

# APPLICATIONS

## Demonstration of SecurityCAP™ Exhaust Filter's Adsorption Capacity for Harmful Laboratory Vapors

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*Danny is a self-proclaimed font enthusiast. His hobbies include gardening, sun-screen, wearing sweaters around his shoulders, and doing donuts in his station wagon while heckling people for using Comic Sans.*

### Introduction

Providing a safe working environment for employees is of prime concern for employers. Often little consideration is given to the solvent waste produced by reversed phase HPLC/ UHPLC systems. Non-airtight waste container caps and unsecured tubing allow vapors and gasses into the laboratory creating exposure risks for laboratory workers and visitors.

SecurityCAP exhaust filters contain media intended to capture dangerous solvent vapors from LC waste containers and prevent them from entering the lab (**Figure 1**). In this study, we examine the media's uptake capacity of two common solvents—Methanol and Acetonitrile. Both solvents are irritating to eyes, may cause skin and respiratory tract irritation, and may cause serious effects if inhaled.<sup>1,2</sup> Using SecurityCAP LC Solvent Safety Products to prevent inhalation of these and many other dangerous solvents should be a standard practice for all analytical laboratories. In this study we used thermal desorption and headspace gas chromatography on a Zebtron™ ZB-624 GC column to test the SecurityCAP exhaust filter media's uptake capacity of these common solvents.

### Materials

Acetonitrile was obtained from Merck KGaA (Darmstadt, Germany); Methanol was obtained from Fisher Scientific (Loughborough, United Kingdom); Water from Millipore (Billerica, Massachusetts); and Glyceryl-triacetate from Fluka Analytical (Steinheim, Germany).

### Study Design

Two empty analytical thermal desorption tubes (TD tubes) were filled with SecurityCAP media and weighed on analytical scales. Tubes were then connected to an apparatus connected to a headspace vial containing solvent—one containing Methanol and one containing Acetonitrile of varying volume. The apparatus-connected headspace vial was placed in a 100 °C water bath to accelerate evaporation of solvent and subsequent uptake by SecurityCAP media. **Figure 2** shows a schematic of the evaporation apparatus.

Under nitrogen flow the volatile solvent is pushed through the TD tubes for 30 minutes. TD tubes were then weighed and contents

were placed in a headspace vial and suspended in 1 mL of glyceryl-triacetate to extract the analytes of interest (methanol and acetonitrile). Both samples were analyzed by headspace GC-FID using a Zebtron ZB-624 GC column.

### Results and Discussion

**Table 1** shows adsorption properties measured for SecurityCAP exhaust media for Acetonitrile. To determine the capacity of the sorbent for the solvent, we increased solvent volume from 100 µL to 700 µL and identified the volume which the second TD tube began adsorbing—an indication of solvent breakthrough. At 100 and 200 µL of Acetonitrile, the TD tube #2 does not adsorb much. However, at 400 µL of Acetonitrile, the TD tube #1 has reached capacity and a peak area of 90958 µVs was observed in TD tube #2. Therefore, the uptake capacity for acetonitrile is conservatively around 557 mg/g of SecurityCAP media or 200 µL of Acetonitrile—highlighted in blue. **Figure 3** shows the chromatogram for Acetonitrile. **Table 2** shows the adsorption properties measured for SecurityCAP exhaust media for Methanol. Solvent breakthrough occurs with 400 µL of Methanol, therefore the uptake capacity of SecurityCAP media is conservatively 535 mg/g or around 300 µL of Methanol—highlighted in blue. **Figure 4** shows the chromatogram for Methanol.

SecurityCAP exhaust filters come with >70 g of high quality media. SecurityCAP exhaust media is a blend of several different sorbents. Many competitor products use only activated charcoal. These media fall short on the absorption of amines and ammonia-containing compounds. However, SecurityCAP media can easily absorb these compounds. SecurityCAP media works symbiotically to remove mixed vapors better than charcoal alone by providing better adsorption across a larger vapor pressure range. Common exhaust media contain large-particle charcoal. Under normal conditions large-particle charcoal can only adsorb on its surface. The finer particles in SecurityCAP media has improved absorption effectiveness by delivering higher absorption capacity.

### Conclusion

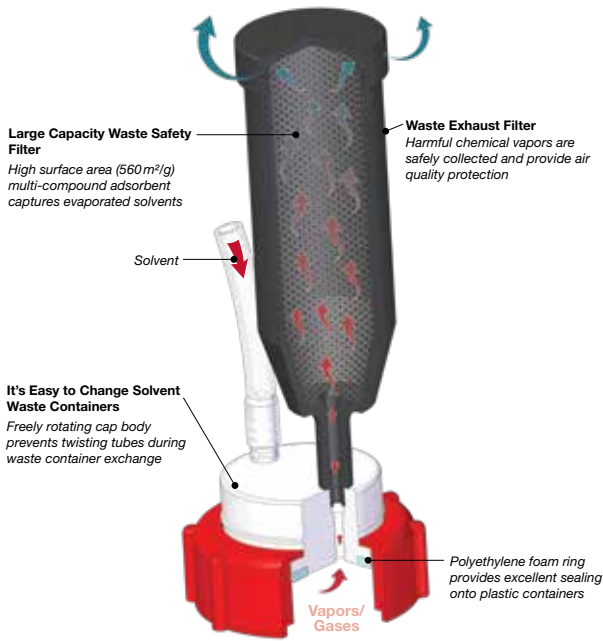
In this technical note we demonstrated the efficacy of SecurityCAP exhaust filter media to capture hazardous chemicals and prevent them from entering the breathable laboratory air. By using thermal desorption we were able to approximate the uptake capacity for Acetonitrile and Methanol.

### References

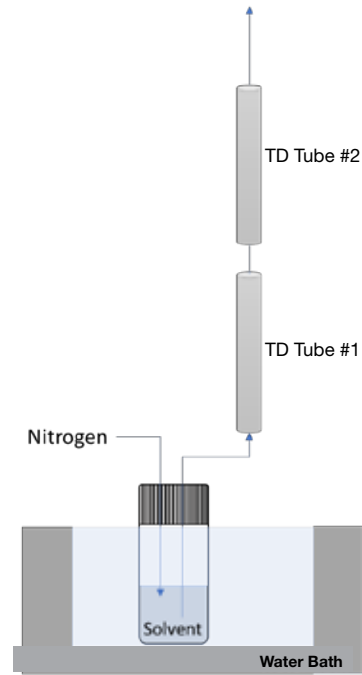
1. NIOSH Pocket Guide. Acetonitrile. Available at: <https://www.cdc.gov/niosh/npg/npgd0006.html>. Accessed on December 4, 2017
2. NIOSH Pocket Guide. Methanol. Available at: <https://www.cdc.gov/niosh/npg/npgd0397.html>. Accessed on December 4, 2017.



**Figure 1.** Schematic of SecurityCAP Waste Exhaust Filter and Cap



**Figure 2.** Schematic of Evaporation Apparatus



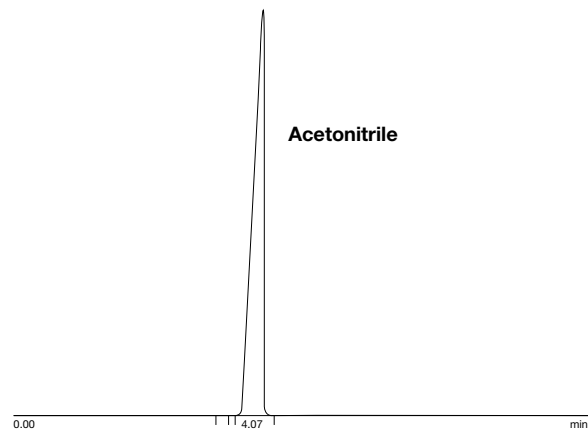
**Table 1.** Adsorption Capacity Results for Acetonitrile

Weight of the Adsorbent (g)		Volume of Acetonitrile (µL)	Weight of the Acetonitrile (mg)	Area (µVs)
Tube 1	Tube 2			Tube 1
0.4833	0.4525	100	78.6	532140
0.2822	0.2794	200	157.2	1673382
0.3064	0.3560	400	314.4	3249665
0.2572	0.2183	600	471.6	3922472
0.4456	0.5113	700	550.2	3859732

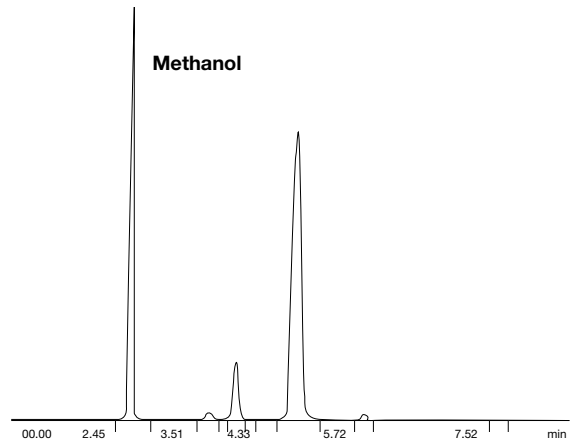
**Table 3.** Adsorption Capacity Results for Methanol

Weight of the Adsorbent (g)		Volume of Methanol (µL)	Weight of the Methanol (mg)	Area (µVs)
Tube 1	Tube 2			Tube 1
0.4207	0.2951	100	79.2	115764
0.4432	0.3065	300	237.5	814534
0.3289	0.4383	400	316.7	1064699
0.4918	0.5548	500	395.9	1048309

**Figure 3.** Representative GC-FID Chromatogram for Acetonitrile



**Figure 4.** Representative GC-FID Chromatogram for Methanol



**SecurityCAP™ Ordering Information**



**Starter Kits**

**SecurityCAP Mobile Phase (Eluent) Safety Starter Kits**

Part No.	Description
AC2-1245	2-port GL45 Cap and 6-month Safety Filter
AC2-4245	2-port GL45 Caps (x4) and 6-month Safety Filters (x4)
AC2-4240	2-port Merck S40 Caps (x4) and 6-month Safety Filters (x4)
AC2-1345	3-port GL45 Cap and 6-month Safety Filter
AC2-4345	3-port GL45 Caps (x4) and 6-month Safety Filters (x4)
AC2-4445	4-port GL45 Cap (x1) and 2-port Caps (3x) and 6-month Safety Filters (x4)
AC2-1445	4-port GL45 Cap and 6-month Safety Filter
AC2-1545	5-port GL45 Cap and 6-month Safety Filter
AC2-1561	5-port S60/S61 Cap and 6-month Safety Filter

**SecurityCAP Waste Safety Starter Kits**

Part No.	Description	Unit
AC1-1245	2-port GL/DIN45 Cap and 6-month Exhaust Filter and Barbed Connector	ea
AC1-1545	5-port GL/DIN45 Cap and 6-month Exhaust Filter	ea
AC1-1551	5-port DIN51 Cap and 6-month Exhaust Filter	ea
AC1-1553	5-port B53 Cap and 6-month Exhaust Filter	ea
AC1-1561	5-port S61 Cap and 6-month Exhaust Filter	ea

**Replacement Filters**

**SecurityCAP Mobile Phase Safety Filters**

Part No.	Description	Unit
AC2-0161	6-month Capacity, ¼ in.-28 Threads	ea
AC2-0961	6-month Capacity, ¼ in.-28 Threads	10/pk



**SecurityCAP Waste Safety Filters**

Part No.	Description	Unit
AC1-0161	6-month Exhaust Filter for SecurityCAP, ¼ in.-28 Threads	ea
AC1-0361	6-month Exhaust Filter for SecurityCAP, ¼ in.-28 Threads	3/pk
AC1-0162	6-month Exhaust Filter for Wide-port Caps, GL14 Threads	ea
AC1-0362	6-month Exhaust Filter for Wide-port Caps, GL14 Threads	3/pk

**Fittings and Accessories**

**SecurityCAP Fittings**

Part No.	Description	Unit
AC3-1101	for ¼ in. or 2.0 mm ID Tubing, ¼ in.-28 Threads (POM), blue	ea
AC3-1201	for 2.3-2.6 mm ID Tubing, ¼ in.-28 Threads (POM), white	ea
AC3-2101	for ¼ in. ID Tubing, ¼ in.-28 Threads (POM), black	ea

**SecurityCAP Connectors**

Part No.	Description	Unit
AC3-1001	Barbed Connector, for 5-8 mm ID Tubing (PTFE), white	ea
AC3-1301	Y-connector, for 6-8 mm ID Tubing (POM), white	ea

POM = polyoxymethylene  
PTFE = polytetrafluoroethylene (Teflon®)

**SecurityCAP Adapter**

Part No.	Description	Unit
AC2-1138	Cap Thread Adapter, PTFE, GPI/GL 38 Female to GL45 Male	ea
AC3-1111	Waste Adapter for Male ¼ in. NPT-port (PTFE)	ea

**SecurityCAP Sealing Plug**

Part No.	Description	Unit
AC3-2001	¼ in.-28 Threads (POM), white	ea



**SecurityCAP Waste Safety Compatibility Table**

Supplier	Phenomenex SecurityCAP Filters	
	ea	3/pk
<b>SCAT® Safety Waste Caps</b>	AC1-0162	AC1-0362
<b>AIT® SmartCaps™</b>	AC1-0162	AC1-0362
<b>Agilent® InfinityLab Stay Safe Caps</b>	AC1-0162	AC1-0362
<b>VICI® Waste Caps</b>	AC1-0161	AC1-0361
<b>Canary-Safe™ Safety Caps</b>	AC1-0162	AC1-0362
<b>DURAN® DG Safety Caps</b>	AC1-0162	AC1-0362
<b>Vaplock™ (with AC3-1111)</b>	AC1-0161	AC1-0361



If SecurityCap Products do not perform as well or better than your current solvent safety products of similar type, dimensions, and material, return the product with comparative data within 45 days for a FULL REFUND.



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