

Emissions

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Emissions indices

Emission index for species i is the ratio of the mass of species i to the mass of the fuel burned

$$EI_i = \frac{m_{i, \text{emitted}}}{m_{f, \text{burned}}}$$

for a hydrocarbon in air:

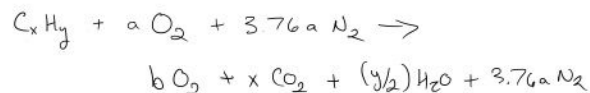
$$EI_i = \left(\frac{X_i}{X_{CO} + X_{CO_2}} \right) \left(\frac{x \text{ MW}_i}{\text{MW}_f} \right)$$

Corrected concentrations

wet basis: w/ H₂O

dry basis: w/o H₂O

assuming $\phi = 1$ or less:



+ trace species

$$X_{i, \text{dry}} = \frac{N_i}{N_{\text{mix, dry}}} = \frac{N_i}{x + b + 3.76 a}$$

$$X_{i, \text{wet}} = \frac{N_i}{N_{\text{mix, wet}}} = \frac{N_i}{x + b + y/2 + 3.76 a}$$

$$\frac{N_{\text{mix, wet}}}{N_{\text{mix, dry}}} = 1 + \frac{y}{2(4.76 a - y/4)}$$

$$a = \frac{x + (1 + X_{O_2, \text{wet}}) y/4}{1 - 4.76 X_{O_2, \text{wet}}}$$

or

$$a = \frac{x + (1 - X_{O_2, \text{dry}}) y/4}{1 - 4.76 X_{O_2, \text{dry}}}$$

$$X_{i, \text{dry}} = X_{i, \text{wet}} \frac{N_{\text{mix, wet}}}{N_{\text{mix, dry}}}$$

$$X_i \left(\begin{array}{l} \text{corrected to} \\ O_2\text{-level 2} \end{array} \right) = X_i \left(\begin{array}{l} \text{raw or corrected} \\ \text{to } O_2\text{-level 1} \end{array} \right) \frac{N_{\text{mix } O_2, \text{ level 1}}}{N_{\text{mix } O_2, \text{ level 2}}}$$

$$N_{\text{mix, wet}} = 4.76 \left[\frac{x + (1 + X_{O_2, \text{wet}}) y/4}{1 - 4.76 X_{O_2, \text{wet}}} \right] + \frac{y}{4}$$

or

$$N_{\text{mix, dry}} = 4.76 \left[\frac{x + (1 - X_{O_2, \text{dry}}) y/4}{1 - 4.76 X_{O_2, \text{dry}}} \right] - \frac{y}{4}$$

Specific Emissions Measurements

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$$\text{Mass Specific emission (MSE)} = \frac{\text{Mass flow of pollutant}}{\text{Brake power produced}}$$

$$\text{MSE} = \frac{\dot{m}_F E_{Ii}}{\dot{w}} \quad \dot{w} = \text{power delivered}$$

$$\downarrow \quad \frac{\text{Mass of pollutant } i}{\text{Fuel energy supplied}} = \frac{E_{Ii}}{\Delta h_c} \quad [\text{g/MJ}]$$