# KORY'S TECK-TIPS

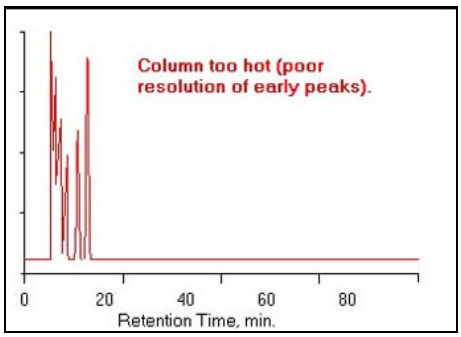
## How does temperature affect a compounds retention time?

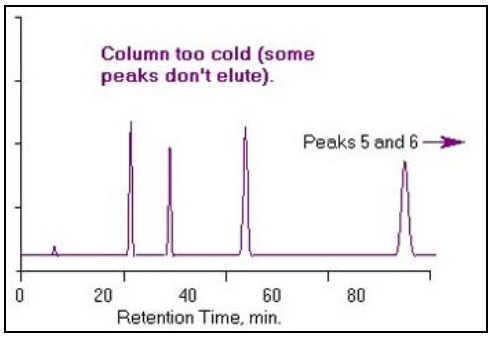
Evaporation is the process in which a liquid will slowly transfer from the condensed (liquid) phase to the vapor (gas) phase. Condensation is the opposite trend where a vapor will condense into a liquid. These are both processes which are at equilibrium with each other and are temperature dependent. As the temperature increases, more of the substance will be transferred to the vapor phase and vise versa.

When a sample evaporates, the resulting vapor will push the existing gas out of the way and this pushing force (pressure) is called the vapor pressure. If the temperature increases, the rate of evaporation will increase as will the resulting vapor pressure. The temperature (and vapor pressure) can increase until the vapor pressure equals the pressure above the liquid. This temperature is the boiling point and the substance will start to vaporize throughout the sample instead of only evaporate from the surface.

Different substances can have different rates of evaporation and boiling point temperatures. It is these differences in evaporation and boiling points in addition to the manipulation of temperature that provide a primary basis of separation in gas chromatography.

If the oven temperature is too low, a compound will spend most of its time condensed in the stationary phase. Only a very small amount of sample can evaporate. The transfer from liquid to gas will be very slow and will result in very long retention times. Conversely, if the temperature is very high then the equilibrium will shift in to the gas phase. The compound will spend all of its time in the vapor phase moving through the column and not condense into (or interact with) the stationary phase. This results in very short retention times.




Gas chromatography works best when a compound is at equilibrium where sample can transition freely both into and out of the stationary (condensed) phase. Ideally the best separation should take place when the temperature offers the most transitions in and out of the phase. This happens between 20°C and 50°C *below* the boiling point of the compound.

Isothermal separations can be set to this temperature range to give the best separations. If changing temperatures using an oven program, a slower temperature ramp should be used during these temperature ranges to give the best separations for problematic compounds.

Key words: GC, temperature, retention time

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