

Analyses procedure for BTEX passive samplers

1. Solvent for extraction

- 1.1. Benzene-free CS₂ should be used for the extraction. Commercial CS₂ always contains benzene at different level, which is hundreds time more than the amount of benzene collected in samples by active or passive sampling. Thus benzene should be removed and checked to ensure that no benzene remained before making standards and extracting.
- 1.2. Solvent for the extraction should contain internal standards. The common internal standards for BTEX analyses are fluorobenzene and benzene C14.

2. Standards and calibration curve

- 2.1. Working standards containing internal standards are made from stock standard purchased from Sigma-Aldrich. BTEX levels in ambient air are low, so concentration in the range of 0.050 – 1.00 mg/l (µg/ml) is enough. For the sample collected in working environment, higher concentration of standards might be required.
- 2.2. Calibration curves of $C_i/C_{int} = f(S_i/S_{int})$, where i refers to a pollutant of interest, int refers to internal standards, C is concentration in the extract and S is a pick area of the pollutant, should have correlation coefficient not lower than 0.999.

3. Sample preparation

1. Add 1 ml of benzene-free CS₂ containing internal standards into the vial with sample.



2. Wait 1h. Shake slightly occasionally.



3. Analyses by GC/FID or GC/MS.



2. Quantification

Inject 1 standard after each 10 samples to check repeatability. Adjust calibration curves when needed.
Concentration of a pollutant in the extract is evaluated from the calibration curves.

3. Evaluation of pollutant concentration in ambient air

The amount of air pollutant m_a collected is estimated as given in the expression (1)

$$m_a (\mu\text{g}) = V_{\text{extract}} (\text{ml}) \times C_{\text{extract}} (\mu\text{g} / \text{ml}) \quad (1)$$

Where V_{extract} is the extraction volume and C_{extrac} is concentration of a pollutant in the extract.

Concentration of a pollutant in the ambient air C_o is evaluated by using the following expression

$$C_o (\mu\text{g} / \text{m}^3) = \frac{m_a}{v_a t} \times 10^6 \quad (2)$$

Where v_a is a sampling rate (ml/min), t is duration of sampling (min).

The following table reports sampling rate at 30°C.

	Tốc độ lấy mẫu (ml/phút)	F (ppb→ $\mu\text{g}/\text{m}^3$)	
		25°C	30°C
Benzene	17,7	3.19	3.14
Toluene	16,2	3.76	3.70
Ethylbenzene	15,3	4.34	4.27
p,m-Xylenes	15,1	4.34	4.27
o-Xylenes	14,4	4.34	4.27

$$C (\mu\text{g}/\text{m}^3) = C (\text{ppb}) \times F$$

Sampling rate is temperature-dependent and is adjusted by the following expression

$$V_{T_2} = V_{30^\circ\text{C}} \left(\frac{T_2 + 273}{303} \right)^{1.5} \quad (3)$$

Example 1: sampling duration was 27 hours, average temperature during sampling was 30°C. Benzene concentration in the extract is 0,361 µg/ml. The amount of benzene collected is

$$m_a = 0,361 \mu\text{g/ml} \times 1 \text{ ml} = 0,361 \mu\text{g}$$

Benzene concentration in the ambient air would be

$$C_o = \frac{0,361}{17,7 \times 60 \times 24} \times 10^6 = 14,2 \mu\text{g} / \text{m}^3 = 14 \mu\text{g} / \text{m}^3$$

Example 1: the duration of exposure was 24 hours and the amount of benzene collected was 0,361 µg/ml as in the example 1, but temperature during exposure was 15°C. Sampling rate would be

$$V_{T_2} = 17,7 \text{ ml} / \text{min} \times \left(\frac{15 + 273}{303} \right)^{1.5} = 16,4 \text{ ml} / \text{min}$$

Benzene concentration in the ambient air would be

$$C_o = \frac{0,361}{16,4 \times 60 \times 24} \times 10^6 = 15,3 \mu\text{g} / \text{m}^3 = 15 \mu\text{g} / \text{m}^3$$