

Calculation For The Concentration In Ambient Air

Conversion Equation:

$$\text{NO concentration (ppb)} = \alpha_{\text{NO}} \times (W_{\text{NOx}} - W_{\text{NO}_2}) / t$$

$$\text{NO}_2 \text{ concentration (ppb)} = \alpha_{\text{NO}_2} \times W_{\text{NO}_2} / t$$

$$\text{SO}_2 \text{ concentration (ppb)} = \alpha_{\text{SO}_2} \times W_{\text{SO}_2} / t$$

$$\text{NH}_3 \text{ concentration (ppb)} = \alpha_{\text{NH}_3} \times W_{\text{NH}_3} / t$$

$$\text{O}_3 \text{ concentration (ppb)} = \alpha_{\text{O}_3} \times W_{\text{O}_3} / t$$

Where:

$W_{\text{NOx}}, W_{\text{NO}_2}$: NO_2 quantity (ng) collected in NOx and NO_2 collection elements

W_{SO_2} : SO_2 quantity (ng) collected in SO_2 collection element

W_{NH_3} : NH_3 quantity (ng) collected in NH_3 collection element

W_{O_3} : O_3 quantity (ng) converted from NO_3 quantity collected in O_3 element

$\alpha_{\text{NO}}, \alpha_{\text{NO}_2}, \alpha_{\text{SO}_2}, \alpha_{\text{NH}_3}, \alpha_{\text{O}_3}$: ppb concentration conversion coefficient
(ppb·min / ng) normally at 20°C, R.H. 70% to be based.

$$\alpha_{\text{NO}} = 60, \alpha_{\text{NO}_2} = 56, \alpha_{\text{SO}_2} = 39.4, \alpha_{\text{NH}_3} = 43.8, \alpha_{\text{O}_3} = 46.2$$

These values were obtained by a theoretical calculation and an experimental basis using a glass chamber. These values are also changeable depending on temperature, humidity and exposure time.

t : exposure time (min)

Calculation Of Concentration Conversion Coefficients For NO And NO₂

In order to enhance the accuracy of Ogawa sampler measurement method

α_{NO} and α_{NO_2} can be calculated for a combination of temperature and relative humidity using the following formulas:

$$\alpha_{NO} = \frac{10000}{(-0.78 \times [P] \times [RH]) + 220}$$

$$\alpha_{NO_2} = \frac{10000}{(0.677 \times [P] \times [RH]) + (2.009 \times [T]) + 89.8}$$

[T] : Ambient temperature in degree Centigrade

[RH] : Relative humidity %

$$[P] = \left\{ \frac{2P_N}{P_T + P_N} \right\}^{2/3}$$

P_N : 17.535 (water vapor pressure in mm Hg at 20 degC

P_T : Vapor pressure of water at the ambient temperature [T]

Calculation Of Concentration Conversion Coefficients For SO₂, NH₃ And O₃

$$\alpha_{\text{SO}_2} = 39.4 \times (293 / (273 + T))^{1.83}$$

[T] : Ambient temperature in degree Centigrade

$$\alpha_{\text{NH}_3} = 43.8 \times (293 / (273 + T))^{1.83}$$

[T] : Ambient temperature in degree Centigrade

$$\alpha_{\text{O}_3} = 46.2 \times 10^2 \times (293 / (273 + T))^{1.83} / (9.94 \times \ln(t) - 6.53)$$

[T] : Ambient temperature in degree Centigrade

t : Exposure time (min)