

OxiTop® for BOD – much simpler – much easier

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SALES GMBH & CO KG



a xylem brand

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



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®



Poll Question #1

What is your professional background?



Poll Question #2

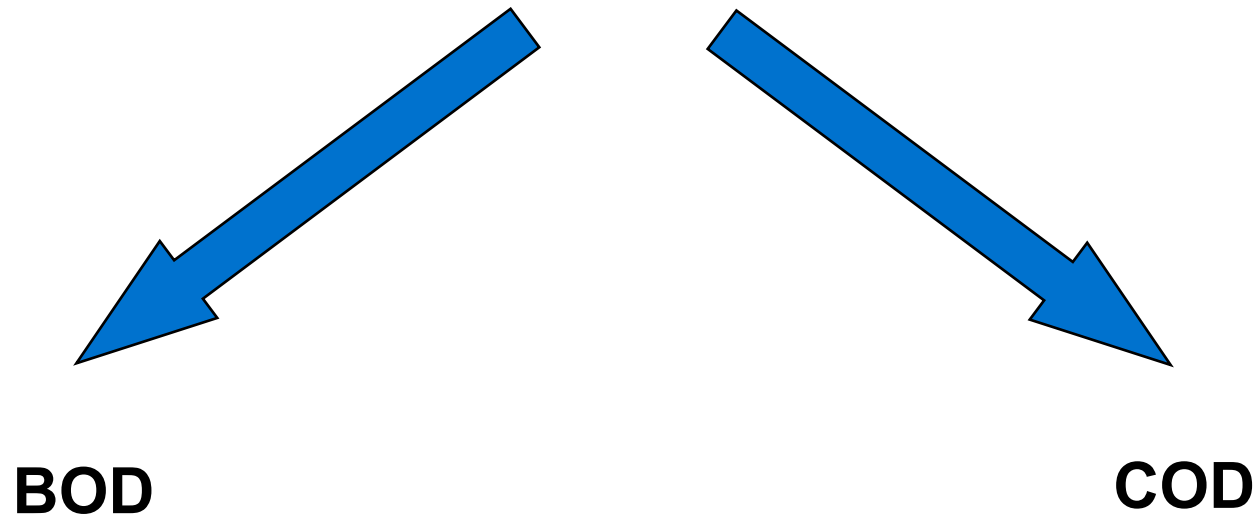
What is your professional focus?

Biochemical Oxygen Demand (BOD)

- Sum parameter in water, soil and waste analysis for characterization and quantification of metabolism in aerobic processes.
- Introduced in 1912: „Final Report of the Commissioners appointed to inquire and report what Methods of Treating and Disposing of Sewage (...) may properly be adopted“ (1915) included in the “Eight Report” (1912) (Royal Commission on Sewage Disposal)
- Today part of DIN EN 1899-2, ISO 5815-2, ASTM of Water and Wastewater Analysis 5210 D

Biochemical Oxygen Demand (BOD)

Oxygen consumption parameters



Common ratio BOD : COD = 1 : 1

Biochemical Oxygen Demand (BOD)

Microbes as living organisms need:

- Adaptation period to environment
- Incubation temperature to be stable
- pH - values about pH 7
- Well balanced supply with nutrients (C,N,P)
- Oxygen



amount of consumed O_2  BOD_x

Biochemical Oxygen Demand (BOD)

Why BOD_x :

- “Waste water plant in a bottle”
- Samples are taken from inlet and outlet
- Comparison shows the efficiency of the plant on the degradation of the carbon freight
- Helpful for adjusting process parameters
- Not suitable for instant monitoring

Biochemical Oxygen Demand (BOD)

Dilution BOD (official reporting method)

- Preparation of dilution series – requires trained personnel!
- Measurement with oxygen probe / standard method (DIN EN 1899-1, Standard Methods 5210 B)
- Alternative determination: photometric (monitoring)

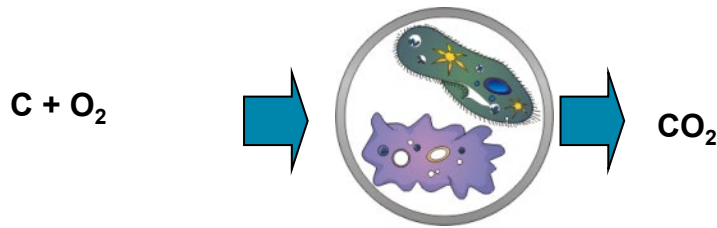
Respirometric BOD: (self-check, proposed method)

- Use undiluted sample, adjust by sample volume
- Measurement of pressure
- Self check method (DIN EN 1899-2, Standard Methods 5210 D)

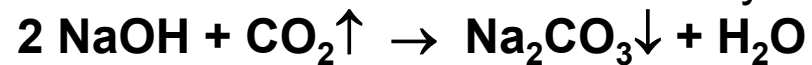
Biochemical Oxygen Demand (BOD)

Principle of Respirometric Measurement

Bacteria decompose organic substances C_{org} by consuming oxygen and producing carbon dioxide CO_2



Carbon dioxide will be absorbed by sodium hydroxide:

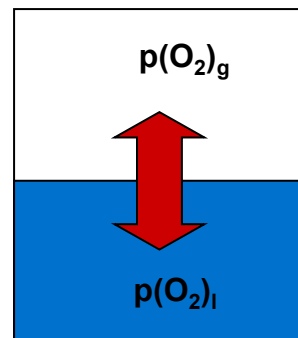


Biochemical Oxygen Demand (BOD)

Conversion of pressure values to oxygen demand (BOD) by using the modified common gas equation (closed bottle). The unit of BOD is mg/L.

$$\text{BOD} = \frac{M(\text{O}_2)}{RT_m} \cdot \left(\frac{V_{\text{tot}} - V_1}{V_1} + \alpha \frac{T_m}{T_0} \right) \cdot \Delta p(\text{O}_2)$$

Constant stirring ensures a continuous and fast gas exchange



Biochemical Oxygen Demand (BOD)

Which points have to be considered in every BOD_n measurement?



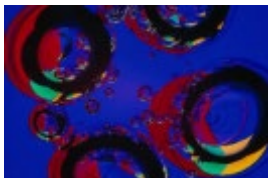
Sampling (typical composition of source, temperature during storage)



Homogenization (stirring preferable to homogenization avoiding destruction of bacteria)



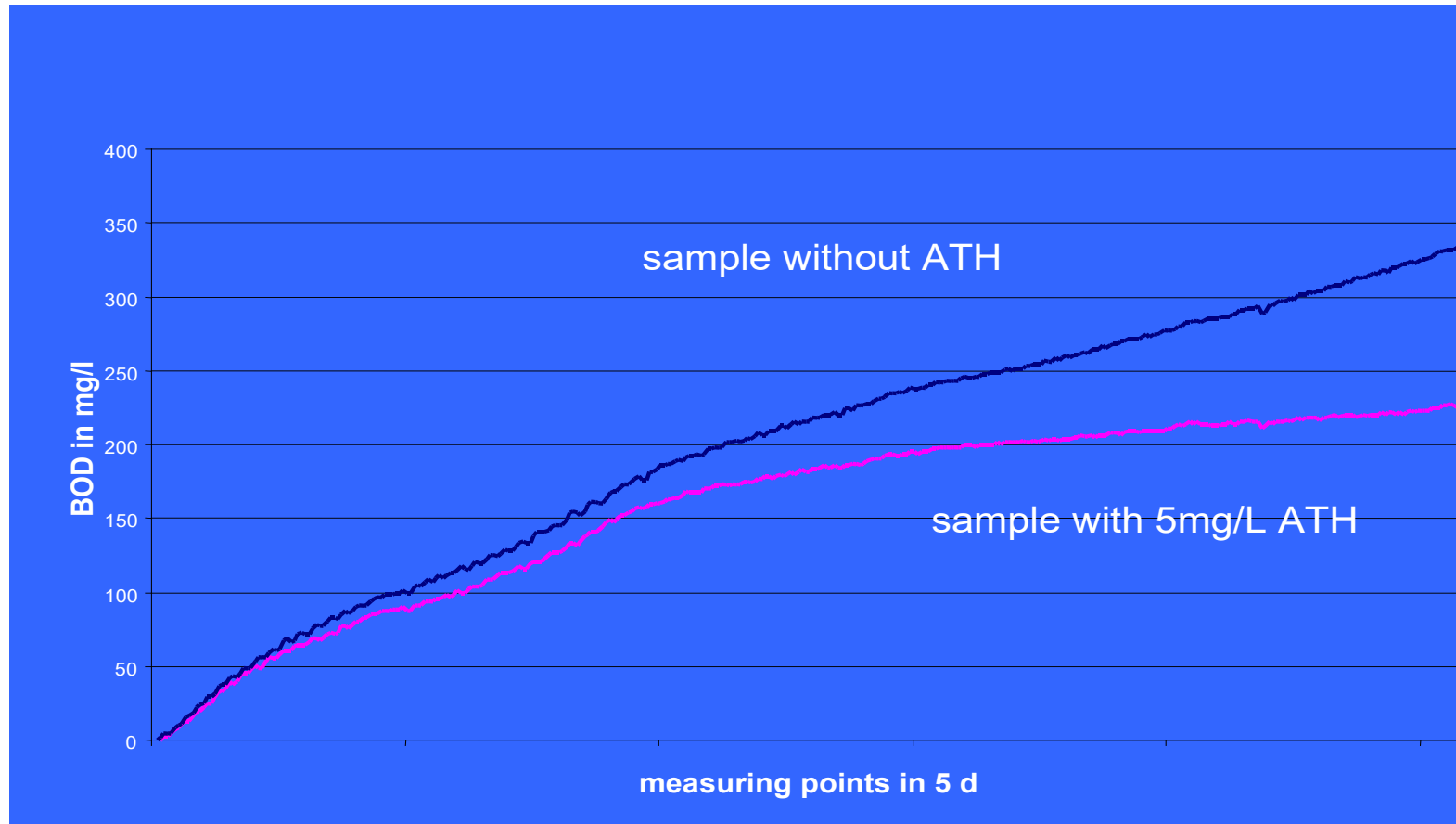
Oxygen concentration (saturation by stirring to avoid lack of oxygen during testing period)



Nitrification inhibitor (avoiding oxygen demand by nitrifying bacteria)

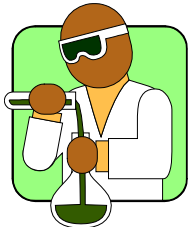
Biochemical Oxygen Demand (BOD)

Effect of nitrification inhibitor on measurement



Biochemical Oxygen Demand (BOD)

Which points should you also consider in a BOD measurement?



pH value (approx. pH 7)



No inhibiting and toxic ingredients (can be observed at course of curve)



No chlorine or other bacteria-killing substances



Poll Question #3

What do you currently use for your studies?

The Past: A Story of Success!



- 24 year unaltered in the market
- Replacement of old mercury manometers
- Easiest use
- Far more than 200,000 heads sold

In Spite of This: It's time for something new— Time for....

OxiTop[®]-i



OxiTop[®]- i: Secure, easy, convenient

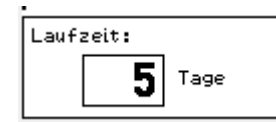
- Easy to identify: Assign a manual ID-no.



- Easy to select:

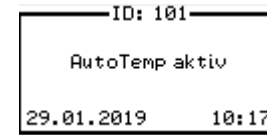


- Measuring period 1 – 7 days
- Units: mg/l, hPa, Δ hPa, digit
- Sample volume (ml): 22,5 43,5 97 164 250 365 432



- Start the measurement:

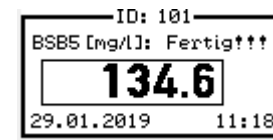
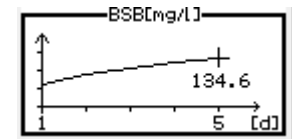
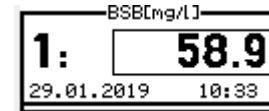
- AutoTemp is running



OxiTop[®]- i: Secure, easy, convenient

- Check your measurement:

- Call up intermediate results
- Read the curve
- Get final results
- Terminate the measurement



- Additional convenient settings

- Languages (D, E, F, Sp)
- Illumination
- Signal LED (Blue: Measurement, Green: Ready, Red: Attention)
- Display off
- ID setting

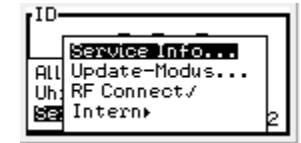


OxiTop[®]- i: Secure, easy, convenient

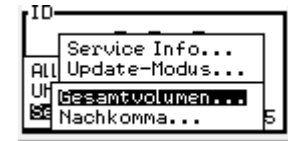
- Adjusting date/time:



- Internal function: Setting of bottle volume(!)



- Special function OxiTop[®] PT Routine



Operating principle from handhelds: long press/short press!

Fully automatic:

Calculation of BOD using the common gas equation in closed bottle

$$\text{BOD} = \frac{M(\text{O}_2)}{RT_m} \cdot \left(\frac{V_{\text{tot}} - V_{\text{fl}}}{V_{\text{fl}}} + \alpha \frac{T_m}{T_0} \right) \cdot \Delta p(\text{O}_2)$$

$M(\text{O}_2)$ Molecular weight O_2 (32000 mg/mol)
 R Gas constant (83,144 L hPa/(mol K))
 BOD_5
 α Bunsen absorption factor (0,03103)
 $\Delta p(\text{O}_2)$ Differential partial pressure oxygen(hPa)

T_0 abs. temperature (273,15 K)
 T_m temperature of measurement (293,15 K)
 V_{tot} bottle volume (mL)
 V_{fl} sample volume

Important points

- Menu controlled LCD display
- Selection of sample volume for direct output of BOD in mg/l
- Adjustable measuring period between 1 and 7 days.
- Representation of measured values in a curve at the display- Easy checking of the measurement
- Display of BOD in mg/l – No conversion necessary
- Control-LED for signaling the current operating state
- ID No. for sample identification
- Robust plastic housings in blue and and cosmic grey for easy assignment of inlet and outlet

And everything else remains as it is????



**Yes, without
Ifs and Buts!**

And everything else remains as it is????

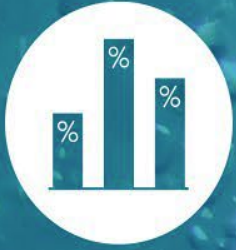


All accessories can be used without change:

- Bottles PF 600
- Stirring platforms IS 6 and IS 12 (new: now cosmic grey)
- Nitrification inhibitor NTH 600
- Sodium hydroxide pellets NHP 600
- Thermostatic cabinets TS 608...TS 1008 and the OxiTop[®] Box

Some specs....

OxiTop [®] -i G resp. OxiTop [®] -i B	
Measuring range (hPa)	500 to 1250
BOD Measuring range (mg/l)	0 to 4000 mg/l
Selectable measuring period (Tage)	1 to 7
Selectable sample volume (ml)	22.7 ; 43.5 ; 97.0 ; 164 ; 250 ; 365 ; 432
Display	LCD graphic, backlit, menu controlled
Control LED	RGB
Battery	1 x CR 2450



Poll Question #4

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

Questions?

Contact us:

Xylem APAC & MEA

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Klaus Reithmayer

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