



Certification Boulevard

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Test Your Knowledge of Residuals Management

- Given the following data, what is the cost of polymer used, in \$ per dry ton processed, in this Gravity Belt Thickener (GBT)?
 - Total sludge feed to the GBT is 176,750 gpd
 - Feed sludge concentration is 0.75%
 - Total neat polymer used is 5 gpd
 - Polymer specific gravity (S.G.) is 1.03
 - Polymer cost is \$1.24 per pound

A. \$5.24/dt B. \$15.50/dt
C. \$9.68/dt D. \$33.54/dt
- Given the data from question No.1, is this an acceptable cost of polymer usage for a Gravity Belt Thickener (GBT)?

A. Yes, very reasonable
B. No, it is too high
C. There is not enough data to calculate this parameter
- Given the following data, what is the annual chlorine budget at this plant?
 - Plant Flow = 7.25 mgd
 - Preliminary Treatment Chlorine Dosage = 3.5 mg/L
 - Effluent Filtration Chlorine Dosage = 2.0 mg/L
 - Effluent Chlorine Dosage = 4.9 mg/L
 - Effluent Chlorine Residual = 1.5 mg/L
 - Chlorine Cost = \$0.29 per Pound

A. \$125,564 B. \$35,245
C. \$14,789 D. \$66,562
- What does this formula represent?

$$\frac{[(\text{lbs/day sludge feed} - \text{lbs/day sidestream}) \times 100] \div (\text{lbs/day sludge feed})}{100}$$

A. Polymer dosage rate
B. Percent capture efficiency
C. Throughput production
D. Filtrate to feed ratio
- What is the FIRST warning sign that trouble is starting in an anaerobic digester?

A. Increase in carbon dioxide production
B. Increase in pH
C. Increase in sludge volume
D. Increase in volatile acid/alkalinity relationship
- Which term is most related to vector attraction reduction in an aerobic digester?

A. Settleometer B. Pathogen
C. SOUR D. F/M

- What color should digested sludge be in a properly operated anaerobic digestion process?

A. Black B. Grey
C. Green D. Brown
- What 15-minute test will help to identify the concentration of thickened sludge product from a gravity belt thickener system?

A. Laboratory TSS B. Settleometer
C. Centrifuge spin-down D. Sludge judge
- What is the primary function of polymer conditioning in the belt filter press process?

A. To decrease solids content.
B. To promote rapid water release in the gravity section.
C. To sterilize the microorganisms.
D. To disinfect the sludge particles.
- What does the production of foam typically indicate in an anaerobic digester?

A. The alkalinity level is too high.
B. The acid production is too low.
C. The acid production is too high.
D. This is a normal indication ... all is OK.

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Readers are welcome to submit questions or exercises on water or wastewater treatment plant operations for publication in Certification Boulevard. Mail your question (with the answer) or your exercise (with the solution) to Roy Pelletier, City of Orlando Public Works Department, 5100 L.B. McLeod Road, Orlando, FL 32811. Or send it by e-mail to roy.pelletier@cityoforlando.net.

Looking for Answers? Here Are the Questions from Past Issues

Are you new to the water and wastewater field? Want to boost your knowledge about topics you'll face each day as a water/wastewater professional?

All past editions of Certification Boulevard back through July 2000 are available on the Florida Water Environment Association's Web site at the following Internet address.

<http://www.fwea.org/dynamics.asp?id=109>

This will take you to a Web page titled "Quizzes and Case Studies." All Certification Boulevard questions and answers since January 2006 are posted on this page.

Also, near the top left corner of the page above the "Quizzes and Case Studies" title, click on the phrase "Archives CBTS" to access all Certification Boulevard questions and answers dating back to the year 2000.

Certification Boulevard Answer Key

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1. **C. \$9.68/dt**

Formula: (Total Cost of Polymer Used, \$) ÷ (Total Dry Tons of Sludge Processed, dt)

Cost of Polymer

= 5 gpd x 8.34 lbs/gal x 1.03 S.G.
 = 42.95 lbs polymer used
 = 42.95 lbs polymer x \$1.02 per lb polymer
 = \$53.25 polymer used

Dry Tons Processed

= 0.176750 mgd x 7,500 mg/L x 8.34 lbs/gal
 = 11,056 lbs dry solids divided by 2,000 lbs/ton
 = 5.5 dry tons processed

(Total Cost of Polymer Used) ÷ (Total Dry Tons of Sludge Processed)

= \$53.25 ÷ 5.5 dt
 = \$9.68 per dt processed

2. **A. Yes, very reasonable**

An acceptable cost of polymer used per dry ton processed in a GBT is about \$10 per dt.

3. **D. \$66,562**

Total Chlorine Dosage

= 3.5 mg/L + 2.0 mg/L + 4.9 mg/L
 = 10.4 mg/L

Total lbs/day Chlorine used

= 7.25 mgd x 10.4 mg/L x 8.34 lbs/gal
 = 628 lbs/day chlorine used

Cost per day Chlorine used

= 628 (plus decimals) lbs/day x \$0.29 per lb
 = \$182.36 per day

Cost per year Chlorine used

= \$182.36 per day x 365 days/year
 = \$66,562.29 per year chlorine used

4. **B. Percent capture efficiency**

This is the basic formula for percent removal, or efficiency [(In-Out ÷ In) x 100]. It calculates the removal rate of the pounds of solids entering the belt press in relationship to the pounds of solids in the unit's side-stream. The result is the solids capture efficiency on the belt press—and the ultimate pounds of solids in the cake product.



5. **D. Increase in volatile acid/alkalinity relationship**

Because the alkalinity is so high in an anaerobic digester, the pH is slow changing and the digester will basically go “sour” before the pH begins to drop. This is why the acid/alkalinity ratio is the best process tool to use to monitor the performance efficiency of anaerobic digestion.

6. **C. SOUR**

Vector attraction reduction is related to volatile solids reduction, which identifies long-term stability of the conditioned sludge. Specific Oxygen Utilization Rate (SOUR) is the test most used to determine the vector attraction reduction performance of aerobically digested sludge. The maximum SOUR value allowed to meet vector attraction reduction for Class B standards is 1.5 mg/hr/gm total solids.

7. **A. Black**

High-quality anaerobically digester sludge is black—the blacker the better. Sludge that is under-conditioned is called “green sludge,” even though the color is actually grey.

8. **C. Centrifuge spindown**

A centrifuge spindown test takes about 15 minutes and provides excellent indication of solids inventory. Comparing spindown test results to laboratory total solids testing can identify increasing or decreasing solids concentration. The centrifuge is not intended to replace a laboratory TS test, only to supplement the lab data with quick indicators for field process control parameters.

9. **B. To promote rapid water release in the gravity section.**

The result of polymer conditioning of the feed sludge is a release of water in the gravity section of the belt filter press. This is accomplished by neutralizing the charge of the sludge, which allows bound water to be released and drained from the sludge slurry.

10. **C. The acid production is too high.**

When an anaerobic digester is over-fed, or when other conditions increase the production of acids beyond the capability of the methane-forming bacteria to convert the acids to alkalinity, the end result is the production of foam ... at times, massive amounts of foam ... over-the-wall type of foam!