Chemical Oxygen Demand Encyclopedia Article

Chemical Oxygen Demand

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Chemical Oxygen Demand

Chemical oxygen demand (COD) is a measure of the ability of chemical reactions to oxidize matter in an aqueous system. The results are expressed in terms of oxygen so that they can be compared directly to the results of biochemical oxygen demand (BOD) testing. The test is performed by adding the oxidizing solution of a dichromate salt (e.g. potassium dichromate, $K_2Cr_2O_7$) to a sample, boiling the mixture on a refluxing apparatus for two hours, and then titrating the amount of dichromate remaining after the refluxing period. The titration procedure involves adding ferrous ammonium sulfate (FAS), at a known normality, to reduce the remaining dichromate. The amount of dichromate reduced during the test--the initial amount minus the amount remaining at the end--is then expressed in terms of oxygen. The test has nothing to do with oxygen initially present or used. It is a measure of the demand of a solution or suspension for a strong oxidant. The oxidant will react with most organic materials and certain inorganic materials under the conditions of the test. For example, Fe(II) and Mn(II) will be oxidized to Fe(III) and Mn(IV), respectively, during the test.

Generally, the COD is larger than the BOD exerted over a five-day period (BOD_5), but there are exceptions in which microbes of the BOD test can oxidize materials that the COD reagents cannot. For a raw, domestic wastewater, the COD/BOD_5 ratio is in the area of 1.5-3.0/1.0. Higher ratios would indicate the presence of toxic, non-biodegradable or less readily biodegradable materials.

The COD test is commonly used because it is a relatively short-term, precise test with few interferences. However, the spent solutions generated by the test are hazardous. The liquids are acidic, and contain chromium, silver, mercury, and perhaps other toxic materials in the sample tested. For this reason laboratories are doing fewer or smaller COD tests in which smaller amounts of the same reagents are used.