

# Basic performance of solid-phase extraction device “Magic Chemisorber®”

**[Background]** Solid-phase micro extraction (SPME) is a simple and rapid sample preparation technique used to extract and concentrate organics in liquid or gaseous matrices. Organics extracted into the solid phase are thermally desorbed and analyzed using GC/MS. The traditional SPME fibers are easily damaged because they are quite fragile and they exhibit a limited extraction capacity due to the small amount of sorbent on the fiber surface. To address these issues, a durable solid-phase extraction device, the “Magic Chemisorber®” (MC), was developed by Frontier Laboratories Ltd. In this report, the basic performance of the Frontier MC is described.

**[Experimental]** The Frontier MC (Fig. 1) consists of a deactivated titanium capillary tube ( $L=6$  or  $30$  mm, i.d. =  $1.2$  mm, o.d. =  $1.6$  mm) coated with a thick film ( $500$   $\mu\text{m}$ ) of PDMS (polydimethylsiloxane). The PDMS is chemically bonded to the titanium tube which stabilizes the PDMS during the thermal desorption of the extracted organics. Before use, the tube is conditioned by heating it ( $150$ - $280^\circ\text{C}$  at  $20$   $^\circ\text{C}/\text{min}$ ,  $10$  min hold) in a helium atmosphere. A pesticide, benfluralin (bethrodine MW  $335.3$ ) was used to demonstrate the performance of the MC. A series of aqueous standard solutions ranging from  $2.5$  to  $2.5 \times 10^4$  ng/L were prepared. The extracted benfluralin on the MC surface was analyzed using both evolved gas analysis (EGA)-MS and thermal desorption (TD)-GC/MS.

**[Results]** The EGA-MS thermogram of benfluralin extracted from an aqueous solution ( $40$  mg/L) is shown in Fig. 2. The thermogram was obtained by heating the MC/benfluralin sample:  $50$  to  $280^\circ\text{C}$  at  $40$   $^\circ\text{C}/\text{min}$ . The desorbed benfluralin was measured using the MS in the SIM acquisition mode ( $m/z$   $292$ ). Analysis of the EGA thermogram indicated that the desorption process is completed when the temperature reaches  $280^\circ\text{C}$ . A typical plot of extraction time vs. peak intensity is shown in Fig. 3. The plot indicates that  $45$  min is required to reach the partition equilibrium of benfluralin at the water-PDMS interface. Analysis of a series of aqueous benfluralin solutions ( $2.5$  to  $2.5 \times 10^4$  ng/L) shows that the linear dynamic range is ca.  $10^4$ . Fig. 4 shows a mass chromatogram of  $20$  mL distilled water spiked with  $2.5$  ng/L benfluralin. The detection limit calculated from the SN ratio is  $0.5$  ng/L. These results illustrate the usefulness of the MC as a solid-phase extraction device.

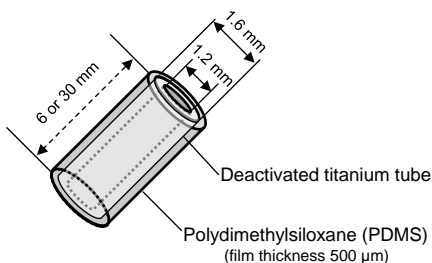


Fig. 1 Structure of Magic Chemisorber®

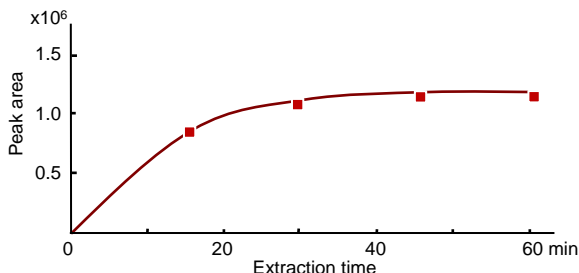


Fig. 3 Peak area vs. extraction time of benfluralin ( $2.5$   $\mu\text{g}/\text{L}$ )

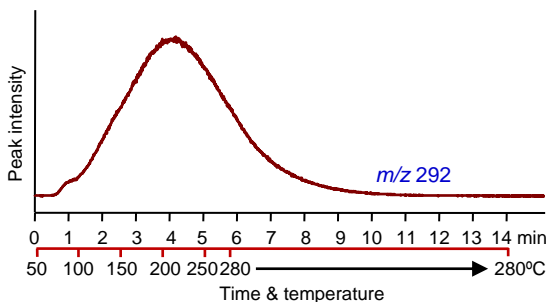


Fig. 2 EGA thermogram of MC after extraction of benfluralin ( $40$  mg/L) for  $60$  min (SIM mode,  $m/z$   $292$ )

EGA tube: Deactivated metal tube ( $L=2.5$  m, i.d.= $0.15$  mm)  
GC oven temperature:  $300$   $^\circ\text{C}$

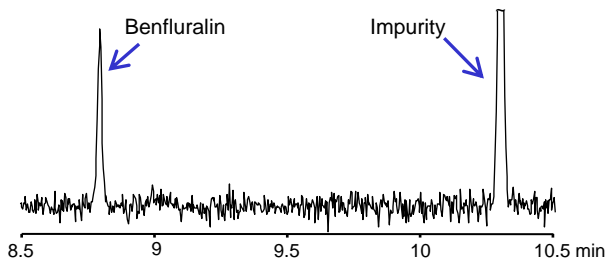


Fig. 4 Mass chromatogram of characteristic ion of benfluralin ( $m/z$   $292$ )

Sample: Benfluralin ( $2.5$  ng/L), extraction time:  $60$  min  
TD temp.:  $60$ - $280^\circ\text{C}$  ( $40$   $^\circ\text{C}/\text{min}$ ,  $8.5$  min hold), GC oven temp.:  $40$ - $280^\circ\text{C}$  ( $20$   $^\circ\text{C}/\text{min}$ ,  $10$  min)  
Column: Ultra ALLOY®-5 (5% diphenyl 95% dimethylpolysiloxane,  $L=30$  m, i.d.= $0.25$  mm, d.f.= $0.25$   $\mu\text{m}$ )  
Column flow rate:  $1$  ml/min He, split ratio:  $1/5$   
Measurement mode: SIM ( $m/z$   $292$ )

Reproduced from L. Wang et al., J. Chromatogr. A 1035 (2004) 277-279

**Keywords :** Magic Chemisorber®, Solid-phase extraction, SPME, thermal desorption, EGA, PDMS, Pesticide, Benfluralin

**Applications :** Quantitative analysis of volatiles and additives in liquid and gaseous media

**Related technical notes :**

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