

The optimisation of GC x GC and the analysis of diesel petrochemical samples

by

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Abstract

Comprehensive two-dimensional gas chromatography (GC x GC) is a new technique with a promising future in analytical chemistry. Researchers have already shown the advantages of this

technique to unravel complex samples consisting of hundreds of compounds. The predominant advantage of GC x GC above conventional one-dimensional gas chromatography is the greatly enhanced peak capacity. To fully utilise this enhanced peak capacity the instrumentation needs to be run at optimum conditions. The optimisation of one-dimensional gas chromatography (GC) is done on a routine basis in analytical laboratories and handbooks are available to cover these optimisation strategies. This study was aimed at providing similar guidelines for GC x GC. Since the underlying theory of GC and GC x GC are essentially the same, conventional GC optimisation strategies were the point of departure for this research. The different operational parameters in GC x GC were identified and emphasis was then placed on a method to simultaneously optimise the flow rate in both columns, taking into consideration the common practice of series-coupling of columns of different internal diameters. The influence of second-dimension stationary phase, temperature program and modulator operation on the distribution and shape of chromatographic peaks in the two dimensions is also investigated. The results obtained from this study provide a useful new approach to optimise a GC x GC system where two gas chromatographic columns of various dimensions are connected in series. The use of diesel samples in this optimisation process presented some useful applications for future research in the petrochemical industry. Examples of potential applications such as “fingerprinting techniques” and compositional analysis are also discussed.

The optimisation of GC x GC and the analysis of diesel petrochemical samples

(Die optimering van GC x GC en die analise
van diesel petrochemiese monsters)

deur

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Ekserp

Twee-dimensionele gaschromatografie (GC x GC) is 'n nuwe tegniek met 'n belowende toekoms in analitiese chemie. Navorsers het reeds die voordele van die tegniek uitgewys om komplekse

monsters, bestaande uit honderde komponente, te ontrafel. Die mees prominente voordeel van GC x GC bo gewone een-dimensionele GC is die verhoogde piek-kapasiteit. Om die groter piek-kapasiteit ten volle te benut moet die instrument by optimum kondisies funksioneer. Die optimering van een-dimensionele GC word gedoen op 'n roetinebasis in menigte analitiese laboratoriums en daar is handboeke beskikbaar wat die optimering van GC bespreek. Hierdie studie was daarop gemik om soortgelyke riglyne vir die optimering van die meer komplekse GC x GC daar te stel. Omdat die onderliggende teorie van GC en GC x GC essensieel dieselfde is, is konvensionele GC-optimering gebruik as uitgangspunt gebruik vir hierdie navorsing. Die verskillende operasionele parameters in GC x GC is eers geïdentifiseer, waarna klem gelê is op 'n metode wat gelyktydig die lineêre vloeï in beide kolomme kan optimeer, met inagneming van die algemene praktyk om seriegekoppelde kolomme met verskillende binnedeursneë te gebruik. Die invloed van die tweedimensionele stasionêre fase, temperatuur-programmering en die modulator op die vorm en verspreiding van chromatografiese pieke in die twee dimensies is ook ondersoek. Die resultate verkry in hierdie studie bevestig die bruikbaarheid van 'n nuwe optimeringsmetode vir GC x GC waar kolomme van verskillende binnedeursnit aanmekaar gekoppel word. Die gebruik van dieselmonsters in die optimeringstudie het 'n paar potensiële gebruike uitgewys vir toekomstige navorsing in die petrochemiese industrie. Voorbeelde bespreek sluit hoofkomponent- en “vingerafdruk”-analises in.

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