

CETCO TESTING CAPABILITIES AND INSTRUMENTATION FOR REMEDIATION APPLICATIONS

Executive Summary

Remediation applications require a wide variety of testing, utilizing many different instruments and methods. The following overview is a cross-section of the majority of instruments available in the CETCO laboratories for evaluation of remediation applications.

Solidification and Stabilization Treatability

These tests are used in solidification/stabilization treatability studies to determine the optimum amount of Portland cement and additives to treat contaminated soils.

1. **Particle Size (ASTM C136; modified ASTM D422):** Determines the particle size distribution as used in engineering classification of materials. The test uses sieve analysis to provide data pertaining to material characteristics, such as, relative proportions of gravel, sand, silt/clay.
2. **Atterberg Limits (ASTM D4316):** Determines the physical characteristics of a material as a function of its water content.
3. **Moisture Content (ASTM D2216):** Determines the amount of free water in a material. A preweighed sample is dried for 24 hours in a 110°C oven and then cooled in a desiccator.
4. **Paint Filter Test (EPA method 9095):** This is a simple test to determine the presence of free water in a waste solid. A solid is placed in a 60 mesh filter for 5 minutes. If any water passes through the filter, the solid will fail this test.
5. **Bulk Density–Stabilized Waste:** Determines the density of a monolithic stabilized waste. A sufficiently cured sample of known volume is weighed.
6. **Unconfined Compressive Strength (ASTM D1633):** Determines the compressive strength of cement-soil mixtures.
7. **Freeze-Thaw (ASTM D4842):** Determines how materials behave or degrade after repeated freeze-thaw cycles.
8. **Wet-Dry (ASTM D4843):** Determines how materials behave or degrade after repeated wet-dry cycles
9. **Permeability (ASTM D5084):** Determines the hydraulic conductivity of a material. This is a falling head test where the specimen is placed within a flexible wall permeameter. A head differential is created across the specimen and flow measured.
10. **Total Characteristic Leaching Procedure (EPA method 1311 (TCLP)):** Determines the ability of elements to leach from a sludge. Sludge, acid, and DI water are mixed overnight and the resulting solution is filtered. The filtered water is then analyzed using the ICP. Results are recorded in parts per million (ppm) and 100 grams of sludge are required for the test.

Inductively Coupled Plasma (ICP): By burning a liquid sample, this instrument can determine the concentration of various elements found in a sample. This instrument is used primarily to determine how well our products work on removing waste elements from water.



Organoclay Analysis™

These tests are used to analyze key Organoclay® properties and characterize its components.

1. **Thermogravimetric Analysis (TGA):** Used to measure and identify the organic components in a solid. A small amount of material is slowly heated, and its weight loss is measured. Results are recorded in a percentage, and less than one gram is required for testing. This test is mainly used for analysis of organo-clay in order to determine the level of oil loaded onto the media. However, it is also useful in measuring the level of polymer in a sample.
2. **Oil Adsorption Capacity:** Used to determine the amount of oil (as motor oil) adsorbed by organophilic clay on a weight to weight basis.
3. **Column Test:** Used to determine the ability of a media to remove contaminants from liquids. These contaminants include, but are not limited to; oil/grease, NAPL, partial soluble and soluble organics, and certain heavy metals. A column is packed with media or Reactive Core Mat and then the test liquid is pumped through the column at a controlled rate. Effluent is collected and analyzed.
4. **X-Ray Diffraction (XRD):** Used to identify mineral components of a material. This test does not quantify the amount of the mineral, just notes its presence and its concentration relative to other components. Two grams of material are required, but the test is non-destructive so the material can be returned or reused. This test is mainly used for the detection of impurities in a clay and identification of unknown materials.

Thermogravimetric Analysis (TGA): The TGA measures weight changes in a sample as a function of time and temperature. It is primarily used to determine thermal stability and composition of a sample.



X-Ray Diffraction (XRD): By determining crystalline structure, this instrument provides insight into what kind of minerals are present in a sample. The XRD can also measure the space between bentonite platelets which is useful in determining the type of bentonite. X-rays are beamed onto a sample and the angle at which they bounce off is measured. A sample is pressed into a slide and then analyzed.



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Water and Sludge Analysis

These tests are used to analyze groundwater, wastewater and sludge.

1. **Total Suspended Solids (Standard Methods 2540-D):** Water is pulled through a pre-weighed glass filter by a vacuum pump. The filter is dried and the final weight is recorded. Results are recorded in parts per million (ppm) and 100mls of water are required for the test. Can also analyze total solids and total dissolved solids (Standard Methods 2540-B and C).
2. **Oil and Grease:** Hexane extraction gravimetric analysis based on EPA method 1664. Results are recorded in parts per million (ppm) and 100mls of water are needed for the test.
3. **Metals Analysis:** Water is digested with acid in a microwave (EPA method 3015), filtered, and then analyzed with an ICP Spectrometer (EPA method 200.7), which is capable of determining the presence and concentration of most metals. Results are recorded in parts per million, and 100mls of water are required for the test.
4. **Total Organic Carbon (EPA method 415.1 (TOC):** Measures level of total organic carbon in a water (it is a more direct and convenient expression of total organic content than the BOD or COD, but does not provide the same information and does not replace these tests). Results are recorded in parts per million (ppm) and 20mls are required for the test.
5. **Chemical Oxygen Demand (EPA method 410.4 (COD):** A spectrophotometer is used to measure the chemical oxygen demand in water. Results are recorded in parts per million (ppm) and 20mls are required for the test.
6. **Total Characteristic Leaching Procedure (EPA method 1311 (TCLP):** Determines the ability of elements to leach from a sludge. Sludge, acid, and DI water are mixed overnight and the resulting solution is filtered. The filtered water is then analyzed using the ICP. Results are recorded in parts per million (ppm) and 100 grams of sludge are required for the test.
7. **Paint Filter Test (EPA method 9095):** This is a simple test to determine the presence of free water in a waste solid. A solid is placed in a 60 mesh filter for 5 minutes. If any water passes through the filter, the solid will fail this test.

Note: Some tests may be performed by a third-party laboratory.

Spectrophotometer The spectrophotometer analyzes liquid samples using both visible and ultraviolet light. This instrument can identify many different compounds and provide concentration data of the compounds present in a sample.

