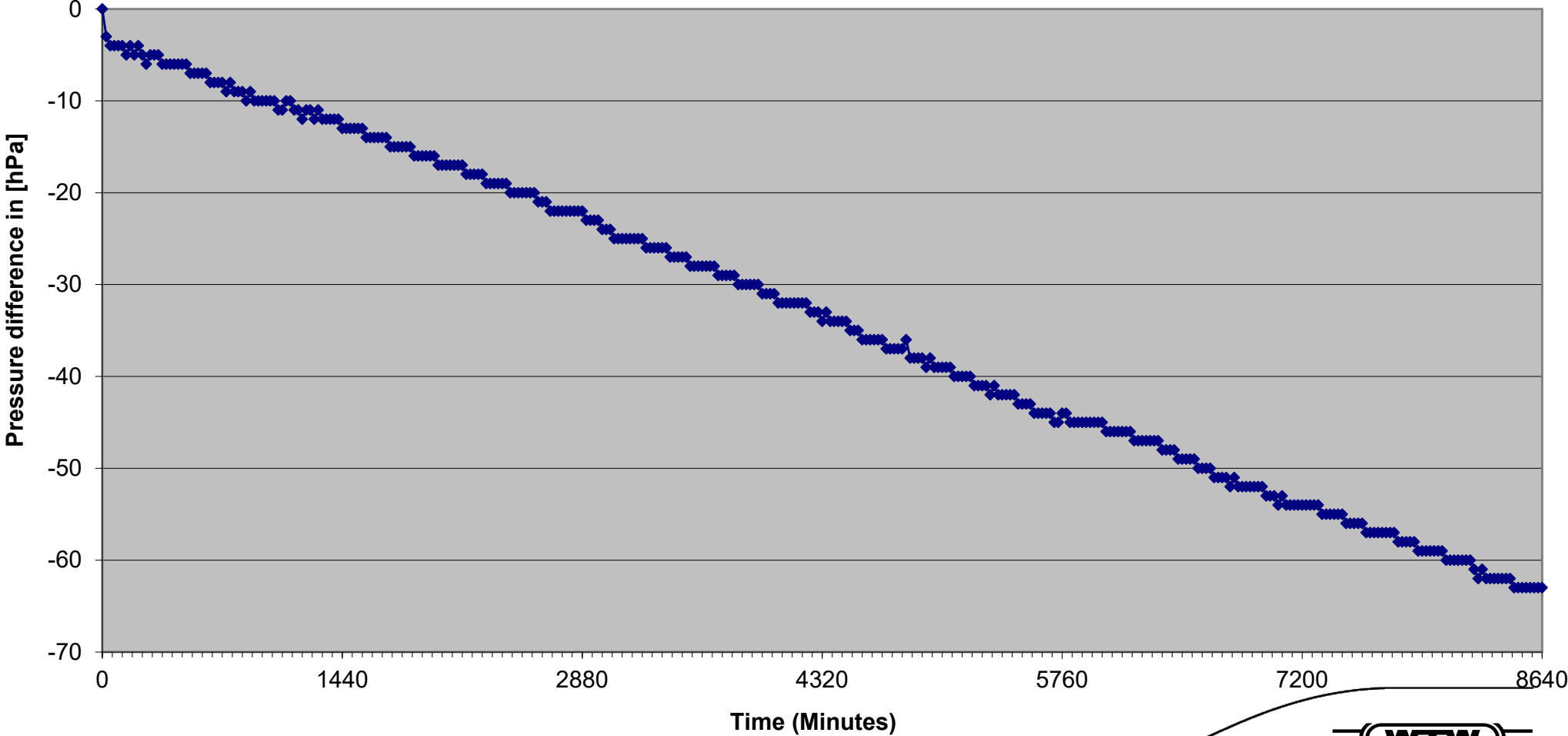
Anaerobic Measurements and Biogas

OxiTop®-IDS/B
- Corrosion proof pressure sensors
- Pressure range up to 1500 hPa
- Parst of following sets: OxiTop®-IDS AN 6/AN 12
- More Safety: Active over pressure warning (Display/red blinking LED!)

Anaerobic Measurements and Biogas

Example of biogas compositions:

Methan	40 - 75 %
Carbon dioxide	25 - 55 %
Water vapor	0 - 10 %
Nitrogen	0 - 5 %
Oxygen	0 - 2 %
Hydrogen	0 - 1 %
Ammonia	0 - 1 %
Hydrogen peroxide	0 - 1 %
Hydrogen sulfide	0 – 1 %

Example for a Biogas Measurement

Cow manure

Two different samples of cow manure, two repeat determinations each

Pressure decrease after adding NaOH solution as CO_2 absorber

Blank test

Lag phase (adaption of microorganisms)

Time [d]

Pressure [hPa]

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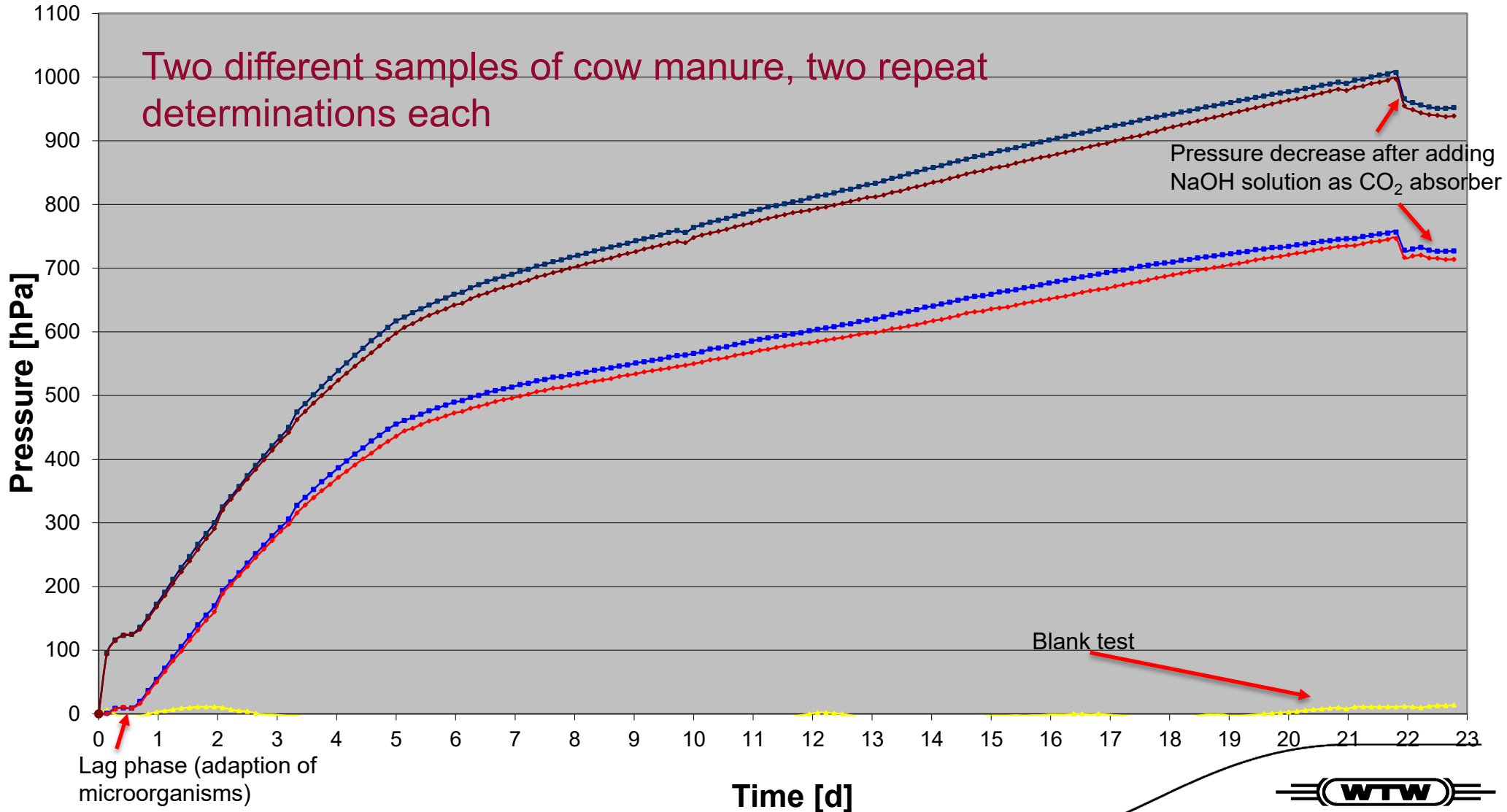
A new feature: OxiTop®- IDS: Not only with the Multi…

- Easy to identify: Use the manual ID-No.

- Simply select:
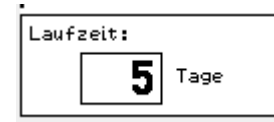
  - Duration 1 – 7 days
  - Unit of the result: mg/l, hPa, ΔhPa, digit
  - Sample volume (ml): 22.5 43.5 97 164 250 365 432
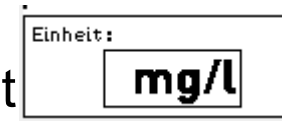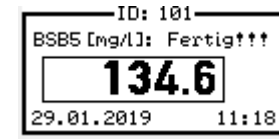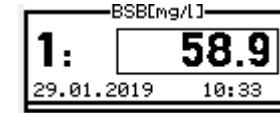
- Start the measuerement:

  - AutoTemp is running
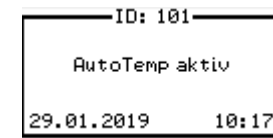
A new feature: OxiTop®- IDS: Not only with the Multi…

- Checking the measurement:

    - Call-up intermediate results
    - Read out of curves
    - Receiving final results
   - Terminate the measurement
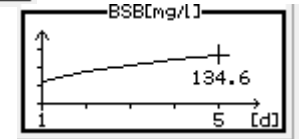
- More convenient settings

    - Languages (D,E, F, Sp)
    - Illumination
    - Control-LED (Blue: Measuring, Magenta: Wireless advertising (only when ECO-Mode is On), Green: Done, Red: Attention)
    - Display off time
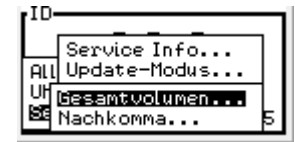   - ID assignment (also valid for IDS measurement)

A new feature: OxiTop®- IDS: Not only with the Multi…

- Setting date/time:

- Additional points: Update for wireless heads!
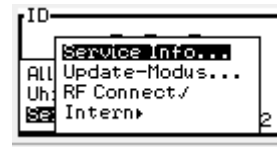
- Menu „Internal": Bottle Volume (Attention!)
- Special function: OxiTop® PT test program

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Everything else stays as it is????

Almost:

All OxiTop®-C accessories, consumbles and replacement parts will remain for sale: Bottles, vessels, absorbents, stirring platforms (IS 6, IS 12, IS 6-Var now in cosmic grey), thermostatic cabinets, etc.

The following heads will be supplied as replacement until end of 2020: OxiTop®-C, OxiTop®-C 2, OxiTop®-C/B All sets are without meters!

Separate instruction manual for Multi 36x0 IDS for OxiTop®-IDS! (download or part of Multi 36x0 IDS WL sets!)

Some technical specs….

OxiTop®-IDS/OxiTop®-IDS/B	
Pressure range (hPa)	500 to 1250 resp. 500 to 1500
BOD measurement range (mg/l)	0 to 4000 mg/l (with Multi 36x0 up to 400.000 mg/l)
Selectable measuring range (day)	1 to 7 with Multi 36x0: 0,5 h to 180 days)
Selectable sample volume (ml)	22.7 ; 43.5 ; 97.0 ; 164 ; 250 ; 365 ; 432 (freely selectable with Multi 36x0 IDS)
Display	LCD graphic, backlit
Control LED	RGB
Battery	1 x ½ AA Lithium (LS 14250)
Operation lifetime (Eco mode settings)	Availability 24 h/day: 100 days continuously 3 h/day: about 2 years continuously 0.5 h/day: up to 5 years continuously
Capacity	Up to 100 heads

Overview about existing sets…

	New	Comment
209714	OxiTop®-IDS IS 6	Extension set
209716	OxiTop®-IDS IS 12	Extension set
209713	OxiTop®-IDS Set 12	Basic Set, 6 bottles
209711	OxiTop®-IDS Set 6	Basic Set, 12 bottles
209700	OxiTop®-IDS	Single head
209701	OxiTop®-IDS/B	Single head, biogas
209702	OxiTop®-IDS 2	Two single heads
209704	OxiTop®-IDS 6	Six single heads
Multi 3620 IDS SET WL or Multi 3630 IDS SET WL	2FD56W or 2FD57W	Meter with two channels / Meter with three channels
209721	OxiTop®-IDS A6	Aerobic set, 6 bottles (1 L)
209723	OxiTop®-IDS A12	Aerobic set, 12 bottles (250 mL)
209725	OxiTop®-IDS AN6	Anaerobic set, 6 bottles (1 L)
209727	OxiTop®-IDS AN12	Anaerobic set, 12 bottles (250 mL)
209729	OxiTop®-IDS B6	Soil respiration, 6 bottles (0.5 L)
209732	OxiTop®-IDS B6M-2.5	Soil respiration, 6 vessels (1.0 L)
209731	OxiTop®-IDS B6M	Soil respiration, 6 vessels (2.5 L)

Note:
Sodium hydroxide pellets NHP 600 have to be ordered separately!

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Summary – Reasons for buying OxiTop®-IDS

- Maximum versatility for aerobic and anaerobic degradation
- Ease-of-use
- Modular system: change accessories – change application
- Robust and long-term stable measuring principle – pressure measurement
- Low cost of ownership
- Easy switch to Echem parameters by adding IDS sensor
- Data acqusition via PC

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Poll Question #3

Do you want someone from Xylem to contact you to discuss OxiTop sensors?