

# Wastewater treatment: Heavy metals removal

## Exercise:

Wastewater from an industry containing 64 mg/L of  $\text{Fe}^{3+}$  should be treated prior to discharge into the municipal sewer. Fe removal is required. Hydroxide precipitation with lime addition will be used. Determine:

- (1) The daily amount of a commercial lime ( $\text{CaO}$ , 90% purity) required if 1140  $\text{m}^3/\text{d}$  of wastewater should be treated.
- (2) The yearly cost of the commercial lime, considering a price of 110 €/ton

*Solution:*

- (1) 122 kg/day
- (2) 4902 €/year

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## (1) Daily amount of commercial lime required for wastewater treatment:

Daily amount of iron to be removed:

$$\text{Fe} = 1140 \text{ m}^3/\text{d} \cdot 1000 \text{ L/m}^3 \cdot 64 \text{ mgFe/L} / 1000 \text{ mg/g} = 72960 \text{ gFe/d}$$

$$\text{Calcium hydroxide dose} = 1.99 \text{ gCa(OH)}_2/\text{gFe}$$

Daily amount of calcium hydroxide:

$$\text{Ca(OH)}_2 = 72960 \text{ gFe/d} \cdot 1.99 \text{ gCa(OH)}_2/\text{gFe} = 145190 \text{ gCa(OH)}_2/\text{d}$$

Daily amount of lime:

$$\text{CaO} = 145190 \text{ gCa(OH)}_2/\text{d} \cdot 56 \text{ gCaO/gCa(OH)}_2 = 109874 \text{ gCaO/d}$$

Daily amount of commercial lime:

$$\text{CaO (commercial)} = 109874 \text{ gCaO/d} / 0.9 = 122082 \text{ g/d} = 122.1 \text{ kg/d of commercial CaO}$$

## (2) Annual cost:

$$\text{Cost} = 122.1 \text{ kg/d} \cdot 365 \text{ d/year} \cdot 110 \text{ €/ton} / 10^3 \text{ kg/ton} = 4902 \text{ €/year}$$