

Screening and identification of several toxic additives in tobacco using automated difficult matrix introduction (DMI) and GC-MS with a LINer EXchanger (LINEX)

Key Words:

Automated Difficult Matrix Introduction (DMI)*
GC-MS
additives
tobacco

Introduction

Philip Morris explains: “The cigarette should be conceived not as a product but as a package. The product is nicotine. Think of the cigarette as a storage container for a day supply of nicotine.”

A major tool used by the tobacco industry is the additive technology. More than 600 authorised additives are used for several reasons for example to cover the ‘bad taste’ of nicotine, increase in the delivery or for better mouth feeling for the smoke.

Generally, the tobacco additives are screened for their direct toxicity. However, the additional smoking of all those compounds together brings increased exposure to over 4000 chemicals, including toxic and highly toxic compounds.

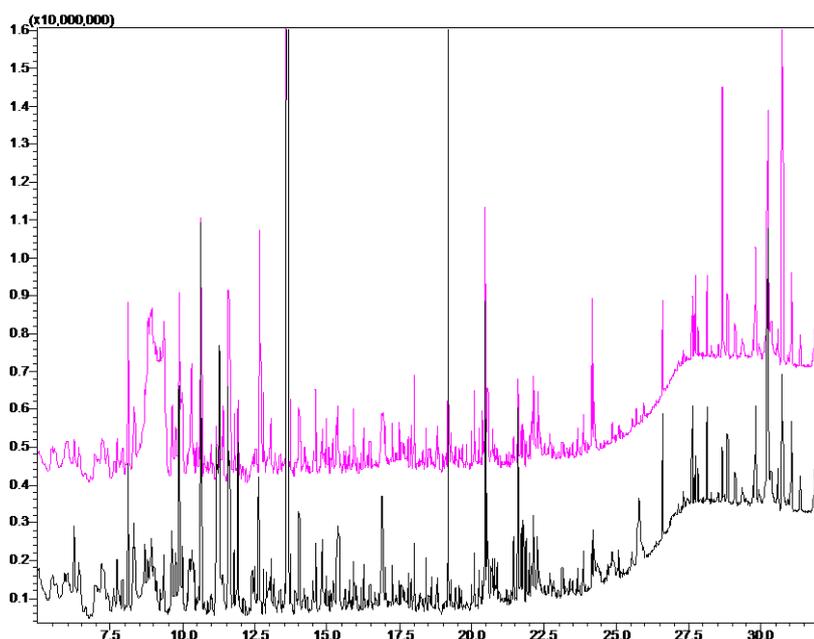
At this time only the manufacturer knows which additives are used and in which brands. Not even the responsible Government or the EU have this kind of information. For this reason we have started to develop an application for screening of additives in tobacco.

Results

Generally, for screening of solid samples no sample preparation is required because of potential losses of compounds during the sample preparation.

Therefore, especially for this application, DMI is an excellent tool for screening of this type of sample.

The most important step in the development was the optimization of the desorption temperature. Results shown that the optimum TD temperature was around 400 °C. Below this temperature the recovery of most of the compounds was lower. Above the 400 °C some compounds, the thermal unstable ones, started to degradate and therefore the recovery decreased. After the optimisation of the gas flows, the amount of sample, and the GC-program several brands of tobacco were screened. Two examples, Drum (black line) and Marlboro (pink line) light are shown in figure 1.



Several compounds identified:

1. furfural
2. phenol
3. maltol
4. coumarin
5. furancarboxaldehyde
6. benzenediol
7. dihydrobenzofuran
8. nicotine
9. benzylnitrile
10. myosmine
11. hexose
12. tetradecanoic acid

Experimental:

Sample preparation for DMI-analysis:

First the tobacco is cut into very small pieces. 5-10 mg of the tobacco was placed into a DMI micro-vial. The micro vial is placed into a cleaned DMI-Liner.

Instrumentation:

Injector: OPTIC 3 injector (ATAS GL International BV, Eindhoven, the Netherlands).

GC/MS: GC-MS-QP2010 (Shimadzu Deutschland GmbH, Germany).

Autosampler: FOCUS (ATAS GL International BV)

LINEX (ATAS GL International BV)

DMI-GC-MS conditions for tobacco:

GC-column: Inertcap TC-5 0.25 mm x 30 m, film thickness 0.25 μm (GL Sciences)

GC program: 40 °C (hold 3 min), 10 °C/min to 280 °C (hold 5 min)

Carrier gas: Helium

PTV-injector: 35 °C to 400 °C rate 10 °C/sec.

Column flow: 1,0 ml/min

Split flow: Start 1.5 min. 150 ml/min (flush liner)

During analysis: 1:50

Liner: DMI-liner



* H. Jing, A. Amirav, Anal. Chem 1997,69, 1426-1434