THE BENEFITS AND DISADVANTAGES OF USING SMALL INNER DIAMETER CAPILLARY COLUMNS

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INTRODUCTION

Fast GC is a term used to describe a reduction in analysis time compared with using conventional 30 meter x 0.25mm inner diameter capillary columns. The technique usually involves short (10 meter) capillary columns with an inner diameter of 0.1mm (100 microns). The smaller bore capillary columns must have higher efficiencies (plates/meter) which provide resolution of complex mixtures using shorter column. This results in shorter analysis times. Capillary column flow rates and oven temperature programs are also usually optimized. This poster will describe some of the benefits and pitfalls of Fast GC and provide practical information to use in your laboratory.

BENEFITS

- shorter run times
- greater sample throughput
- cheaper columns
- higher signal to noise ratio
- lower bleed (thinner films)

DISADVANTAGES

- difficult to use for conventional GC/MS
- easier to overload the phase (less sample capacity)
- careful attention required for splitless injections
- conventional Van Deemter curves do not apply (high pressure drop)

HOW TO OPTIMIZE YOUR SYSTEM FOR FAST GC

Injector

The low carrier gas flow rates used with fast columns can cause band broadening in the injection port, especially during splitless injections. If a liner with a small internal volume is used, the velocity of the carrier gas through the liner is increased, which reduces the amount of time the sample spends in the injection port, therefore minimizing band broadening. It is recommended to use a smaller inner diameter liner for Fast GC. For Agilent 5890 and 6890 GC's, for example, a 2mm ID liner or less is recommended. Halving the ID of the liner will result in a total liner volume of just one quarter. It is therefore important to keep the total sample volume as low as possible.

Column

Typically Fast GC columns are 10 meters x 0.1mm ID with a 0.1 micron film. This column has a phase ratio of 250, which is the same as a 0.25mm ID column with a 0.25 micron film. The reduced film thickness places a restriction on the amount of sample which can be injected on to the column, i.e. reduced sample capacity. Sample capacity for fast GC columns can be up to 10 times less than a 0.25mm ID column with a 0.25 micron film. If the column's sample capacity is overloaded, fronting peaks will result producing poor quantitation and irreproducible retention times.

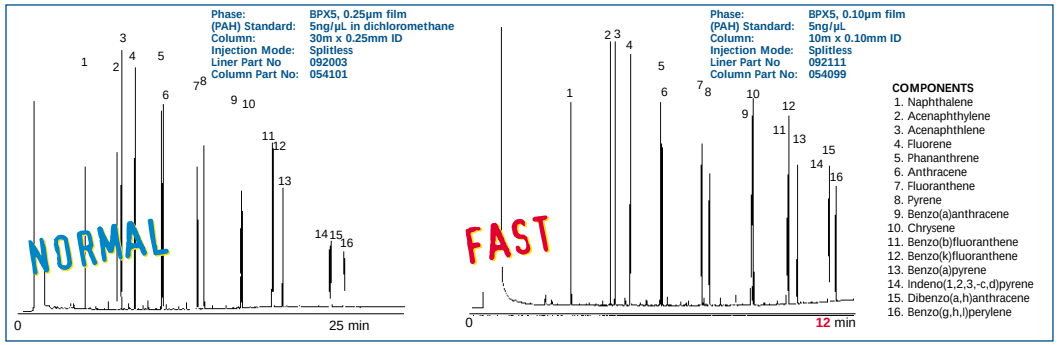

Figure 1a. Chromatogram showing Polynuclear Aromatic Hydrocarbons (PAHs) using a conventional 30 meter x 0.25mm ID BPX5 column with a 0.25 micron film.

Figure 1b. Chromatogram showing separation of Polynuclear Aromatic Hydrocarbons (PAHs) using a FAST BPX5 column.

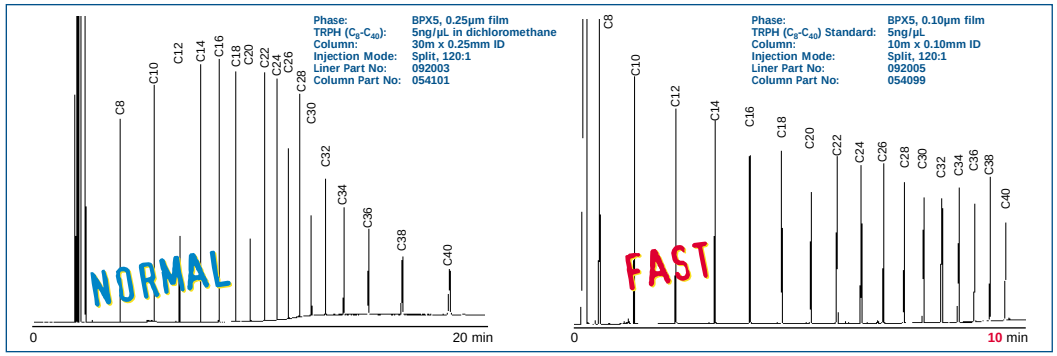

Figure 2a. Chromatogram showing separation of Total Recoverable Petroleum Hydrocarbons using a conventional 30 meter x 0.25mm ID BPX5 column with a 0.25 micron film.

Figure 2b. Chromatogram showing separation of Total Recoverable Petroleum Hydrocarbon using a FAST BPX5 column.

Column Flow Rates

Normal optimum Van Deemter velocities do not apply to Fast GC columns. High velocities of 70cm/sec and greater can be used and this requires higher inlet pressures for these small bore capillary columns. The higher inlet pressure places more stress on ferrule and septum sealing and even the pressure asserted on the sample syringe during injection.

Oven Temperature Program Rates

Program rates can be up to 30°C/minute for Fast GC analysis. Increasing program rates will decrease total analysis time but the user should be aware that peak swapping could occur.

Detector Sampling Rates

The peaks eluting from a Fast GC column can be too narrow for the detector sampling rate of a benchtop quadrupole MS. Inadequate detector sampling can result in poor quantitation, or in the worst case, missed peaks. It is crucial when using a MS with Fast GC column to be aware of this. Reducing the mass range in full scan mode or moving to Selected Ion Monitoring (SIM) mode can increase the detector sampling rate. Another option is to use Time Of Flight (TOF) mass spectrometers that are capable of very fast detector sampling rates making these mass spectrometers very suitable for Fast GC columns.

ORDERING INFORMATION

Phase	ID (mm)	Film (µm)	Length (m)	Part No.
BP1	0.10	0.1	10	054022
BPX1	0.10	0.1	10	054777
BPX5	0.10	0.1	10	054099
BP20	0.10	0.1	10	054405
BPX35	0.10	0.1	10	054699
BPX50	0.10	0.1	10	054740
BPX70	0.10	0.2	10	054600
FAST PCB	0.10	0.1	10	054690

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