Effluent Neutralisation: Acid or Alkali Dose

Dose and daily use of caustic, lime, soda ash, sulphuric or hydrochloric acid to neutralise an effluent, from its titrated acidity or alkalinity as $CaCO_3$.

Method: Equivalent-weight stoichiometry (acidity as $CaCO_3$)

Input parameters

Unit system: SI

Parameter	Value	Unit
Effluent flow	20.000	m³/h
Neutralising chemical	Caustic soda NaOH (for acidic effluent)	
Strength of the chemical as supplied For example 48 % caustic lye, 98 % sulphuric acid, 33 % hydrochloric acid, 90 % hydrated lime.	48.000	%
Acidity or alkalinity to remove, as $CaCO_3$ (from a titration to the target pH)	500.00	mg/L
Effluent pH, for a strong-acid or strong-base check (0 = none, so a pH of exactly 0 cannot be checked)	0	

Calculated results

Parameter	Value	Unit
Dose of the chemical as supplied	832.55	mg/L
Chemical as supplied	16.651	kg/h
Chemical per day	399.63	kg

Notes for this case

- Real effluents are buffered: dose from a titration of the actual effluent; the pH-only figure is a lower bound for strong acids or bases.

Formula and method

$$D = A_c \frac{E_r}{E_{CaCO_3}} \cdot \frac{1}{s}$$

$$\dot{m}_r = D\,Q, \quad m_d = \dot{m}_r \cdot 86\,400 \text{ s}$$

$$A_{pH} = 10^{-pH} \text{ (or } K_w/10^{-pH}) \text{ eq/L} \times E_{CaCO_3}$$

Variables

Q	effluent flow	m³/s
$\mathrm{reagent}$	neutralising chemical	-
S	strength as supplied	-
A_c	acidity or alkalinity as $CaCO_3$	kg/m³
pH	Effluent pH, for a strong-acid or strong-base check (0 = none, so a pH of exactly 0 cannot be checked)	-
E_r	equivalent mass of the reagent	kg/kmol
E_{CaCO_3}	equivalent mass of $CaCO_3$ (50.04)	kg/kmol
K_w	ionic product of water at 25 °C	(mol/L)²
D	dose as supplied	kg/m³
$\dot{m}_r$	chemical rate	kg/s

m_d	chemical per day	kg
A_{pH}	acidity from pH alone	kg/m³

Method and standards

Acidity measured as $CaCO_3$ converts to any reagent by the ratio of equivalent masses (NaOH 40.0, $Ca(OH)_2$ 37.0, Na_2CO_3 53.0, H_2SO_4 49.0, HCl 36.5, $CaCO_3$ 50.0), then to product by its strength. The pH-only figure applies to unbuffered strong acids or bases.

Assumptions and limits

- Dose from titration to the target pH; reaction complete.

References

- Equivalent-weight stoichiometry (acidity as $CaCO_3$)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/wastewater/effluent-neutralisation-dose

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.