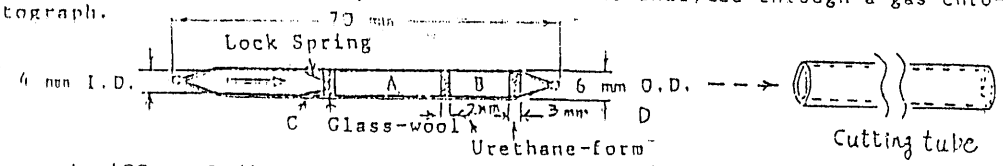
INSTRUCTION MANUAL ON CHARCOAL TUBE

No.800B

1. PREFACE:

Charcoal tube is used to analyze organic solvent vapours except polar solvent vapours in the atmosphere. Organic solvent vapour is adsorbed and collected on charcoal section in passing through the tube. The desorption of the organic solvent vapour is made by the solvent and is analyzed through a gas chromatograph.



A: 100 mg 20/40 mesh coconut shell charcoal(1st section)
B: 50 mg 20/40 mesh coconut shell charcoal(2nd section)

Fig.1 Charcoal Tube

2. SAMPLING:

(1) In case of Model AP-1 Aspirating pump

1) Cut both ends of a new charcoal tube with the tube-tip cutter attached as standard accessory.
2) Connect the tube end "D" to the AP-1.
3) Align the guide marks (red dots) on shaft and stopper of the AP-1. Pull the handle at a full stroke and wait for 15 seconds.

(2) In case of continuous drawing pump

1) Cut both ends of a new charcoal tube with the tube-tip cutter attached as standard accessory.
2) Connect the tube end "D" to a continuous drawing pump which has stable sampling flow rate (0.1 to 1.0 L/min.)
3) The sampling volume is obtained by the following equation;

Sampling Volume (L) = Flow Rate (L/min.) x Time (min.)

(An example of Sampling Equipment)

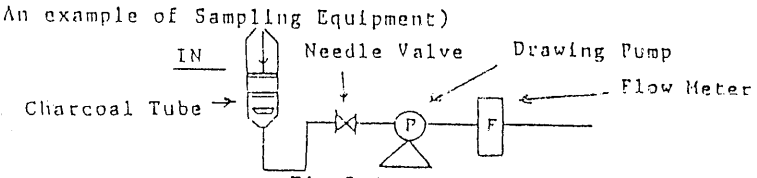


Fig.2 Sampling Equipment

3. SAMPLING AMOUNT:

The sampling amount is to be determined 0.5 - 5.0 L in accordance with the sensitivity of gas chromatograph and the concentration of the sample. When it is over 5.0 L, pay attention to saturation of the charcoal section in the tube.

(Note)

1) In case of sampling 1 ppm Toluene, 1 L of the sample volume is enough.
2) After sampling, put caps of standard accesory on both tube ends of the charcoal tube and preserve it in a cool, dark place.

4. ANALYSIS:

4-1. Working Curve

1) Dissolve the standard sample (which means known concentration sample) into desorption solvent. This is standard solution.

(An example; Making standard solution)

Dissolve 1 mL of Toluene (specific gravity= 0.867) into Carbon disulphide (CS_2). The total amount of solvent is 100 mL. The concentration of this standard solution is as follows:

$$8670\ (\mu g/mL) = 0.867\ (g) \ /\ 100\ (mL)$$

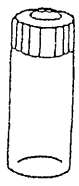
2) Dilute the standard solution step by step and make the working curve by means of injecting the diluted standard solution at each step into gas chromatograph.

4-2. Recovery and Analysis

1) Cut the charcoal tube at the point "C" with inserting the cutting tube, as shown in Fig. 1. Take off the Lock spring and Glass-wool plugged on the 1st section's charcoal. Remove the 1st section's charcoal and put into a sample vial completely.
2) Take off the Urethane-form plugged on the 2nd section's charcoal. Remove the 2nd section's charcoal and put into another sample vial completely.
3) Pour 2 - 3 mL of desorption solvent such as CS_2 into above both sample vials, put on the lid, shake them for 1 minute and leave them for approx. 30 minutes. While the leaving time, shake them several times.
4) After the leaving, inject the extracted solvent 1 - 5 uL into a gas chromatograph and determine the concentration of the sample by using the following equation with the working curve and other figures:

$$W.R. = R \times (VIs\ /\ VId) \times Vt \times (D.E.\ /\ 100)$$

W.R.: Weight recovered
R : Reading from the working curve (ug/mL)
VIs : Injection volume of standard solution (uL)
VId : Injection volume of desorption solvent (uL)
Vt : Total volume of desorption solvent (uL)
D.E.: Desorption efficiency (%)



3.5 mL
Sampling Vial

D.E. = (Average weight recovered) / (Weight added)

Total weight recovered = (1st section's weight recovered) + (2nd section's weight recovered)

Corrected mg/sample = (Total weights) / D.E.

$$\text{Sample gas concentration (mg/cu m)} = \frac{\text{Corrected mg/sample} \times 1000\ (L/cu\ m)}{\text{Air volume sampled (L)}}$$

$$\text{Sample gas concentration (ppm)} = \frac{\text{Corrected mg/sample}}{\text{(cu m)}} \times \frac{22.4}{M.W.} \times \frac{760}{P} \times \frac{T+273}{273}$$

P : Pressure (mmHg) of air sampled
T : Temperature (°C) of air sampled
22.4: Molar volume (1 L/mole) at 0 (°C) and 760 (mmHg)
M.W.: Molecular weight (g/mole) of analyte
760 : Standard pressure (mmHg)
273 : Standard temperature (°K)

(Note)

1) The desorption efficiency is different with each other by kinds of sampled organic solvent and desorpion solvent. Various desorption efficiency of organic solvent are shown below for reference. The desorption efficience differ by used equipment and analytical operation. It should be obtained by each analyst. Furthermore, the desorption efficiency is determined by means of comparison with direct collection method or weight recovered of charcoal which is adsorbed a certain volume of the standard solution.
2) The 2nd section's charcoal is for checking a state of desorption in the 1st section's charcoal. When the weight recovered of the 2nd section's charcoal is over half of the 1st section's one, the desorption amount of the charcoal tube exceeds the limit. The sampling amount should be decreased not to detect the sample in the 2nd section. In general, when 5 L of the sample amount is collected, it is rare to detect the sample in the 2nd section except a low grade alcohol.

Table 1 Desorption Efficiency

Substances	Desorption Efficiency (%)	Desorption Solvent
Toluene	102.0	CS_2
Trichloroethylene	99.6	"
Acetone	68.6	"
Iso-propanol	77.1	1% 2-Butanol/CS_2
Butyl cellosolve	97.6	5% Methanol/ Dichloromethane

5. PERSONAL SAMPLER MODEL PM-1:

5-1. General

Model PM-1 is an air sampler which can do long duration sampling by means of detecting the working environment, and the volume of the desorption is shown by counter indication. This PM-1 is available to detect the personal exposure concentration of some organic solvent by carrying this one attached holder with a worker as a sampler for charcoal tube.

5-2. Specifications

Sampling	:	Diaphragm method
Flow rate	:	50 - 200 mL/min. (with loading of charcoal tube)
Flow rate adjustment	:	By variable resister and digital flow rate counter
Max. flow rate	:	250 mL/min. (non-loading) 200 mL/min. (with loading of charcoal tube)
Max. vacuum pressure	:	100 mmHg
Max. out-pressure	:	100 mmHg
Power supply	:	Rechargable battery
Continuous operation	:	Approx. 8 hrs. after 14 hrs. charging
Temperature	:	0 - 40 °C
Outside dimension	:	56 (W) x 118 (H) x 27 (D) mm
Weight	:	Approx. 360 (g)