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APPEDIX

Caculation of hydrocarbon concentration

1 ml of exhaust emission sample was injected and

1μl of 200 ppm benzene or toluene standard solution were used

From Weight = Volume x Density

Benzene 200 ppm $= \frac{200 \times 10^{-3} \times 0.8787}{10^6} = 1.757 \times 10^{-7}$ g

Toluene 200 ppm $= \frac{200 \times 10^{-3} \times 0.866}{10^6} = 1.732 \times 10^{-7}$ g

Assumption

Area of Benzene in Benzene standard solution = X

Area of Benzene in exhaust emission sample = X_1

Area of Toluene in Toluene standard solution = Y

Area of Toluene in exhaust emission sample = Y_1

Thus

Benzene in exhaust emission sample $= \frac{X_1 (1.757 \times 10^{-7} g)}{X}$

Toluene in exhaust emission sample $= \frac{Y_1 (1.732 \times 10^{-7} g)}{Y}$

From the Gas Law, 1 g-mole of vapor or gas contains 24.45 l at 20°C and 760 mmHg.

Thus

Benzene $= \frac{X_1 (1.757 \times 10^{-7}) (24.45 \times 10^6)}{X (78.11)} = \frac{0.05500 X_1}{X}$ μl

$$\text{Toluene} = \frac{Y_1\,(1.732 \times 10^{-7})\,(24.45 \times 10^{6})}{Y\,(92.13)} = \frac{0.0460 Y_1}{Y}\ \mu l$$

1 ml of injected exhaust emission sample thus

$$\text{Benzene} = \frac{55X_1}{X}\ \text{ppm}$$

$$\text{Toluene} = \frac{46Y_1}{Y}\ \text{ppm}$$

$$\text{From Responce (R)} = \frac{\text{weight of 1 molecule Carbon}}{\text{molecular weight}}$$

Example

$$\text{Butane concentration} = \frac{\text{Area of Butane x Benzene concentration x } R_b}{\text{Area of benzene in exhaust sample x } R_{be}}$$

R_b = responce of butane

R_{be} = reponce of benzene

Assumption

Area of Benzene in Benzene standard solution = 50000

Area of Benzene in exhaust emission sample = 5000

Area of Butane in exhaust emission sample = 2000

Thus

$$\text{Bezene concentration} = \frac{55 \times 5000}{50000} = 5.5\ \text{ppm}$$

$$\text{Butane concentration} = \frac{2000 \times 5.5 \times 48/58}{3000 \times 72/78} = 3.3\ \text{ppm}$$

VITA

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