

KORY'S TECK-TIPS

Is Water Safe To Inject In Gas Chromatography?

This is a question that is continually asked and is based upon a long history of water injections in gas chromatography. In the first GC columns, gas chromatography phases were simply coated onto the column. This was mostly with packed columns but also the same with the very first capillary columns. Injecting water onto these phases dissolved the phase and caused the phase to elute from the columns.

Over time, the capillary columns were bonded instead of coated. This chemical bonding made them stable to water injections, as well as solvent rinsing.

Today, every GC column from Phenomenex is chemically bonded - meaning that water will not remove the phase from the column. Therefore bonded columns are chemically stable to water injections and can even be column rinsed with water

Very polar phases like PolyEthyleneGlycol (PEG) based columns are so polar that the water can build up over time and cause slight changes in the phase. Even though this will not remove the phase, it is advisable that water injections be limited on most PEG based phases for this reason. One exception is the ZB-WAXplus column which is a PEG based phase that has been specially processed to be stable to multiple or continuous water injections.

There is only one other consideration for GC and water injections. The expansion volume of water when vaporized is HUGE! As an example, 1.0 uL of water will expand to over 1200 uL in a 225°C inlet with a 12psi head pressure. By contrast, 1.0uL of isooctane will only expand to 136 uL of volume under the same conditions. This large expansion volume for water does needs to be taken into account. If the expansion volume is larger than the volume of the liner, then the vapor will back-flush into the gas supply lines which are not heated and cause persistent sample carryover. Small injection volumes are therefore recommended for water.

One common application that utilizes water as a matrix is volatiles. Because the analytes are volatiles, a higher elution temperature might not be necessary to elute the analytes but this can leave the water and other higher boiling contaminants on the column. If using low temperatures, the water (even from headspace injections) will remain on the column until eluted. This water complements the polarity of the phase and alters the separation. The water will need to be routinely baked off of the column to restore performance.

Summary:

1. Most of the hesitation about water is due to stories about column instability from when columns were coated instead of chemically bonded. Though there are still a couple of coated columns available, but Phenomenex does not supply these.
2. The only consideration with bonded columns is injection volume / expansion volume and possible buildup at low temperatures. Successful water injections can be performed by keeping these two factors in mind.