

## Abstract:

Comprehensive gas chromatography (GC×GC) is a modern and advanced analytical method designed to separate very complex samples, when the separation efficiency of classical gas chromatography is not sufficient. GC×GC allows complete simultaneous analysis of a sample on two different columns, interconnected by special interface called the modulator.

Three types of control units were set up and a robust pulse flow modulator (PFM) was developed in this work. PFM working parameters have been always optimized to allow combinations of columns with different sizes. Optimized PFM allows application of columns with 10-60 m length and 0.15-0.25 mm internal diameters for the first dimensions and with 1-10 m length and 0.25-0.32 mm internal diameters for the second dimension.

For demonstration reasons, analyses of complex real samples, such as essential oils, oil derivatives and biological samples, were performed. PFM was compared with the commercial cryofocusing modulator Zoex for the selected column set and one sample (a mixture of volatile solvents) on a gas chromatograph equipped with both modulators. The average repeatability of retention times, expressed as a relative standard deviation, was approximately 2.0 % for PFM (cryofocusing about 0.5 %) and of the peak areas was approximately 3.5 % (cryofocusing about 1.0 %). As a result, it can be stated, that PFM is applicable modulation tool when all parameters are set correctly. Unfortunately, the commercial cryofocusing modulator is still more robust and more efficient. However, the advantages of PFM are very low initial costs and almost zero operating costs. An approximate daily operation costs of a PFM device are 75 CZK per day compared to 750 CZK per day when using a cryofocusing modulator.

## Keywords:

Pressure modulator, multidimensional gas chromatography, comprehensive gas chromatography, multifactorial optimization