Chemical Oxygen Demand

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Comparison Chart

Parameter	HI 83214 Meter	HI 83099 Meter	HI 839800 Thermo-Reactor	HI 3898 Test Kit
Alluminum		•		
Ammonia HR	•			
Ammonia MR		•		
Ammonia LR	•	•		
Bromine		•		
Chlorine bioxide		•		
Chlorine, free	•	•		
Chlorine, total	•	•		
Chromium VI HR		•		
Chromium VI LR		•		
COD LR EPA*	•	•	•	•
COD MR EPA*	•	•	•	•
COD LR ISO **	•	•	•	•
COD MR ISO **	•	•	•	•
COD LR mercury-free***	•	•	•	•
COD MR mercury-free***	•	•	•	•
COD HR	•	•	•	•
Color		•		
Copper HR		•		
Copper LR		•		
Cyanide		•		
Cyanuric acid		•		
Fluoride		•		
Hardness (Calcium)		•		
Hardness (Magnesium)		•		
Hydrazine		•		
Iodine		•		
Iron HR		•		
Iron LR		•		
Manganese HR		•		
Manganese LR		•		
Molybdenum		•		
Nickel HR		•		
Nickel LR		•		
Nitrate	•	•		
Nitrite HR		•		
Nitrite LR		•		
Nitrogen, total LR	•		•	
Nitrogen, total HR	•		•	
Oxygen, dissolved		•		
pH		•		
Phosphate HR		•		
Phosphate LR		•		
Phosphorus		•		
Phosphorus, acid hydrolyzable	•		•	
Phosphorus, reactive	•			
Phosphorus, reactive HR	•			
Phosphorus, total	•		•	
Phosphorus, reactive HR	•		•	
Silica		•		
Silver		•		
Zinc		•		
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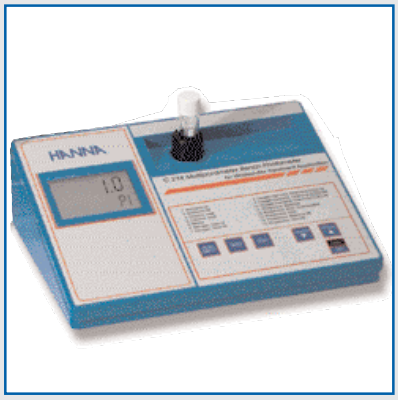
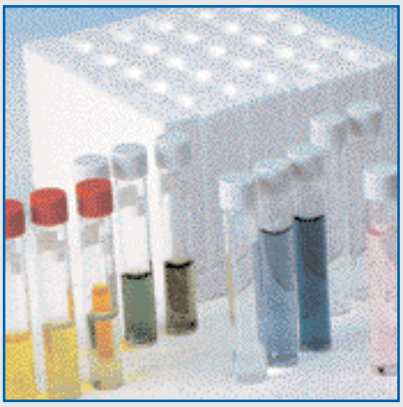


Notes:

* Method with chromium-solforic acid is officiallly recognized by EPA for wastewater analysis

** The HI 93754F-25 and HI 93754G-25 method follows the official method ISO 15705.

*** This method is recommended for general purpose analysis with no chloride interferance



Chemical Oxygen Demand

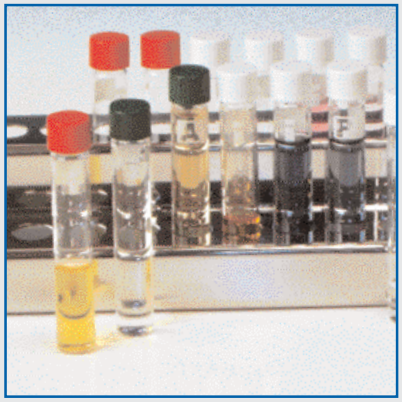
In the past untreated wastewater was allowed to runoff freely into surface waters. With increasing population and industrial activity in the world's cities, the water quality of the surrounding surface water steadily decreased. In these areas, the ecosystem was disturbed, bodies of water began to smell badly and aquatic flora and fauna languished and died. Eventually this became a huge environmental problem, and as a result, different waterborne human illnesses appeared more frequently in these areas.

Oxygen Demand and COD

Chemical Oxygen Demand (COD) is defined as the amount of specified oxidant that reacts with a sample under controlled conditions. The quantity of oxygen consumed is expressed in terms of its oxygen equivalent: mg/L of O_2.

The HANNA instruments® COD method is based on the well established 'closed dichromate-reflux colorimetric method', in concordance with the main official courses for chemical analysis in water and wastewater: "Standard Methods for the Examination of Water and Wastewater" (20th ed.) method #5220D and "US Environmental Protection Agency, Methods and Guidance for Analyses of Water" (2nd ed.) EPA method #410.4 and ISO 15705-2002.

Moreover the US Environmental Protection Agency specifies that the dichromate reflux method is the only method acceptable for reporting purposes. The advantage in using this method includes certifiable results as well as high accuracy.



COD Testing Applications

COD is used as a measurement of pollutants. It is normally measured in both municipal and industrial wastewater treatment plants and gives an indication of the efficiency of the treatment process. COD is measured on both influent and effluent water. The efficiency of the treatment process is normally expressed as COD Removal, measured as a percentage of the organic matter purified during the cycle. COD has further applications in power plant operations, chemical manufacturing, commercial laundries, pulp & paper mills, agriculture & animal waste runoff, environmental studies and general education. HANNA instruments® equipment can be used in the laboratory or for on-site testing. The measurement procedure has been designed for ease of use by personnel at any skill level.

Monitoring examples:

Test no	COD Influent	COD Effluent	COD Removal
1	1214	451	62%
2	948	328	63%
3	1341	307	77%

Easy to use:

HANNA instruments® pre-dosed test tubes make COD measurement effortless. Even a novice can run COD tests in just 3 simple steps:

Fill the pre-dosed vial with the sample and replace the cap

Place the vial in the reactor and set the timer

Place the vial in the HANNA instruments® photometer and read the result on the LCD

Certified COD Reagents

HANNA instruments® COD reagents are available in the following formats:

Code	Method	Range
HI 93754A-25	EPA*	0 to 150 mg/L
HI 93754B-25	EPA*	0 to 1500 mg/L
HI 93754C-25		0 to 15000 mg/L
HI 93754D-25	Mercury-free***	0 to 150 mg/L
HI 93754E-25	Mercury-free***	0 to 1500 mg/L
HI 93754F-25	ISO**	0 to 150 mg/L
HI 93754G-25	ISO**	0 to 1000 mg/L

Each box of 25 vials is supplied with a HANNA instruments® certificate of quality. The reagents are traceable to NIST SRM® 930.

- **Three measurement ranges to satisfy each need**
  As COD levels vary depending on the application and process measuring points, HANNA instruments® offers reagents to cover three separate ranges. Simply choose the best range for your application:
  low range: 0 to 150 mg/L O_2
  medium range: 0 to 1500 mg/L or 0 to 1000 mg/L O_2
  high range: 0 to 15000 mg/L O_2
- **Accurate and repeatable measurements**
  HANNA instruments® COD reagents have been developed in accordance with Standard Methods 5220D, USEPA 410.4 and ISO15705:2002 methods.
- **Pre-dosed vials**
  HANNA instruments®' vial contains approx. 3 mL of pre-dosed reagent. The operator just needs to add a small quantity of the sample - 2 mL for LR and MR, and 0.2 mL for HR analysis.
- **Quick and accurate measurements**
  With pre-dosed vials test preparation time is dramatically reduced. There is no time-consuming reagent preparation procedure or glassware cleaning.
- **Safe reagents**
  HANNA instruments® COD reagents are safe for operators and the environment. Vials and caps have been designed to avoid accidental reagent spills. Thanks to the pre-dosed reagents, the amount of chemicals is minimized.

HANNA instruments® also produces mercury-free reagents, to be used for analyzing samples without chloride.

Notes:
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*** This method is recommended for general purpose analysis with no chloride interferance.

Beyond COD: Nitrogen and Phosphorus

The target in Waste Water Treatment is not only COD reduction, but also to control Nitrogen and Phosphorus, which are responsible for eutrophication phenomena in natural environments. Moreover, COD, Nitrogen, and Phosphorus control in plants are performed not only to respect the laws for environmental protection, but also to optimize plant costs.

Effective monitoring and control of parameters such as ammonia, nitrate, total nitrogen and total reactive phosphorus allows plant managers to profile and improve the health of an aquatic ecosystem. By accurately monitoring levels of each specific pollutant, operational parameters can be adjusted to maintain high efficiency of biodegradation treatments while also minimizing costs.

Nitrogen

When a treatment plant uses processes like nitrification and denitrification, it is important to monitor and maintain the equilibrium between Ammonia Nitrogen, Nitrate and Total Nitrogen during the bio-treatment. The nitrogen level is important because it needs to be related to the quantity of oxygen provided in the nitrification area. Ammonia is also controlled because it can become very toxic for the bacteria responsible for denitrification.

Nitrification

$$NH_4^+ + 3/2\ O_2 \xrightarrow{\text{nitrosomonas}} NO_2^- + 2\ H^+ + H_2O$$

$$NO_2^- + 1/2\ O_2 \xrightarrow{\text{nitrobacteria}} NO_3^-$$

$$NH_4^+ + 2\ O_2 \xrightarrow{\text{nitrobacteria}} NO_3^- + 2\ H^+ + H_2O$$

Denitrification

$$2NO_3^- + \text{carbon} \xrightarrow{\text{denitrobacteria}} N_2 + 3CO_2$$

Phosphorus

Phosphorus is measured during both biological and chemical dephosphorization. An excessive amount of phosphate discharged in superficial waters or in bio-treatment tanks causes a great increase of algae and system eutrophication.