

Chemical oxygen demand

Oxygen required to convert organic compounds to CO₂

ex) COD for a bacterial cell:



MW for C₅H₇O₂N = 113 g/mole

(5 mol x 32 g COD/mole) / (113 g cells/mole) = 1.42 g COD/g cells (shown in Table 2.1)

Equation for true yield:

$$Y = f_s^0 \frac{(M_c \text{ g cells/mole cells})}{(n_e \text{ e}^- \text{ eq/mole cells})(8 \text{ g COD/e}^- \text{ eq donor})}$$

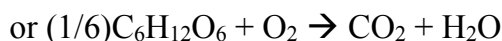
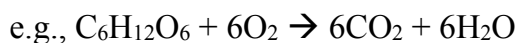
Generally concentration of substrates are expressed as COD because of complex nature of wastewater

$$f_s^0 = (\text{e-eq cells}) / (\text{e- eq donor})$$

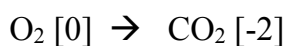
$$Y = \frac{(\text{e}^- \text{ eq cells})}{(\text{e}^- \text{ eq donor})} \frac{(M_c \text{ g cells/mole cells})}{(n_e \text{ e}^- \text{ eq/mole cells})(8 \text{ g COD/e}^- \text{ eq donor})} = \frac{\text{g cells}}{\text{g COD}}$$

- Why 8 g COD/e⁻ eq donor?

For a COD reaction



e⁻ donated by C₆H₁₂O₆ = e⁻ accepted to O₂



32 g COD/4 e⁻ eq donor (=acceptor) = 8 g COD/e⁻ eq donor

- Other parameters for the equation

$M_c = \text{C}_5\text{H}_7\text{O}_2\text{N} \rightarrow 113 \text{ g/mole}$

$n_e \rightarrow \text{C}_5\text{H}_7\text{O}_2\text{N}$, see p. 137 O-20: $n_e = 20$

Then, plug in the numbers for the case of $\text{C}_5\text{H}_7\text{O}_2\text{N}$ with NH_4 as nitrogen source
(ammonia acid dissociation constant (pK_a) = 9.25 \rightarrow mostly in NH^+ under normal pH
conditions)

$\rightarrow Y = 0.706 f_s^0$