
COMPREHENSIVE GC × VACUUM-GC: A STUDY OF THE POSSIBILITIES AND LIMITATIONS

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In comprehensive GC×GC the second dimension separation needs to be significantly faster than the first dimension run. Ideally, four 2nd dimension runs are performed across a 1st dimension peak. Since the introduction of GC×GC it is common to obtain this much higher speed for the 2nd dimension by using short and narrow columns in the 2nd dimension as opposed to long, larger internal diameter columns in the first dimension. Typically, a column set of 0.25 mm ID × 0.1 mm ID is used. During the 2nd GC×GC conference in Atlanta in 2005, Jan Beens showed the benefits of using second dimension columns with an ID closer to that of the first dimension column, albeit that also in his work the 2nd dimension columns were still narrower. One of the advantages of using a column with a wider ID in the 2nd dimension is the larger loadability. Overloading is often a problem with 0.1 mm ID columns when running, *e.g.*, trace analysis with a high matrix content.

From linear GC–MS it is known that when chromatography is performed under vacuum conditions, the speed can be higher as compared to chromatography at above-ambient pressures. This as a result of the higher diffusion rates. Vacuum outlet operation could hence be an alternative way to obtain a higher 2nd dimension speed. This at the additional advantage that vacuum-GC can be done on wide-bore columns which have a much higher sample loadability.

In this contribution we will show the theoretical expectations and the practical outcome of a feasibility study into GC × vacuum-GC – ToF MS for a 0.25 mm ID 1st dimension column with 0.53 mm ID 2nd dimension columns of different lengths. It will be shown that a compromise has to be found between the number of plates obtained in the 2nd dimension and the rate at which these plates are generated. Short 2nd dimension columns are very fast, but generate only a limited number of plates. Longer columns generate more plates but are slow.