

# Application

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## Monitor Organophosphorus Pesticides in Air, Using ORBO™-49P Tubes and Capillary GC

A sampling tube containing Supelpak-20 resin and a glass fiber filter effectively adsorbs and releases five organophosphorus pesticides (chlorpyrifos, Diazinon, dichlorvos, malathion, parathion) in vapor or aerosol form in air. At a sampling rate of 1L/min, 8 hour samples can be taken for all of these pesticides except malathion. Short-term (15 min) samples can be taken at the same sampling rate. Analysis on a 0.53mm ID SPB-20 capillary GC column ensures reliable quantification of these analytes. (ChromFax: 394033)

### Key Words:

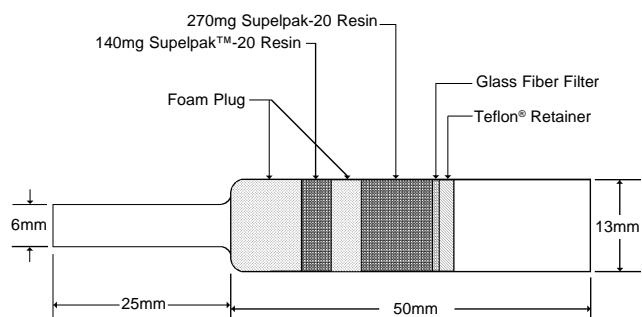
organophosphorus pesticides • airborne pesticides • pesticides  
Diazinon • malathion • parathion

Because earlier methods for monitoring vapors and aerosols of organophosphorus pesticides required a variety of sampling devices, some of which were inconvenient to use, the Occupational Health and Safety Administration (OSHA) has developed one sampling procedure and analysis for monitoring air levels of five of these pesticides (1). A single sampling tube, containing a glass fiber filter and Supelpak™-20 resin (a highly purified grade of Amberlite® XAD®-2 resin), effectively adsorbs and releases both forms of all five compounds: chlorpyrifos, Diazinon®, dichlorvos, malathion, and parathion. In addition to the analytes listed in OSHA Method 62, ORBO-49P adsorbent tubes are effective for sampling carbaryl (Sevin) (OSHA Method 63), chlordane (OSHA Method 67), pyrethrum (OSHA Method 70), or aldicarb (Temik) (OSHA Method 74).

We prepare ORBO-49P adsorbent tubes according to the description of the OSHA versatile sampler (OVS-2) in OSHA Method 62. The tubes contain a glass fiber filter, a 270mg sampling bed and a 140mg backup bed of Supelpak-20 resin, and high purity polyurethane (polyether-type) foam plugs (Figure A). This design allows collection of pesticides in both vapor and aerosol form, without the need for a filter cassette and/or additional adsorbent tube in tandem. The Supelpak-20 resin adsorbs the pesticide vapors. The glass fiber filter traps aerosol forms of the pesticides. The ORBO-49P tube's wide aperture promotes effective trapping of aerosols on the filter, rather than on the walls of the sampling tube.

Adsorbent tubes of this configuration and composition have been evaluated by chemists at OSHA's Organic Methods Evaluation Branch. Tests with aerosols of 0.9mg/m<sup>3</sup> of Diazinon (9 times the threshold limit value) and 38.8mg/m<sup>3</sup> of malathion (2.5 times the OSHA personal exposure limit), sampled at 1.5 times the recommended sample volume, produced less than 5%

Figure A. ORBO™-49P Adsorbent Tube



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Table 1. High Desorption Efficiency for Organophosphorus Pesticides Recovered from Supelpak-20 Resin

Pesticide	Recovery (%)	
	OSHA Data	Supelco Data
Dichlorvos	97.4	94
Diazinon	98.0	100
Chlorpyrifos	98.8	107
Malathion	100.4	100
Parathion	97.5	99

Table 2. Detection Limits for the Overall Procedure (Reliable Quantitation Limits)

Pesticide	µg/sample <sup>■</sup>		
	µg/m <sup>3</sup>	ppb	
Dichlorvos	0.92	1.9	0.21
Diazinon	1.5	3.0	0.24
Chlorpyrifos	1.6	3.3	0.23
Malathion	1.8	30.	2.2
Parathion	1.5	3.1	0.26

<sup>■</sup>Using 2.0mL of solvent to desorb the samples.

breakthrough on the adsorbent (1). OSHA chemists also determined that moisture will not interfere with the adsorbent's ability to effectively retain these pesticides. After air containing 80% relative humidity was pulled through the adsorbent for 8 hours at 1 liter/minute, spiked standards were recovered at virtually 100% of the spiking rate.

The recommended air sampling volume for all pesticides except malathion is 480 liters. For malathion, the volume is 60 liters. At the recommended sampling rate, 1.0 liter/minute, 8 hour samples

## Figure B. Organophosphorus Pesticides by OSHA Method 62

Sample: Calibration Std. — 12µg/mL each pesticide,  
78µg/mL tributyl phosphate (int. std.) in toluene  
Blank — 270mg Supelpak-20, glass fiber filter desorbed in  
toluene + 78µg/mL tributyl phosphate

Sampling Tube: **ORBO-49P**

Cat. No.: **20350**

Column: **SPB-20, 60m x 0.53mm ID, 1.0µm film**

Cat. No.: **25390-U**

Oven: 200°C (2 min) to 250°C at 4°C/min

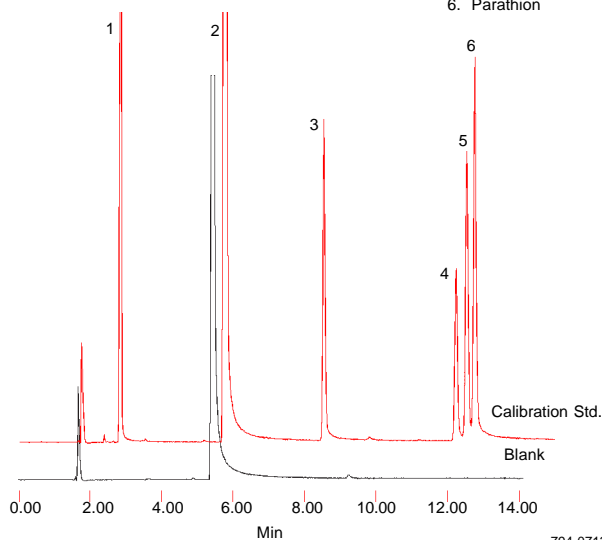
Carrier: helium, 8mL/min

Det.: FPD, 300°C

Inj.: 1µL, direct injection, 220°C

(packed column injector)

1. Dichlorvos
2. Tributyl phosphate (IS)
3. Diazinon
4. Malathion
5. Chlorpyrifos
6. Parathion



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can be taken for all pesticides except malathion. If necessary, short term (15 minute) samples can be taken at the same sampling rate. The glass fiber filter and front adsorbent bed are desorbed in 2.0mL of desorbing solution (78µg/mL tributyl phosphate, an internal standard, in toluene). The backbed and central polyurethane foam plug are analyzed separately. OSHA and Supelco chemists found that all five pesticides were efficiently desorbed from the adsorbent, as shown in Table 1.

According to Method 62, desorbed samples are analyzed by capillary gas chromatography, using flame photometric detection. OSHA chemists determined the detection limits for the overall procedure (which also are the reliable quantitation limits). These are listed in Table 2. The concentration of the pesticides in the calibration standard shown in Figure B, 12µg/mL, corresponds to the lowest action level for the five pesticides: 0.05mg/m<sup>3</sup>, using the recommended 480 liter sample volume. The analysis is completed in 13 minutes on an SPB™-20 capillary column. Background in the ORBO-49P tube is acceptable at 1/10 the lowest action level, for the recommended sample volume.



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If you are required to monitor one or more of these pesticides in air, ORBO-49P tubes will probably be more convenient than the sampling equipment you are now using. When used in combination with analyses on an SPB-20 capillary column, these tubes can also help you obtain highly accurate results.

### Ordering Information:

**ORBO-49P Adsorbent Tubes, pk. of 10** **20350**

**SPB-20 Fused Silica Capillary Column**  
60m x 0.53mm ID, 1.0µm film **25390-U**

### Reference

1. *OSHA Analytical Methods Manual*, Method 62, Organic Methods Evaluation Branch, OSHA Analytical Laboratory, Salt Lake City, Utah, USA (Oct. 1986).

### Trademarks

Amberlite — Rohm and Haas Company  
Diazinon — Ciba-Geigy AG  
ORBO — Supelco, Inc.  
SPB — Supelco, Inc.  
Supelpak — Supelco, Inc.  
XAD — Rohm and Haas Company

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