



Analysis of Antioxidants and UV Absorbers using an Agilent J&W FactorFour VF-5ht UltiMetal Column

Application Note

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Introduction

Engineering plastics and other polymers used for consumer goods and technical applications often contain many additives that significantly influence the final properties of these products. Control and maintenance of a wide range of additives such as anti-oxidants, UV absorbers, heat-stabilizers, release agents and anti-statics in polymers are essential to give a high quality, environmentally safe product. Therefore, the quantitative determination of additives is important to provide a complete compositional analysis.

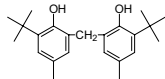
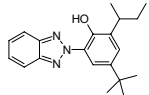
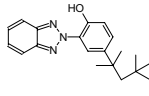
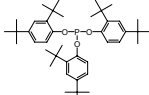
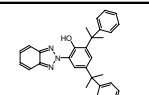
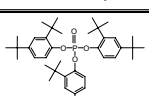
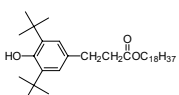
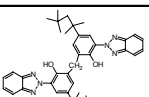


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Instrumentation

The analysis of polymer additives is performed using a VF-5ht UltiMetal column. This column has been developed using the proprietary UltiMetal technology which provides virtually unbreakable metal column material with excellent inertness properties similar to fused silica tubing. The UltiMetal column tubing has been coated with the VF-5 low bleed arylene stabilized liquid phase resulting in a highly temperature stable and durable column perfectly suited for a variety of high temperature applications. This is illustrated by the maximum oven temperature of 400 °C for this polymer additives analysis. The VF-5ht UltiMetal column is also compatible with MS detection techniques as is shown in figures 3,4 and 5.

Table 1. Common polymer additives

Peak no.	Name compound	Mass (m/z)	Chemical structure
1	AO2246=2,2-methylene-bis(4-methyl-6-tertiar-butylphenol)	340	
2	Tinuvin350	323	
3	Cyasorb 5411	323	
4	Irgafos168	646	
5	Tinuvin234	447	
6	Oxidized Irgafos168	662	
7	Irganox1076	530	
8	DLTDP= Dilaurylthiodipropionate	514	$S(CH_2CH_2COC(=O)C_{12}H_{25})_2$
9	LA31	658	
10	PETS= Pentaerythritoltetratearate	>1000	Various structures with different ratios of C ₁₆ and C ₁₈ groups

Conditions

Figures 1 & 2

Technique: GC-FID

Column: VF-5ht UltiMetal 15 m x 0.25 mm x 0.10 µm coupled 2 m x 0.25 mm retention gap (part number CP9091)

Sample: Polymer additives standard

Carrier Gas: 1.0 mL/min N₂, constant flow

Injector: Cool on-column

Oven: 40 °C (2 min), 40 °C/min, 160 °C, 12 °C/min, 280 °C (5 min), 10 °C/min, 400 °C (8 min)

Detector: FID, 400 °C

Figures 3, 4 & 5

Technique: GC/MS

Column: VF-5ht UltiMetal 15 m x 0.25 mm x 0.10 µm coupled 2 m x 0.25 mm retention gap (part number CP9091)

Sample: Polymer additives standard

Carrier Gas: 1.0 mL/min He, constant flow

Injector: Cool on-column

Inj Vol: 0.5 µL

Oven: 40 °C (2 min), 40 °C/min, 160 °C, 12 °C/min, 280 °C (5 min), 10 °C/min, 400 °C (8 min)

Detector: 40 °C (2 min), 40 °C/min, 160 °C, 12 °C/min, 280 °C (5 min), 10 °C/min, 400 °C (8 min)

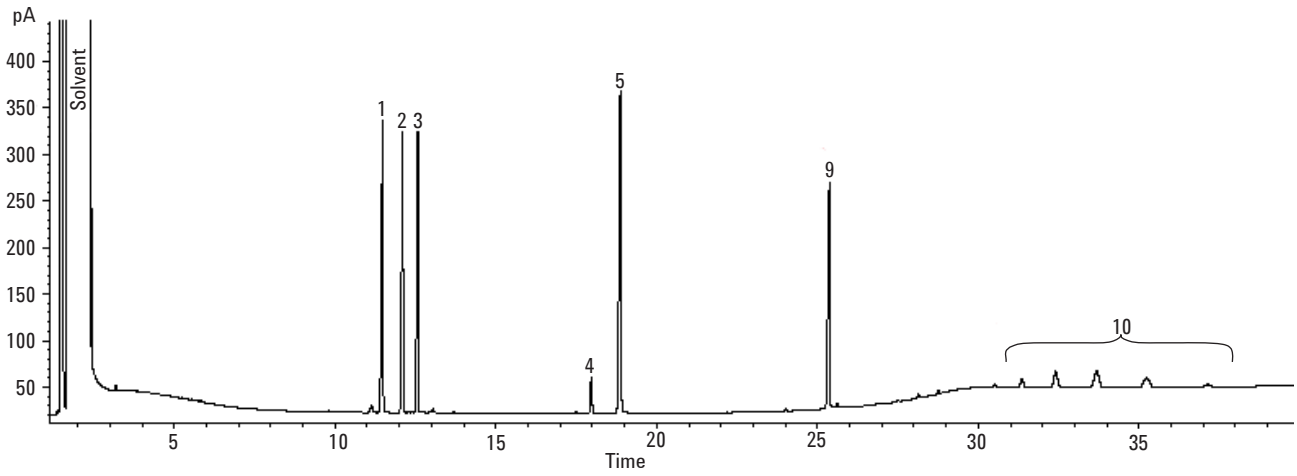


Figure 1. Standard of polymer additives [~ 100 ppm]

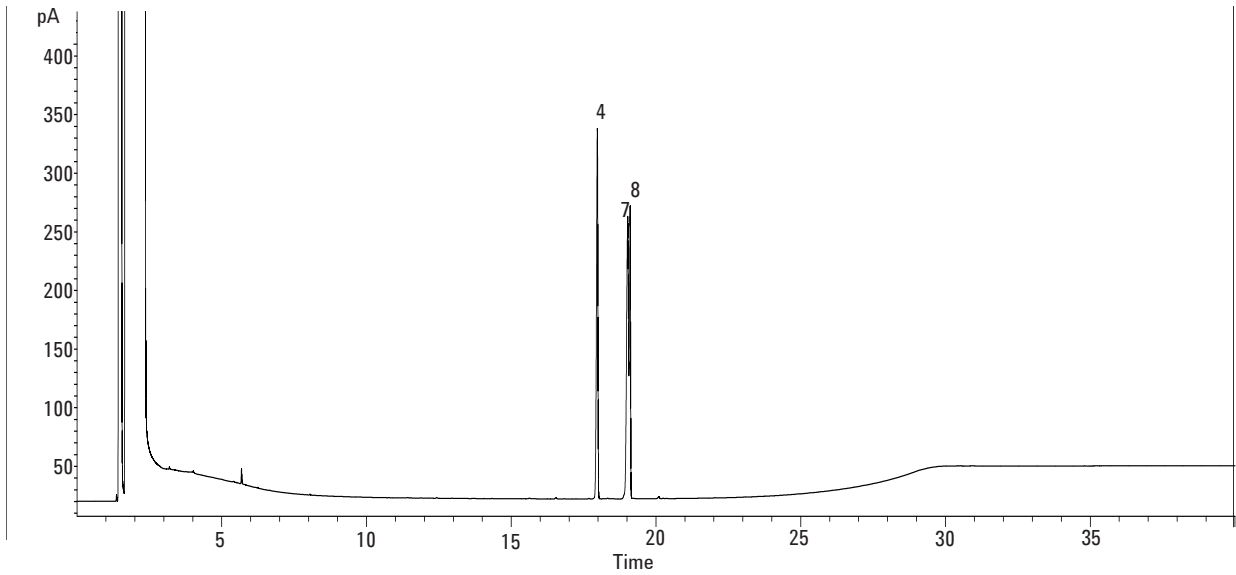


Figure 2. Analysis of Irgafos 168, Irganox 1076, DITDP [~ 100 ppm]

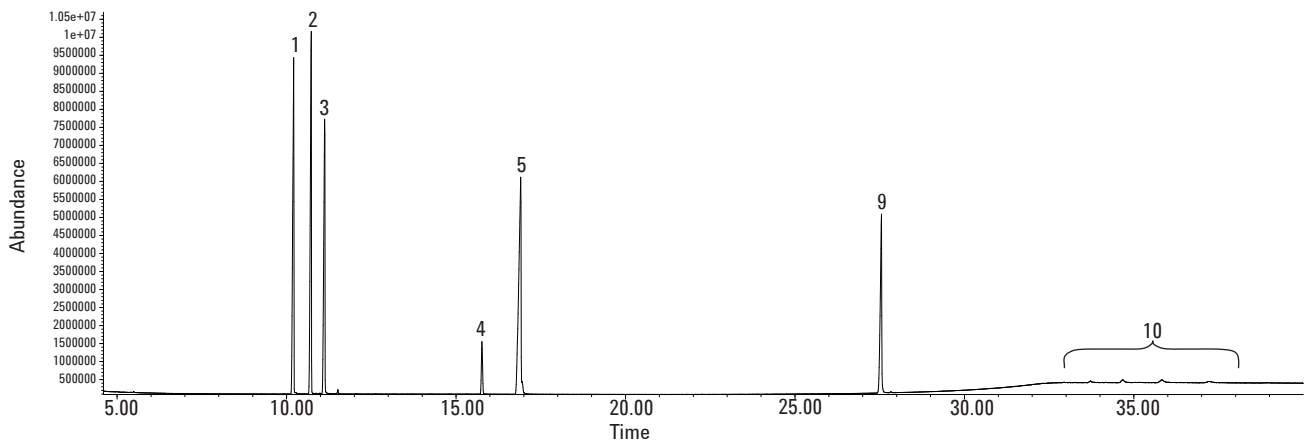


Figure 3. Analysis of polymer additives [~ 100 ppm] by HT-GC-MS

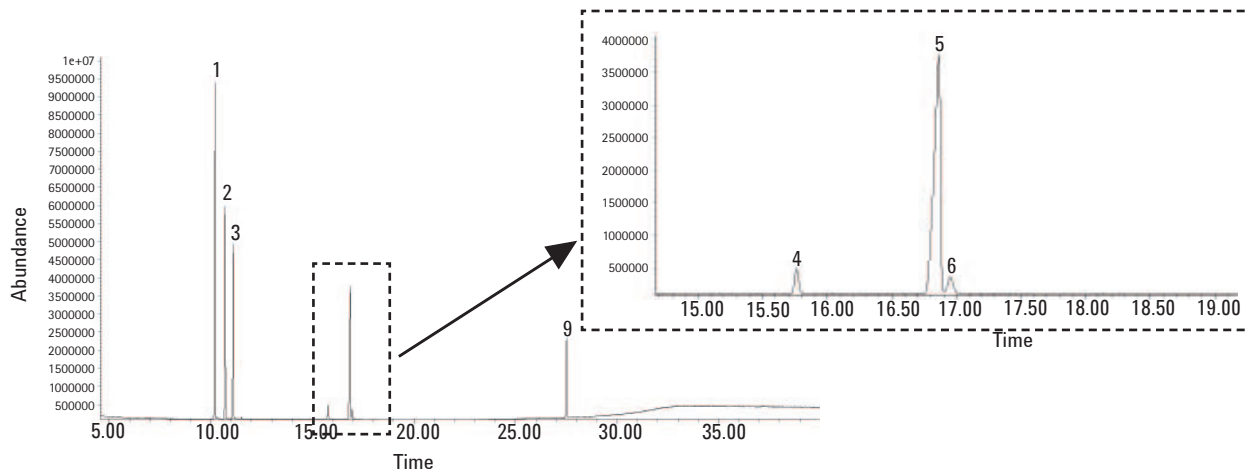


Figure 4. Analysis of polymer additives [~ 50 ppm] by HT-GC-MS (TIC)

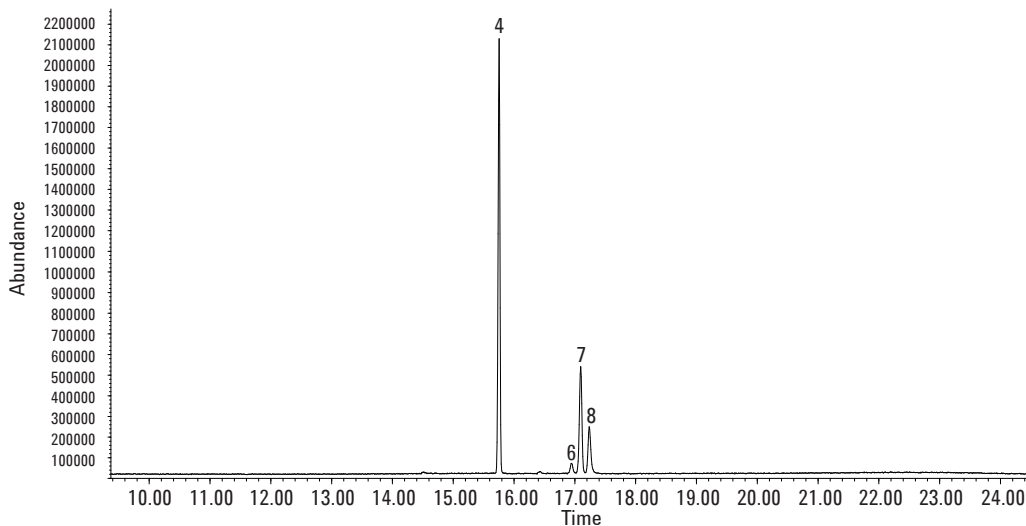


Figure 5. Analysis of IRGAFOS168, IRGANOX1076, DLDP (25 ppm) by HT-GC-MS

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Published in UK, October 08, 2010

SI-02042



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