Mastering BOD Analyses: Techniques, Tips, and Insights for Accurate Water Quality Assessment

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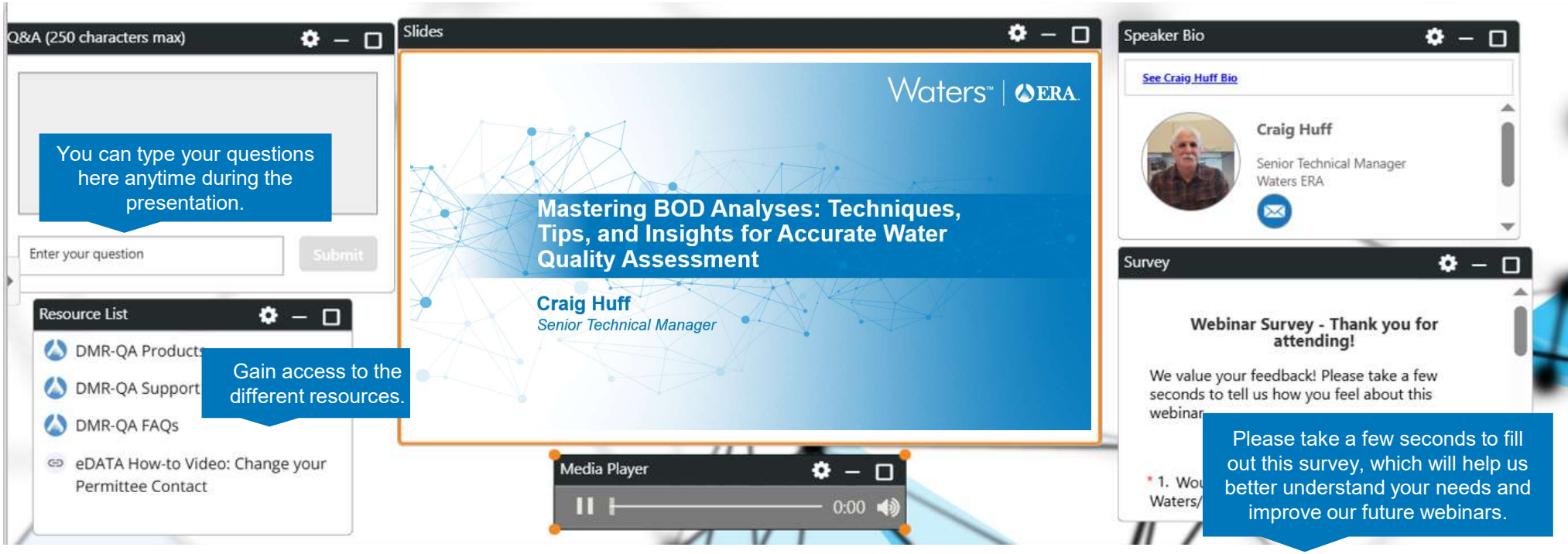
Webinar survey – your feedback is appreciated!

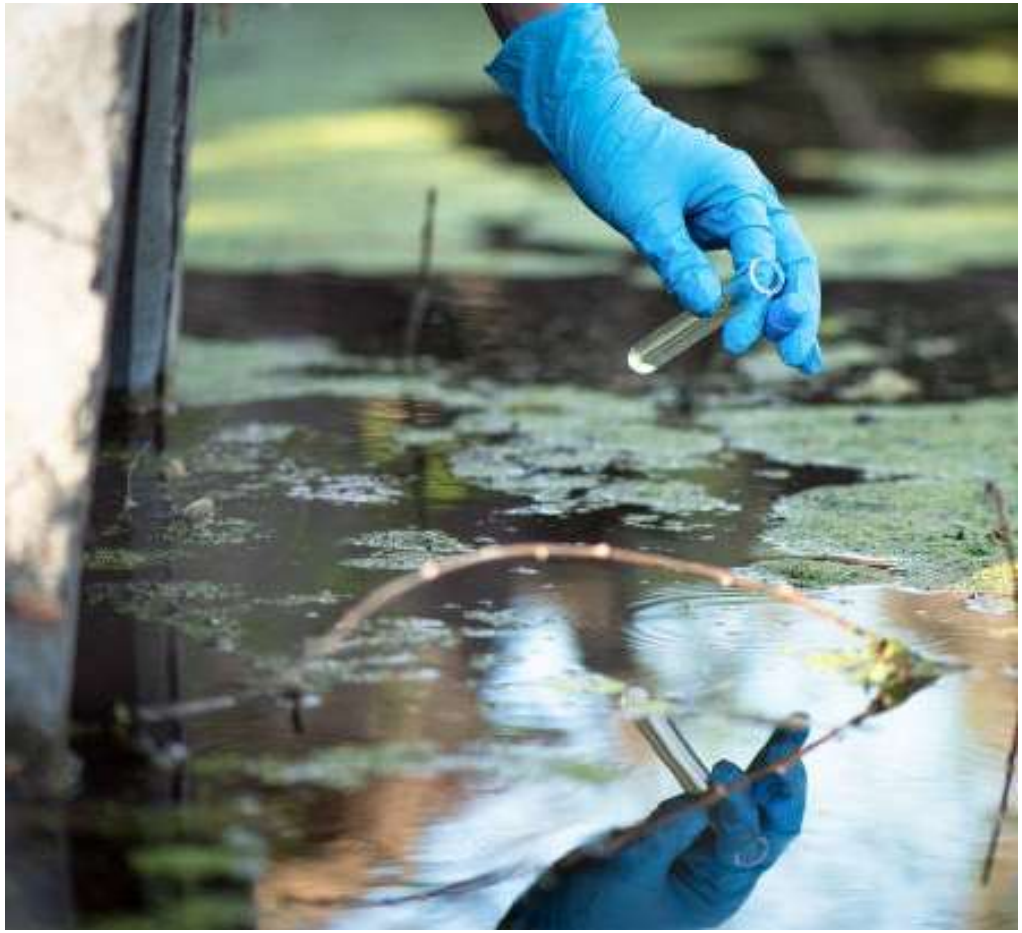


Mastering BOD Analyses

- Key Learning Topics
  - A general method overview
  - Helpful hints and best practices
  - CBOD vs BOD
  - Correlation between CBOD, BOD, COD & TOC
  - Historical Demand PT performance statistics
- Speaker – Craig Huff
  - Senior Technical Manager

Outline

- Method overview
- Helpful hints
- QC checks
- Correlation of BOD results
- PT data summary



Method Overview

- Standard Methods 5210 B (24th Edition)
- Indirect measure of biodegradable organic compounds (carbon & nitrogen)
- Photo-sensitive test (incubate in dark and reduce exposure to light)
- BOD-5 test also measures nitrogenous demand
  - 5 Day incubation period
  - 20 ± 1°C
- CBOD test measures carbonaceous BOD
  - Think of it as BOD-5 but with nitrification inhibitor added
- Both analytes can be correlated to COD & TOC (particularly in CRMs and PT samples)

Helpful Hints

- Dilution water -Preparation and care is critical (distilled, deionized*, or clean tap water)
  - Must be clean, i.e., no toxic metals, chlorine or other contaminants that can kill or inhibit seed microorganism activity.
  - Store in clean glass container
  - DO concentration at least 7.5 mg/L– follow method for proper DO adjustment techniques to attain adequate saturation
  - Prepare ASAP before use
  - DO depletion should not be >0.2 mg/L
- Perform multiple dilutions of samples- at least 3 dilutions recommended
  - Residual DO of at least 1 mg/L and a DO uptake of at least 2.0 mg/L post-incubation
  - pH is critical (6.5 - 7.5 ideal). Be careful when adjusting pH (weak solutions of H_2SO_4 or NaOH)

Helpful Hints Continued

- Seeding--Use of undisinfected effluent is most common. “Poly seed” can also be used
  - Add seed to samples before final dilution/final volume (use same amt of seed for each sample dilution)
  - DO uptake attributed to seed should be 0.6-1.0 mg/L
  - Good practice is to use seed amounts that produce results of 198 ± 30.5 mg/L in the GGA sample
  - ERA PT samples and CRM formulations include GGA and require seeding
- Completely fill BOD bottles (no headspace)
  - Ensure BOD bottles are sealed to prevent introduction of O_2 from atmosphere (water seal with cup or foil cover to prevent evaporation of water seal during incubation)
  - After dilution preparations are complete, measure initial DO within 30 min.

Helpful Hints Continued

- DO measurements (initial & final)
  - Ensure DO probe is calibrated and properly maintained
  - Check accuracy with DO CRM/RM
  - Monitor drift (using DO CRM or extra GGA sample/BOD CRMs during course of analyses
- Ensure proper temperature is attained and consistent during incubation (20 ± 1°C)
- Incubate for 5 days ± 6 hrs (no less, no more)

QC Checks

- For all samples (including seed controls)- Ensure DO depletion is at least 2.0 mg/L and with at least 1 mg/L residual DO (post incubation)
  - Ensure GGA and any supplemental QC checks (BOD CRMs) are within acceptance criteria
  - Reference Section 8. of SM 5210 B for additional information
  - Average dilution results for sample (results that meet criteria)
  - Ensure dilution water quality checks are satisfactory with each analytical batch (avg of 2 or more bottles… uptake must be <0.2 mg/L…preferably <0.1 mg/L)
- Calculate results per section 7. of SM 5210 B
- When performing tests on PT samples, give yourself plenty of time to complete testing, noting that additional testing/re-testing may be required before study close dates.

Correlation of BOD Results to Other Tests on PT Samples

- If you performed other tests (such as CBOD, COD or TOC) on your PT sample, you can do a quick “sanity” check of your BOD results: Use for guidance only
- GGA-based formulations can yield the following correlations between results:
  - CBOD = BOD * ~0.9
  - CBOD = COD * ~ 0.5-0.6
  - CBOD = TOC * ~ 1.4
  - BOD = TOC * ~1.6
  - BOD = COD * ~0.6
- The above correlation factors can change slightly with concentration variations
- For WP and DMR-QA PT studies, your BOD results should fall within the following NELAC concentration range: 18 – 230 mg/L. Again, you can use this as a check on your results as well.

Historical PT Data Summary for ERA Demand Samples

- This data summary represents hundreds of WP studies and >10,000 data points for each analyte reported in ERA WP and DMR-QA PT studies

Analyte	% Recovery	Standard Deviation (%)	Acceptance Limits (%)	Failure Rate (%)
	Hist	Hist	Hist	Hist
BOD	116	16.6	57.9 - 173	4.7
CBOD	105	18.9	45.8 - 165	5.5
COD	98.6	8.30	74.1 - 123	6.3
TOC	100	6.00	82.0 - 118	5.0

Note the precision data for the more “direct measurement” analytes TOC/COD vs BOD/CBOD.

BOD PT Acceptance range = ± ~50% (slightly wider on lower end of range, slightly tighter on upper end of range) because this is a regression eqtn-based calculation

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Thank you!

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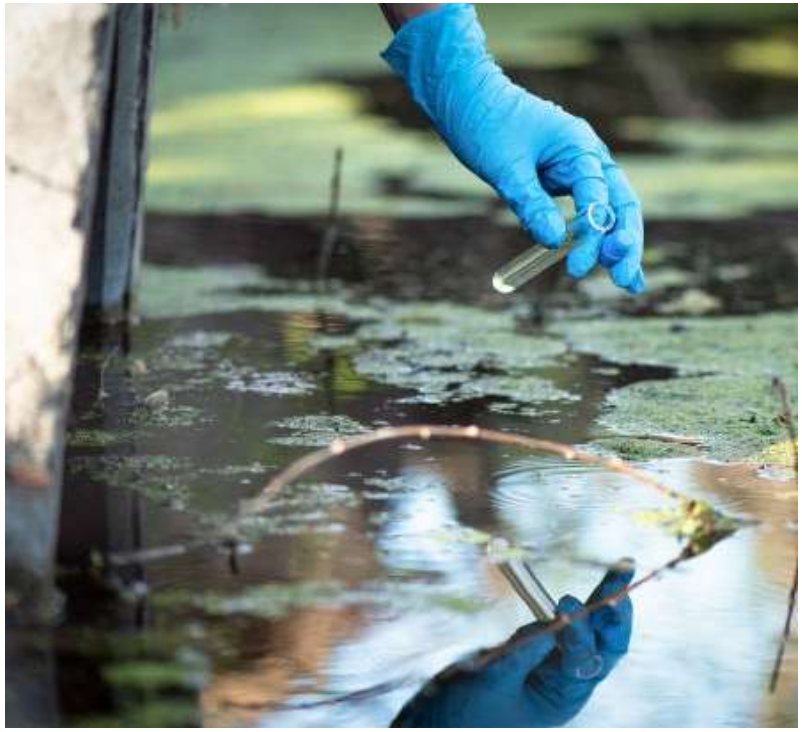

Live Q&A Session: Mastering BOD Analyses: Techniques, Tips, and Insights for Accurate Water Quality Assessment

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