Ellutia
Chromatography Solutions

Residual Solvents in Printed Packaging

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Most inks used for printing are solvent-based, resulting in a printed substrate that will inevitably contain a certain amount of residual solvents. These chemicals can have an influence on the sensory properties of the packed product. The human senses of smell and taste can be sensitive enough to detect very small amounts of residual solvents. Almost all packaging materials have printed surfaces that could come into contact with foodstuffs. Commonly used ink solvents include: alcohols, ethers, acetates and other petrochemicals; all of which have been linked to various health conditions. Many items can contain residual solvents, from manufacturers' packaging to crockery and cutlery, glassware, ceramics and storage containers. These should be tested to ensure they are safe for use and do not exceed any specified limits.

It is the responsibility of the manufacturer of a Food Contact Substance (FCS) to ensure that these materials comply with the specifications and limitations stipulated by each applicable authority.

The residual solvents will be tested using an Ellutia 200 Series Gas Chromatograph with an FID (Flame Ionisation Detector). An FID is used for this analysis as it is well suited for the general detection of organic compounds: it has high sensitivity, a large linear response range and low noise. The FID is mass sensitive rather than concentration sensitive, which makes it the ideal choice for peak ratios and testing for repeatability in samples when testing solvents. The combination of the Ellutia 200 series GC together with the Ellutia Manual Headspace sampler makes for a reliable, low power solution that uses only a small amount of space.

Range Switching

A 10 µl volume of a 25 mix standard was placed in a 20 ml headspace vial and held at 100°C for 45 minutes within an Ellutia Manual Headspace module. A 0.5 ml gas sample was taken and injected into an Ellutia 200 series GC with an FID. The chromatogram of the headspace injection is shown below.

GC Conditions	
Injector Temperature:	230°C
Liner Type:	Focus Liner With Wool
Carrier Gas Type:	Hydrogen
Constant Pressure:	4.65 psi
Splitless Flow:	70ml min^{-1}
Column Type:	ELM-VOC 60 m x 0.32 mm x 1.8 µm df
Temperature Program:	Initial Temperature 40°C (hold 4 minutes)
Ramp:	4°C min-1 to 200°C (hold 3 minute)
Detector Temperature:	240°C

Headspace Conditions	
Headspace Model:	Ellutia Manual Headspace
Incubation Temperature:	100°C
Equilibration Time:	45 Minutes
Sampling Time:	1 Minute

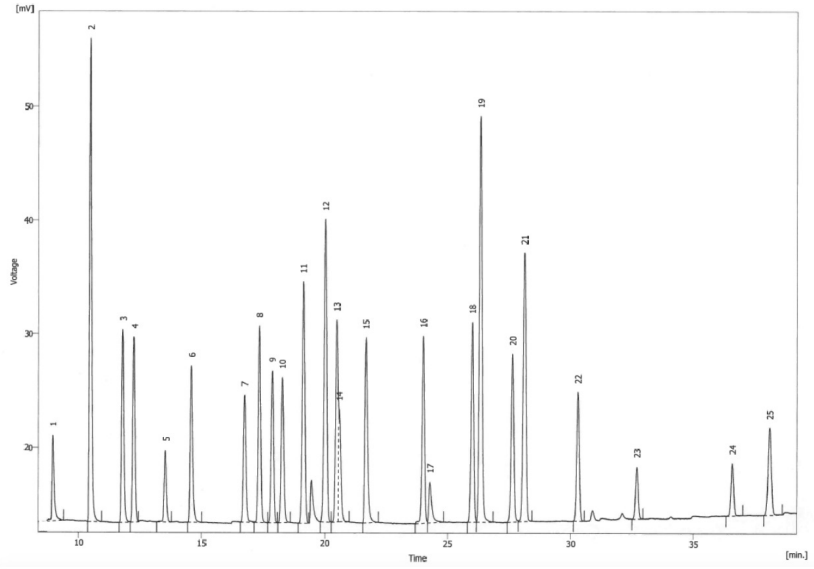

Figure 1. 0.5 ml headspace injection of a 25 component mix standard

1. Methanol,
2. Ethanol
3. 2-Propanol,
4. Acetone,
5. Methyl Acetate,
6. 1-Propanol,
7. sec-Butanol,
8. 2-Butanone,
9. Ethyl Acetate,
10. iso-Butanol,
11. Tetrahydrofuran,
Acetic Acid (breakdown product),
12. Methyl Cellusolve,
13. Cyclohexane,
14. iso-Propyl Acetate,
15. n-Butanol,
16.1-Methoxy-2-Propanol,
17. n-Propyl Acetate,
18.4-Methyl-2-Pentanone,
19. 2-Ethoxyethanol,
20. iso-Butyl Acetate,
21. Toluene,
22. Butyl Acetate,
23. Methyl Cellusolve Acetate,
24. 2-Ethoxyethyl Acetate
25. Cyclohexanone

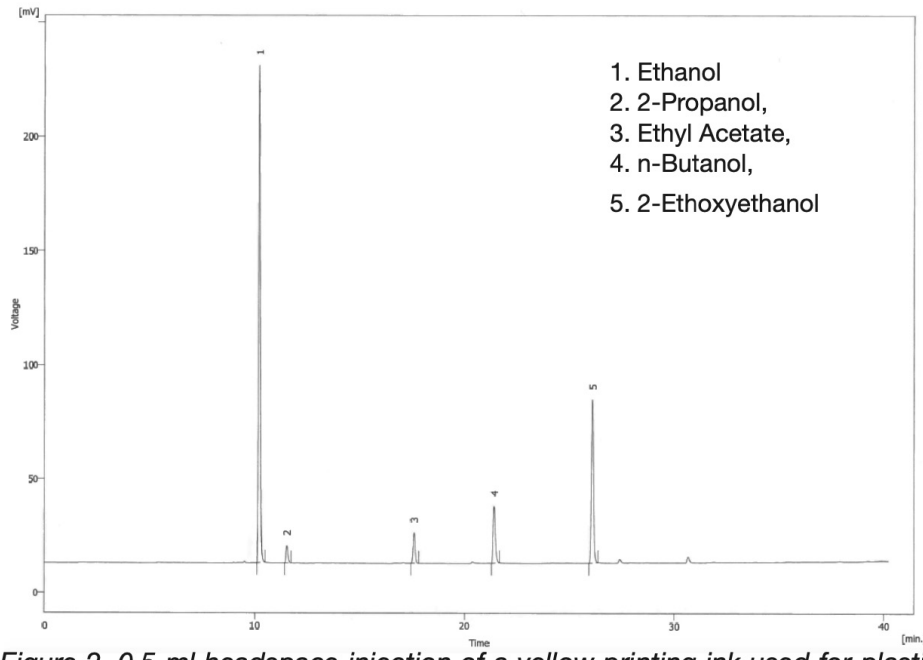

Figure 2. 0.5 ml headspace injection of a yellow printing ink used for plastic film packaging.

Results

The same procedure was carried out on a 10 µl volume of a printing ink. The results of this analysis are shown in the chromatogram below. These were evaluated using a widely implemented industry practice of omitting peaks below 1% and reporting the results as ratios of total peak area. The sample below is therefore reported as 60% Ethanol, 2% 2-Propanol, 4% Ethyl Acetate, 9% n-Butanol and 25% 2-Ethoxyethanol.

Ordering Guide

Main Instruments	
Ellutia 200 Series Gas Chromatograph, FID	(Part no. 20500130)
Ellutia Manual Headspace	(Part no. 30501001)
Ellution Software:	(Part no. 23001001)
Colibrick:	(Part no. 23001022)
ELM-VOC 60m x 0.32mm x 1.8 µm column	(Part no. 51100905)
Alternative Headspace Sampler	
Ellutia EL2000H - Headspace Autosampler - 42 position	(Part no. 30500013)
Ellutia EL2100H - Headspace Autosampler - 14 position	(Part no. 30500014)
GC Mounting Kit for EL2000H/ EL2100H Autosampler	(Part no. 30500018)
Accessories	
20ml Headspace Vials	(Part no. 30500022)
20ml Crimp Caps for Headspace Vials	(Part no. 30500023)
1ml Gas Tight Syringe	(Part no. 20511206)

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To learn more about Ellutia's range of chromatography solutions, please visit:
www.ellutia.com

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