

Improving Safety and Saving time on COD analysis at Dow Chemical with the Hach LCK Cuvette Test System

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Problem

Dow Chemical conducts Chemical Oxygen Demand (COD) analysis in their industrial plants in high volumes. Dow needed a COD test system that was as safe, as fast, and as accurate as possible.

Solution

Dow conducted a 4-day trial of the Hach[®] LCK Cuvette Test System: a package that includes the DR3900, HT200S thermostat, and COD cuvette tests. This trial compared digestion times and measurement results per water sample between Hach products to Dow's current process. Hach products safely digested samples in a 1/4 of the time compared to Dow's current process.

Benefit

The Hach LCK Cuvette Test System proved to be the safe, fast, and accurate solution for COD analysis. Safety measures prevented accidental burns. Digestion was accomplished in just 30 minutes instead of 2 hours. And the automatic 10-fold measurement of cuvettes eliminated potential errors, thus improving accuracy.

Introduction

For over 120 years, Dow Chemical has pioneered chemical production. Founded in 1897 by H.H. Dow, The Dow Chemical Company found commercial success using electric current to separate bromides from brine. Today, Dow Chemical is a multinational corporation known for manufacturing plastics, chemicals and agricultural products.

COD Analysis at Dow Chemical

At Dow Chemical, Chemical Oxygen Demand (COD) analysis is conducted to determine the number of organics in a given water sample. COD analysis can be time consuming, complex and posing potential hazards as the digestion process involves high temperatures. However, this common test is used throughout Dow Chemical.

Dow Chemical sought a COD analysis solution that was safer, faster, and more accurate. A safer solution required instruments with safety measures to prevent accidental burns. A faster solution required faster digestion. And a more accurate solution required automation to prevent errors.



Dow Plant in Böhlen, Germany

Solutions and Improvements

The Safe Method for COD Analysis

The HT200S' High-Speed Digestion (HSD) technology meets the need for safe digestion. By incorporating an internal fan, the HT200S is able to complete COD results in just 30 minutes. During digestion, the HT200S is automatically locked. This safety measure prevents accidental burns. In addition to safe digestion, the COD solution includes safety features to the handling of reagents that prevent contact with reagent chemicals. Reagents are pre-dosed within the cuvettes and cuvette openings prevent spills, even when the cuvette is tilted over.



The HT200S High-Temperature Thermostat

Reducing Digestion Times From 2 Hours to 30 Minutes

In order to assess a faster solution for COD analysis, Dow conducted a comparison between their standard COD equipment and Hach's LCK Cuvette Test System, which includes the HT200S high-temperature thermostat. This 4-day comparison used wastewater samples of varying amounts. It recorded the time and temperature required to digest the wastewater sample.

Table 1: Digestion Comparison between Dow Equipment and the Hach HT200S

	Dow Equipment (2 hrs. at 148 °C)	HT200S (30 Mins. at 170 °C)
Wastewater sample 1	1185 - 1242 mg/L	1200 - 1294 mg/L
Wastewater sample 2	1084 - 1186 mg/L	1073 - 1209 mg/L
Wastewater sample 3	1920 - 2185 mg/L	1955 - 2245 mg/L
Wastewater sample 4	3405 - 3665 mg/L	3475 - 3770 mg/L



Left: the DR3900 spectrophotometer
Right: the 10-fold measurement, which turns the cuvette while taking intermittent measurements

The results in Table 1 show that the HT200S digested samples in a 1/4 of the time when compared to Dow's current process.

The special construction of the HT200S allows fast heating and cooling times for up to twelve cuvettes or reaction vessels.

In addition to COD, the HT200S can test for total phosphate, total nitrogen, total metals, chromium, silver, tin, and TOC.

Reducing Potential for Errors Using the DR3900

The DR3900 spectrophotometer provides the simplest way to perform tests with error-free results. The potential for human errors is minimised with automated measurement control and 10-fold measurements (including averaging and outlier elimination) to avoid errors due to scratches, dirt, and fingerprints. Automated measurement control works by reading each barcode on the cuvette, which checks the following:

- Automated Information message if the expiration date of the reagents is expired
- Automated check if right test data are available
- Automatic documentation of lot number (traceability)
- Automated range control

A clear warning will appear when the cuvette has been compromised by any of the automated controls.

Green Recycling for Used Cuvettes

Choosing Hach for their COD analysis also allows Dow to take advantage of the Hach Environmental Centre, which recycles cuvette test materials. Cuvette test materials can be used in all sorts of ways after recycling, for example as a raw material in the production of glass wool and plastic regranulate or to manufacture broom bristles. The COD reagents run through an electrolysis process, separating chromic acid, mercury and silver.

Conclusion

Implementing the Hach LCK Cuvette Test System: a package that includes the DR3900, HT200S thermostat, and COD cuvette tests, created a safer, more accurate environment for Dow Chemical to conduct COD analysis.

Summary

- High safety standard as the HT200S seals itself automatically and only opens again when the cuvettes have cooled off. Thus no danger of burns.
- The HT200S offered faster turnaround of samples due to reduced digestion time: just 30 minutes instead of 2 hours.
- Less reagent volume since cuvettes have a smaller diameter.
- Automatic 10-fold measurement of cuvettes eliminates potential errors, thus improving accuracy.
- Easier handling of cuvettes when inserting them into the photometer.
- The fast high temperature digestion is also available in a lab robot version. This robot handles the cuvettes automatically: opening, dosing of sample, shaking etc. This increases work safety for the lab staff as well as increasing productivity.
- Other parameters that need digestion, like total phosphate, total nitrogen or metals also benefit from shortened digestion times.