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1) BOD_5/COD

Assume UBOD=COD as the compound can be completely mineralized biologically

$$\frac{BOD_5}{COD} = \frac{BOD_5}{UBOD} = 1 - \exp(-k_1 t) = 1 - \exp(-0.23/d \times 5d)$$

$$\frac{BOD_5}{COD} = 0.68$$

2) COD/TOC

The reaction to completely mineralize the organic compound can be written as

$$C_5H_7O_2N + 5O_2 \rightarrow 5CO_2 + NH_3 + 2H_2O$$

Molecular weight: 113

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COD per g compound is calculated as:

$$\frac{5 \times 32\ g\ O_2}{113\ g\ C_5H_7O_2N} = 1.42\ g\ COD/g\ C_5H_7O_2N$$

This value will be utilized later in this class for modeling biological wastewater treatment!

TOC per g compound is calculated as:

$$\frac{5 \times 12\ g\ C}{113\ g\ C_5H_7O_2N} = 0.53\ g\ TOC/g\ C_5H_7O_2N$$

$$\frac{COD}{TOC} = \frac{1.42}{0.53} = 2.68$$

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cf) CH_4 (methane) COD/TOC value

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

COD per g CH_4:

$$\frac{2 \times 32\ g\ O_2}{16\ g\ CH_4} = 4.0\ g\ COD/g\ CH_4$$

TOC per g CH_4:

$$\frac{1 \times 12\ g\ C}{16\ g\ CH_4} = 0.75\ g\ TOC/g\ CH_4$$

$$\frac{COD}{TOC} = \frac{4.0}{0.75} = 5.33$$

COD/TOC ratio is much higher for CH_4 than for $C_5H_7O_2N$.
Can you find the reason why?