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COMMERCIAL EGG TIP . . .

BASICS OF THE CHEMICAL OXYGEN DEMAND (COD) WASTEWATER ANALYTICAL TEST

Since the implementation of the Clean Water Act and subsequent creation of the United States Environmental Protection Agency (USEPA) in the early 1970s, commercial egg processing plants have been required to continually improve the quality of their process wastewater effluent discharges. The determination of wastewater quality set forth in environmental permits has been established since the 1970s in a series of laboratory analytical tests focused in four (4) major categories: organics, solids, nutrients and physical properties.

For most egg industry professionals, a complete understanding of the standard methods required to accurately complete critical wastewater analytical tests is not necessary. However, a fundamental understanding of the theory behind and working knowledge of the basic procedures used to complete these wastewater tests, and the answers to commonly asked questions about each test can be a valuable tool for anyone involved in generating, monitoring, treating or discharging process wastewater from commercial egg operations.

Measuring the Organic 'Strength' of Wastewater

Analytical tests aimed at establishing the concentration (typically in mg/L or the equivalent unit of ppm) of organic (i.e., carbon based) matter have been traditionally used to determine the relative 'strength' of a wastewater sample. The laboratory test most widely used to establish and monitor environmental permit limits for the concentration of organic matter in wastewater samples (i.e., concentrations >1.0 mg/L) is biochemical oxygen demand (BOD). However, the BOD test takes 5 days to complete and thus has the inherent disadvantage that it cannot be used for real-time system monitoring. In cases where an organic strength analytical test is needed to assist in monitoring and making relatively quick adjustments in wastewater treatment operations, the chemical oxygen demand (COD) test is available.

COD is the most popular alternative test to BOD used to establish concentration of the organic 'strength' of wastewater samples because of four major advantages:

1. The COD test takes less than 3 hours to complete,
2. Only 2 mL of sample wastewater is needed to be added to pre-prepared test vials,
3. Required laboratory equipment is limited to pre-prepared vials, a heating block and a colorimeter, and
4. COD can be used to test wastewaters that are too toxic for the BOD test.

The COD test uses a chemical (potassium dichromate in a 50% sulfuric acid solution) that oxidizes both organic (predominant) and inorganic substances in a wastewater sample which results in a higher COD concentration than BOD concentration for the same wastewater sample since only organic compounds are consumed during BOD testing.

Technically, the COD test should be considered an ***independent*** measure of the organic strength of a wastewater sample rather than a ***substitute*** for the BOD test. However, it is generally accepted that COD and BOD share an empirical relationship. That is to say that extensive observation of the COD and BOD levels on the same wastewater has shown that the COD to BOD ratio of a particular wastewater will remain constant over time.

The most popular testing method for COD used today involves using sealed and heated (i.e., closed reflux) low-range (3 - 150 mg/L) or high-range (20 – 1500 mg/L) pre-prepared vials that change color from orange to green based on the amount of oxidation and are read using a laboratory colorimeter that measures the relative color change.

Basic COD Test Procedures

The basic procedures for COD test completion are as follows. A COD reactor/heating (150^{o}C) block and a colorimeter are turned on so that both instruments are allowed to stabilize. Pre-prepared low-range or high-range vials are selected for the COD test based on expected results. Both ranges can be used if expected results are unknown. One vial is marked as a 'Blank', and 3 or 4 vials are marked with known standard levels. Two (2) vials are then marked for the wastewater sample so the test is completed in duplicate. Note: if multiple wastewater samples are being run, at least 10% of samples are duplicated.

For the test 'Blank', 2 mL of deionized (DI) water are added to the 'Blank' vial. Two (2) mL of each standard are then added to the corresponding standard vials. Finally, two (2) mL of wastewater are added to each wastewater vial. If the wastewater sample is tested at full strength then 2 mL is added to the corresponding vial. If dilution is required, then serial dilutions are performed and 2 mL of the diluted sample are added to the corresponding vial. Each vial is well mixed and then placed into the reactor block for 2 hours. After 2 hours the vials are removed from the block to a cooling rack for about 15 minutes. The colorimeter is set and calibrated per the specific instructions for that unit (i.e., proper wavelength, blank and standards) and each wastewater vial is placed in the unit and the COD concentration read. If the sample was diluted, the corresponding multiplication is made.

WARNING! COD…Hazardous Waste

One disadvantage of the COD test is that it results in the creation of hazardous waste. Along with the potassium dichromate in 50% sulfuric acid solution, some types pre-prepared COD vials also contain silver sulfate as a catalyst and mercuric sulfate to eliminate chloride interference. Thus, these types of COD vials are considered ***hazardous waste*** and must be handled and disposed of in an approved manner.

Do Not Dispose of COD Vial Contents Down the Drain!

Most pre-prepared COD vial vendors will have a return policy for used COD vials so that used vials can be returned sealed in the original containers for proper disposal.

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"Your local County Extension Agent is a source of more information on this subject."