OPTIC-4

OPTIC-4 Pyrolysis GC Solution

The world's fastest programmable GC Inlet

Pyrolysis gas chromatography is a method of chemical analysis in which the sample is heated to decomposition to produce smaller molecules that are separated by GC and detected using sophisticated detector. With OPTIC-4 either liquid polymer solutions or solid polymers can be pyrolyzed directly inside inlet thus eliminating the need in expensive external instrument.

- Pyrolysis of solid or dissolved (bio)polymers
- Direct (in-inlet) thermal desorption for any type of sample
- Single-shot, double-shot or multi-shot
- Reproducibility < 2% Possibility for quantitative pyrolysis
- Very low detection limits
- No transfer line
- Large volume injection pyrolysis GC-MS
- Pyrolysis up to 600 °C (with heating ramp rate up to 3600 °C/min)
- Solid polymers; Analysis can be automated with Liner Exchanger
- Fully automated on-line SEC-Py-GCMS solution
- Thermochemolysis applications (thermal assisted derivatisation)
- Optional integrated cryogenic focusing
- Discrimination free up to C100

One Instrument - Multiple Analytical Solutions

Single Shot
In this mode, after introduction, sample is heated with a fast ramp rate to the pyrolysis temperature. Only one temperature step is used.

Multistep programmed pyrolysis
Analytical runs may be programmed for up to nine temperature steps per sample.

Sample Cup (Micro-vial)
A small glass sample cup that can be placed in the inlet liner is available for solid or liquid samples. The cup is disposed after analysis while the inlet liner remains clean.

Evolved Gas Analysis (EGA)
The sample is put into the inlet which is at a relatively low temperature (ca. 40-100°C). The inlet is then programmed to a much higher temperature (ca. 600°C). Compounds "evolve" from the sample as the temperature increases.

Thermal Desorption (TD)
Thermal desorption is simply a technique for analyzing the compounds evolving from the sample over a given temperature range. The inlet can first function as a thermal desorption unit followed by pyrolysis. OPTIC-4 can be cooled down to very low temperatures (-150 °C) which makes it also very useful for gaseous samples. After thermal desorption step, the compounds can be trapped (again) using either cold GC-oven or ATAS GL cryogenic trap (-150 °C to 350 °C, ramp rate 60 °C/s). Cryotrap is installed into the GC oven and the compounds are directly trapped onto the analytical column. Trapping compounds directly in the column results in very narrow bands and thus in lower detection limits.

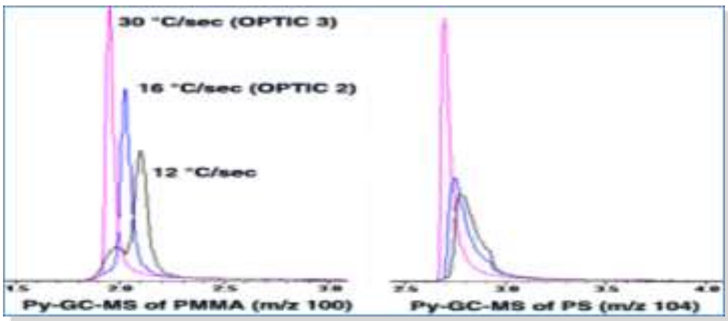
Reactive Pyrolysis
Thermally-assisted Hydrolysis and Methylation (THM) can easily be realized with OPTIC-4 under pyrolysis conditions.

Large Volume Injection Pyrolysis
The right way to get reliable and quantitative composition information of polar biopolymers or synthetic (co)polymers is to inject a homogenous solution of the polymers instead of direct pyrolysis of solid polymer material. With OPTIC-4 inlet, it is fairly simple to inject volumes up to 100 µl even with water as solvent. After controlled solvent elimination, the pyrolysis is performed resulting in truly quantitative compositional/structural information.

Cryo-focusing
OPTIC-4 cryogenic trap produces sharp peaks for early eluting compounds. Trap, mounted into the GC oven, cools first part of column to re-focus the analytes. LN_2 or CO_2 cooling is available.

SEC-Py-GCMS
Both Size Exclusion Chromatography (SEC) and pyrolysis are commonly used for the characterization of (co)polymers. SEC is very useful for determination of the molecular-size distribution and Py-GC provides chemical composition information. Combination of two techniques allows to obtain combined size and chemical information. With the interface-kit from ATAS GL, it is now possible to perform on-line SEC-Py-GC-MS in a fully automated manner. The fractionation of the SEC, the solvent elimination and the pyrolysis of the retained polymer are fully automated allowing high throughput of complex macromolecules for detailed characterization.

Automated Liner Exchange (LINEX)
To automate thermal desorption or pyrolysis analysis of solid samples, a liner exchanger (LINEX) can be used. LINEX offers possibility to automatically the exchange of liners between the OPTIC-4 inlet and the liner tray after every or few analytical runs. This offers a possibility for automation of the analysis of solid or heavy matrix samples to avoid possible carry-over or inlet contamination.



Py-GCMS Chromatogram of PMMA

Selection From List of Publications

Characterization of Polymers by Multi-Step Thermal Desorption/Programmed Pyrolysis Gas Chromatography Using a High Temperature PTV Injector. M. van Lieshout, M.J.J. Hetem; Journal of High Resolution Chromatography, 19 (1996) 193-199.

At-line gas chromatographic-mass spectrometric analysis of fatty acid profiles of green algae using drect thermal desorption interface. P. Blokker, R. Pel, L. Akoto, U.A.T. Brinkman, R.J.J. Vreuls; Journal of Chromatography A 959 (2002) 191-201.

Automated GC-MS analysis of raw biological samples. Application to fatty acid profiling of aquatic micro-organisms. Akoto L., Pel R.,Brinkman U., Vreuls R.J.J.; Journal Anal. Appl. Pyrol., 73, (2005) 69-75.

Determination of the carbon isotopic composition of whole/intact biological specimens using at-line direct thermal desorption to effect thermally assisted hydrolysis/methylation. Akoto L, Vreuls RJ, Irth H, et al. Journal of Chromatography A, 2007, Sep 11.

Fatty acid profiling of raw human plasma and whole blood using direct thermal desorption combined with gas chromatography-mass spectrometry. Akoto L, Vreuls RJ, Irth H, et al. Journal of Chromatography A, 2007, Sep 11.

On-line size exclusion chromatography–pyrolysis-gas chromatography–mass spectrometry for copolymer characterization and additive analysis. Erwin R. Kaal, Geert Alkema, Mitsuhiro Kurano, Margit Geissler, Hans-Gerd Janssen. Journal of Chromatography A, 1143 (2007) 182–189.

On-line SEC-Py-GC-MS for the Automated Comprehensive Characterization of Copolymers. Erwin R. Kaal, Mitsuhiro Kurano, Margit Geißler, Peter Schoenmakers and Hans-Gerd Janssen. LC·GC Europe, September 2007, 444-452.

Characterization of olive oil volatiles by multi-step direct thermal desorption–comprehensive gas chromatography–time-of-flight mass spectrometry using a programmed temperature vaporizing injector. Sjaak de Koning, Erwin Kaal, Hans-Gerd Janssen, Chris van Platerink, Udo A.Th. Brinkman; Journal of Chromatography A, 1186 (2008), 228–235.

Extending the molecular application range of gas chromatography. Erwin Kaal, Hans-Gerd Janssen; Journal of Chromatography A, 1184 (2008) 43–60.

Hyphenation of aqueous liquid chromatography to pyrolysis-gas chromatography and mass spectrometry for the comprehensive characterization of water-soluble polymers. Erwin R. Kaal, Mitsuhiro Kurano, Margit Geißler, Hans-Gerd Janssen; Journal of Chromatography A, 1186 (2008) 222–227.

Two-dimensional Characterization of (Bio-)macromolecules using LC-Py-GC-MS. Erwin R. Kaal, Hans-Gerd Janssen; GIT Spezial . Separation 1/2008. page 20-22.

Fully automated system for the gas chromatographic characterization of polar biopolymers based on thermally assisted hydrolysis and methylation. Erwin Kaal, Sjaak de Koning, Stella Brudin, Hans-Gerd Janssen; Journal of Chromatography A, 1201 (2008) 169–175.

Posters

Use of thermochemolysis-GC-MS for detailed characterization of fractions obtained from HPLC separation of sulphonatedlignin. HTC-10, 2008

Pyrolysis GCMS for studying polymer solubility. HTC-10, 2008.

Studying polymer solubility with Pyrolysis-GC-MS. WGS meeting, Amsterdam, 2008.

Finding biomarkers for fast detection of *Mycobacterium tuberculosis* in sputum samples using THM–GC-MS. HTC-11, 2010

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