SAMPLE FOCUSING TECHNIQUES IN GAS CHROMATOGRAPHY

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WHAT IS SAMPLE FOCUSING?

Focusing is the term used to describe the narrowing of the width of a peak. It is used to improve the signal to noise ratio and increase the detection limit of an analysis. When a peak is focused, it's bandwidth decreases significantly causing the sample to concentrate in a very small area of the capillary column. The result is a very sharp peak that has a high signal to noise ratio.

The most common way to focus a sample is to cool a selected area of the column. Cooling causes the sample to spend more time in the stationary phase which slows it down. As the sample approaches the cold spot, the leading edge of the sample band will travel slower, and eventually the trailing edge will catch it. The sample band becomes very narrow and the cooling is then turned off, releasing the sample. An example of this process is shown in **Figure 1**.

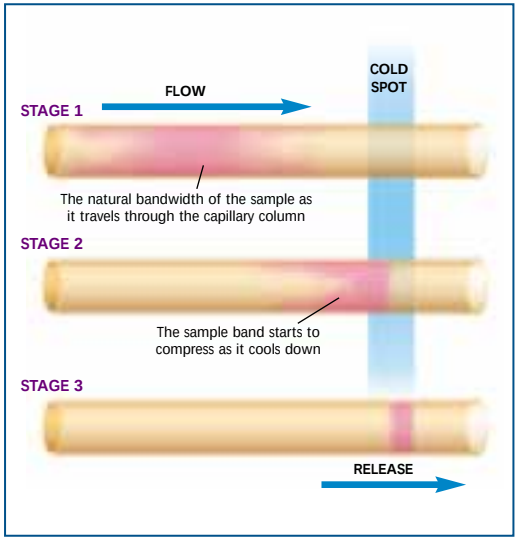

Figure 1. Sample band narrowing as it approaches the cold spot.

COOLING TECHNIQUES

High Pressure Liquid

The most common method of cooling a section of a capillary column is using a high-pressure liquid, usually carbon dioxide. The liquid is brought as close to the column as possible before it expands into a gas. This improves the efficiency of the trap because the cooling is caused by the expansion of the liquid not its temperature. High-pressure liquid traps use large amounts of coolant but can reduce the column temperature to as low as -40°C in a few seconds. An example of a high-pressure liquid cold trap is shown in **Figure 2**.

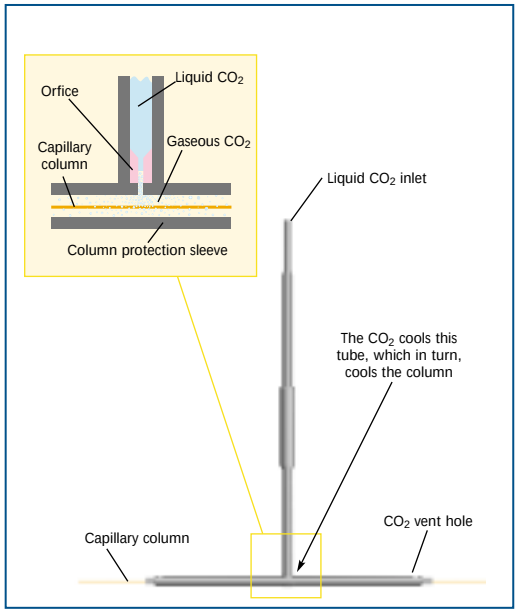

Figure 2. A liquid carbon dioxide cold trap. SGE Part No. 093346.

Compressed Gas

When compressed gas is used to cool an area of the column, the temperature of the cooling gas must be less than the GC oven. This is because compressed gas cold traps completely rely on the temperature of the gas to cool the column.

Cold traps that use compressed gas become more efficient as the oven temperature rises so are particularly useful for trapping semi-volatile and high boiling point compounds. These traps use much less cooling flow than high-pressure liquid traps but transfer it more efficiently. An example of a compressed gas trap is shown in **Figure 3**.

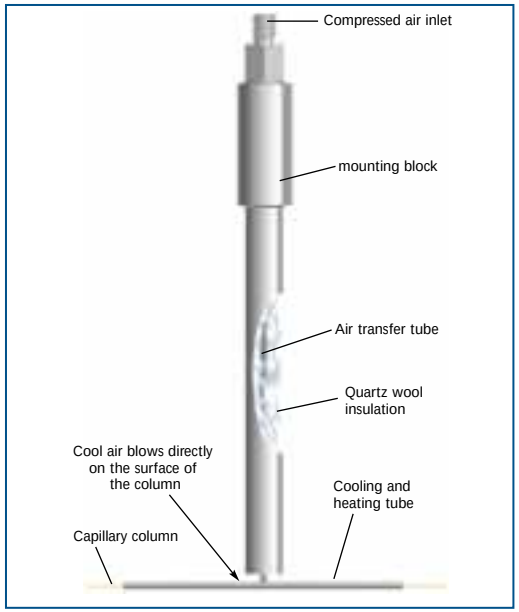

Figure 3. A cold trap that uses compressed air. Soon to be released by SGE.

The compressed air trap has a layer of insulation around its stem to reduce the amount of heat it absorbs from the oven. This insulation is significant because it allows the air transfer tube to rapidly change temperature independently of the GC oven temperature. The compressed air trap is capable of very fast ON/OFF cycling which allows it to selectively trap large numbers of peaks in a chromatogram.

DISCUSSION

Cold traps that use compressed liquids, like CO_2, are best used to trap volatile compounds. They are very effective at the front of the column when used to compensate for bad injection technique (see **Figure 4**). Compressed gas cold traps, like SGE's compressed air trap, are very effective at trapping semi-volatile and non-volatile compounds. They are best placed at the end of the column where they can sharpen up peaks just before they hit the detector. Compressed air traps can also run off a standard air compressor, so they are very economical to run.

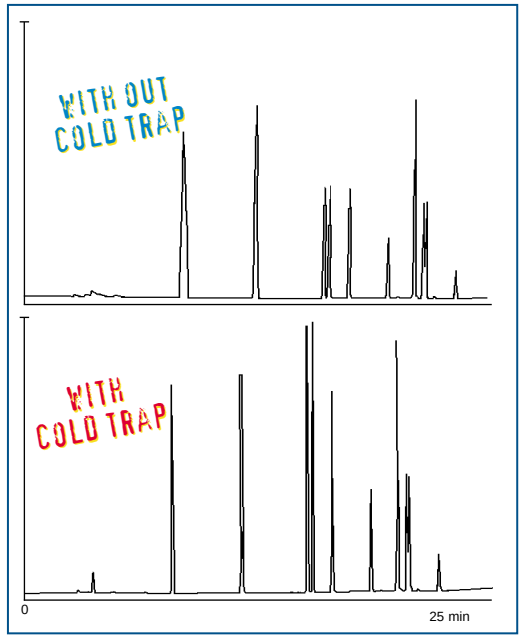

Figure 4. An example of a cold trap used at the front of a column.

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