CleanAir

CleanAir Engineering
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The Right Detector for You

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The overall sampling and analysis technique is chosen based on the analytes and the process parameters. The following is a list of various detectors and their uses:

Catalytic Combustion Detector (CCD)

- Hydrocarbon and Hydrogen Selective
- Detects Down to 500ppm
- Gas-less Operating Capability
- Inexpensive and Rugged

The CCD is about as sensitive as a TCD, the CCD has the hydrocarbon selectivity of an FID, plus the ability to operate on air alone. Because the CCD requires no compressed gases like hydrogen or helium, it can be used in Gas-less GCs where a built-in, "whisper quiet" air compressor supplies the ambient air carrier gas. The CCD detector can also be used as a hydrocarbon monitor in non-chromatographic applications where the CCD senses the total hydrocarbon content of a flowing air stream, or as a hydrogen/hydrocarbon leak detector.

Thermal Conductivity Detector (TCD)

- "Universal" Detector
- Detects from 1% Down to 200-500ppm

Because it detects all molecules, the TCD is commonly used for fixed gas analysis (O_2, N_2, CO, CO_2, H_2S, NO, NO_2, etc.) where the target analytes do not respond well on other, more sensitive detectors. The TCD can detect concentrations from 100% down to a few 100ppm on a flat baseline with sharp peaks. Where the peak is broad or the baseline is not flat, detection limits of 300ppm are more realistic.

Flame Ionization Detector (FID)

- Hydrocarbon Selective
- Robust, Linear, Stable
- Detects Down to 1ppm

The FID is the most commonly used GC detector, responding linearly from its minimum detectable quantity of about 100 picograms to almost 100%. The FID responds to any molecule with a carbon-hydrogen bond, but not at all, or poorly, to compounds such as H_2S, CCl_4 or NH_3. The FID response is very stable from day to day, and is not susceptible to contamination from dirty samples or column bleed.

Dry Electrolytic Conductivity Detector (DELCD)

- Non-radioactive alternative to ECD!
- High Sensitivity—Detects down to 10ppb
- Selective to Chlorinated and Brominated molecules
- Best used with Headspace or Purge & Trap injectors
- Can be Combined with FID, NPD or TID detectors

The DELCD is useful for low-level detection of chlorinated and brominated solvents in environmental samples and other trace analyses. The DELCD is much like the ECD in sensitivity, but it is much more selective to halogens and blind to oxygen. The DELCD differs from the traditional wet ELCD in that it uses neither a solvent

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electrolyte nor a nickel reaction tube, and the reaction products are detected in the gaseous phase. In the high sensitivity mode (no hydrogen, using dry cylinder air) the DELCD can detect down to the low picogram range. In this mode, the DELCD is about 100 times more sensitive than the FID. However, the high sensitivity DELCD is susceptible to contamination from high concentrations of chlorinated hydrocarbons and hydrocarbon solvents.

Helium Ionization Detector (HID)

- Universal (except neon)
- Detect from 1-2% down to 10ppm
- Requires only Helium Carrier and Make-up Gas

The HID is a "universal" detector which responds to all molecules except neon. The HID is particularly useful for volatile inorganics like NO_x, CO, CO_2, O_2, $N_2$and H_2 which do not respond on the FID or other detectors. Unlike an FID, the HID needs no hydrogen or air. Requiring only helium carrier and make-up gas, the HID delivers sensitivity in the low ppm range.

Photo-Ionization Detector (PID)

- Responds to molecules with Carbon Double Bonds and Aromatics
- Sensitive (down to 10ppb) and Non-destructive
- Mandated in several EPA Methods (e.g. Ethylene oxide sterilization processes)

The PID uses the industry standard 10.6eV PID lamp in a spring-loaded mount, which allows the lamp to be removed, cleaned and re-installed in seconds, without tools. Use of the Photo Ionization Detector is mandated in several EPA methods (8021, TO-14, etc.) because of its sensitivity and selectivity. Detection limits for aromatics are in the low picogram (ppb) range. Because it is non-destructive, it is often run in series with other detectors—typically the FID/DELCD combination detector—for multiple chromatograms from a single injection.

Nitrogen Phosphorus Detector (NPD)

- Very Selective to Nitrogen and Phophorus
- Detects down to 100ppb

The NPD responds to nitrogen-phosphorus compounds about 100,000 times more strongly than normal hydrocarbons. Due to this high degree of selectivity, the NPD is commonly used to detect pesticides, herbicides, and drugs of abuse.

Thermionic Ionization Detector (TID)

- Highly Selective to Nitro Functional Groups
- Also responds to Chlorinated Phenols
- Detects down to 1ppb
- Convenient bead design
- Can be run Gas-less in the field!

The TID is similar in design to the FID and NPD. The electrically heated thermionic bead (TID bead) is positioned so that the column effluent contacts the hot bead surface. Analyte molecules containing NO_2 (nitro) functional groups such as TNT (trinitrotoluene) undergo a catalytic surface chemistry reaction. The resulting ions are attracted to a collector electrode, amplified, then output to the data system.

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Flame Photometric Detector (FPD)

- Bandpass Filters for Sulfur or Phosphorus
- Use the Dual FPD for Simultaneous Sulfur and Phosphorus Detection
- Detects Sulfur Compounds to 200ppb, Phosphorus Compounds down to 10ppb
- Use the FPD/FID or Dual FPD/FID for Simultaneous Hydrocarbon Speciation

The Flame Photometric Detector can detect sulfur compounds, such as H_2S or SO_2, down to about 200ppb and phosphorus compounds to 10ppb. While not 100% selective, the FPD is 100,000 times more sensitive to sulfur and phosphorus compounds than hydrocarbons. The phosphorus response is linear, and the sulfur response is exponential (twice the sulfur yields four times the peak area).

Reduction Gas Detector (RGD)

- Detects Reducing Gases like Hydrogen and CO down to the ppb level
- Heated UV detection cell with Absorbance Output
- User replaceable Reaction Tubes

The Reduction Gas Detector is sensitive to volatile reducing compounds down to the ppb level, and is often used to detect atmospheric carbon monoxide and hydrogen. When compared to the FID detector, the RGD is ten times more sensitive to unsaturated hydrocarbons, and virtually unresponsive to saturated hydrocarbons. This combination of sensitivity and selectivity allows the analysis of atmospheric pollutants such as ethylene, benzene, carbonyl sulfide, phosphine, and methanol.