Technical Note

Understanding Chromatography Terminology

An A – Z Guide

Applications Department; SCION Instruments, May 2024

Understanding the terminology associated with chromatography is important in order to understand your application. This technical note aims to provide clarity on some of the most commonly used terms within the industry.

Absorption

Absorption involves molecules or atoms crossing a surface and entering another material. In chromatography, this is a process where a solute partitions into a liquid or liquid-like stationary phase.

Adsorption

Adsorption takes place on the surface – in chromatography it is the process where a chemical mixture is separated based on its interaction with the adsorbent – usually the stationary phase.

Bakeout

The process of heating a column in order to remove contaminants.

Baseline

The line that represents the signal from the detector when only the mobile phase / carrier gas is passing through. The baseline also represents the point where calculations are made to determine peak area and height.

Blank

A blank sample is a sample which represents the sample matrix as closely as possible without any active compounds.

Bleed

Is the loss of material from either the column or septum which is due to operation at high temperatures.

Carrier Gas

An inert gas used to carry samples through the gas chromatograph.

Capillary column

A column with the stationary phase coated on the inner surface – this may be a chemically bonded liquid phase or an adsorbent.

Chemisorption

A chemical reaction with packing that results in sorption. It is usually irreversible and occurs with packings that have reactive functional groups such as silanol or amino bonded phases.

Cold Injection

When the injection takes place at a temperature below the final oven temperature this is usually done either at the solvent boiling point or below it.

Column

A tube which contains the stationary phase which the mobile phase / carrier gas flows through, resulting in chromatographic separation.

Cold on-column Injection

A technique which involves introducing the sample directly onto the GC column as a liquid.

Degassing

A process which removes dissolved gases from the mobile phase either prior to use or during use.

Desorption

Is where a molecule on the surface of the packing material, another solid surface such as the column wall or the stationary phase moves into the mobile phase.

Efficiency

Is the capability of the column to produce peaks which are sharp and well defined.

Eluate/Effluent

The eluate contains both the analyte and solutes that pass through the column. It is the mobile phase leaving the column.

Eluent

The eluent will move the analytes through the column – it is the portion of the mobile phase which carries the analytes.

Elution

Elution is the passing of the mobile phase through the column and transports the solutes.

Flame Ionization Detection (FID)

A type of detector that ionizes hydrocarbon containing molecules in a hydrogen flame.

Fronting

Describes peak shape when the front of the peak tapers before the remainder of the peak I.e. the front of the peak is less steep than the rear of the peak.

GC Inlet

The inlet is a device which transfers the sample into the column, it is found between the carrier gas source and the column inlet. The sample is often vaporized at the inlet.

Ghost peaks

Ghosts peaks are peaks that were not present in the original sample, these peaks can be caused by septum bleed, solute decomposition and mobile phase / carrier gas contamination.

Gradient

Changing solvent strength as a function of time which therefore elutes more highly retained

Headspace Sampling

A form of gas space sampling wherein the solute is sampled from the enclosed space above a liquid or solid sample.

Hydrophilic

Means "water loving", in chromatography it refers to stationary phases which are compatible with water or water soluble molecules.

Hydrophobic

Means "water hating", in chromatography this refer to stationary phases which are not compatible with water or to molecules that have little to no affinity for water.

Inlet Liner

The inlet liner is a glass tube in an inlet system where the liquid sample is injected. See our GC liner guide for more information.

Internal Standard

The addition of a fixed amount of a chemical substance [the internal standard (IS)] to each sample and calibration solution. The internal standard should respond proportionally to changes in the analyte and provide a similar measurement of signal. See our guide to using internal standards on our website.

Large Volume Injection

A most of sample introduction in which a larger than normal volume of sample is injected into a GC capillary column. Typically used for trace analysis.

Limit of Detection (LOD)

The concentration at which an analyte can be distinguished from the baseline noise.

Limit of Quantification (LOQ)

The smallest concentration at which the resulting peak can be quantified at a defined level of certainty.

Linearity

It is critical in quantitative analysis for the detector to generate a linear response in respect to solute concentration. The linearity is a range of concentrations where the responses are fitted to a linear function with defined certain qualities, it is usually related to the calibration curve.

Liquid Chromatography

Liquid chromatography is a separation technique where the mobile phase is a liquid and the separation is carried out in a column with a solid stationary phase.

Make-up Gas

An extra gas which is added to the carrier gas as it flows into or through the detector. The purpose of make-up gas is to improve peak shape when using open-tubular (capillary) columns.

Mass Spectrometrometer Detector

A detector which records the mass spectra of solutes as they are eluted form the column.

Method Development

The process of optimizing separation to ensure reproducible and robust results.

Mobile Phase

The mobile phase is the eluate which moves through the column in liquid chromatography.

Non-Polar

Non-polar molecules have symmetrically distributed electrons and therefore do not have charges at either end – all the charges cancel each other out.

Normal-phase chromatography

A type of liquid chromatography, where the stationary phase is more polar than the mobile phase.

Packing

Packing refers to the adsorbent, gel or solid-support used in chromatography columns.

Peak area

The area which is measured under a chromatographic peak. The peak area is related to the amount of substance which has been eluted in the peak.

Polar

Polar molecules can be defined as having a slightly positive and slightly negatively charged ends.

Programmed Temperature Vaporization

The sample is introduced into the inlet liner at a temperature which is below the boiling point of the sample solvent. The solvent is continuously evaporated and vented through the inlet split line, once the solvent has been completely evaporated the inlet is heated rapidly and the sample transferred onto the column.

Pulsed-Splitless Injection

A type of GC injection where a large increase in flow is put through the inlet in order to reduce volume in the injection liner so that the entire volume of the sample can be moved into the column very quickly.

Recovery

Recovery refers to the amount of solute that is eluted from the column compared to the amount that is injected into the column.

Retention time

The time between the injection of the sample and the appearance of the peak maximum.

Reversed phase chromatography

A type of liquid chromatography where the stationary phase is less polar that the mobile phase – most common form of high performance liquid chromatography.

Robustness

The robustness of an analytical procedure is the measure of the capacity for it to be unaffected by minor changes in method parameters.

Sample capacity

The amount of sample that can be injected onto the column without losing efficiency and causing column overload.

Selectivity

The ability of the analytical process to generate peaks that are free of interferences and give true results that correspond only to the analyte.

Sensitivity

Sensitivity refers to the smallest amount of substance that can be accurately measure in a sample by a particular assay.

Septum

Typically silicone or similar material which protects the sample inlet from the atmosphere and allows the syringe penetration for injection.

Signal to Noise Ratio

Signal to noise ratio is the ratio of the peak hight to the noise level.

Solute

The dissolved component in a mixture which is separated on the column. Solute may also be referred to as the analyte.

Solvent

The liquid which the sample is dissolved in prior to injection.

Split Injection

A technique where only a portion of the sample is directed onto the column. This technique helps to alleviate column overload.

Split Ratio

The ratio of the sample amount that is vented and the sample amount that is directed onto the column.

Standards

Standards are samples that contain a known concentration of analyte. Standards can be used to help identify unknown sample peaks. Standards can be used for quantitation, by constructing calibration curves of peak area against concentration.

Stationary Phase

The stationary phase is the column phase which does not move – this can be a solid, in liquid chromatography (LC), or it may be a high viscosity liquid, in gas chromatography (GC).

Tailing

When the chromatographic peak has a tailing edge.

Thermal Conductivity Detection

In Thermal Conductivity Detection (TCD) the analyte which emerges from the column will change the carrier gas thermal conductivity and thus produce a response from the detector as the detector measures the differential thermal conductivity of carrier and reference gas flows.

Wavelength Detection

Wavelength detection is a common liquid chromatograph technique in which the sample analyte absorbs light from a light source within the detector. The intensity of absorbance is the signal visible on the chromatogram.