Separation techniques in forensic science

The Use Of Separation Techniques In Forensic Science

Forensic scientists employ many different separation techniques, these are essential for collecting evidence to be used against to aid the capture of an offender. There are many different techniques utilised to achieve this from filtration to more specialized chromatography. I will explore a handful of the techniques used by today's forensic scientists.

Filtration is possible the simplest separating technique used in forensic science, and simply put it is used to remove objects from a liquid, by passing it through either a " surface filter" which is like a sieve, trapping any solid particles which can be collected and examined for any incriminating evidence. " Depth filters" can also be used, these are like sand filters allowing liquid to filter through and be collected as the solid particles are collected in the granular material. Filtration is also common in everyday life as it is often used to filter coffee and is the core of an air conditioning unit as it removes particles from the air.

Distillation can be used in forensic science to easily separate two or more liquids that have been mixed together. Because many different liquids have varying boiling points, for example water boils at one hundred degrees C at standard pressure and ethanol boils at 78 degrees C. So it stands that if you were to heat up a mixture of ethanol and water,

Even though both liquids will start to evaporate the ethanol will reach the condensing tube first and be cooled transforming back into liquid form collecting in a beaker. Distillation is also used widely in the commercial industry it is used to separate crude oil, as well as some alcoholic beverages.

Chromatography plays huge role within the forensic services to help gather evidence. “ Chromatography” is actually a collective term used to describe the set of laboratory techniques to separate mixtures, anything from discovering what components make up a certain ink using paper chromatography, which can be used to help identify which pen is used in fraudulent document. To gas chromatography which involves separating and analyzing compounds that can be vaporized without decomposition. Decomposition, being the separation of chemical compound into its individual elements.

Thin layer chromatography (TLC) is a process where by a mixture is placed on a plastic or glass sheet which would have been coated with a layer of absorbent material like silica gel which happens to be highly porous. This part of the process is known as the stationary stage.

The next stage known as the mobile phase involves adding a solvent to the bottom of the plate which is drawn up by capillary action towards the mixture. In the picture this would be dots one, two and three. Separating the analytes (a chemical substance that is the subject of a chemical analysis), which contain different chemical compounds causing them to ascend at different rates. In turn this can be compared to a mixture collected separately to determine if they are the same substance.

High performance liquid chromatography (HPLC) is a highly improved form of column chromatography which is used to purify and separate chemical compounds. HPLC passes liquids through a column which is densely packed with silica particle and solvent. The silica particles act as a mesh which can

capture what passes through it. The mixture instead of being allowed to drip through the tube it is forced through at very high pressure this means small particles will travel faster through the tube, meaning the larger particles would take longer to pass tube as there is more resistance. This is known as the retention time and is commonly measured using ultra violet absorption. Many organic compounds absorb UV light of various wavelengths. If you direct a beam of UV light through the stream of liquid coming out of the column, you can record how much has been absorbed material passing through.

The results can then be analysed, the retention times can be compared to the known times of a pure compound which have already been passed through the column making it possibly to identify unknown compounds.

Gas chromatography is typically used to test the purity of a substance or to separate and calculate the relative amounts of a substance. It is also used as in high performance liquid chromatography to identify individual compounds. In gas chromatography the stationary phase consists of microscopic layer of liquid coated on the solid surface inside piece glass or metal tubing. The gas is then passed through the column and reacts with the walls within the column couasing the each compound making up the the gas to elute (exit the column) at different times. This as in high performance liquid chromatography is known as retention time, there fore we can work out what the compound is by the analysing the time it takes to exit the column. Gas chromatography is notable very similar to column chromatography, the major difference being that in gas chromatography the column is sealed within an oven so that te tempreture of the gas can be controlled.

The principle of chromatography is that different compounds will stick to a solid surface or dissolve in a film of liquid to different degrees.

All these techniques as well as the many others used play a pivotal role within the forensic science service. Whether analyzing body fluids for the presence of illicit drugs, fibre analysis, blood analysis from a crime scene, and airports to detect residue from explosives. They are vital for tracking by comparing substances from different location. And eventually are necessary for ensuring convictions of offenders.