Packed-Tower Air Stripping: Air-to-Water Ratio, NTU, HTU and Height

Minimum and design air-to-water ratio, stripping factor, transfer units and packed height of a countercurrent air stripping tower for a volatile compound.

Input parameters

Unit system: SI

Parameter	Value	Unit
Water flow	0.10000	m³/s
Dimensionless Henry's constant at the water temperature	0.36400	
Influent concentration	35.000	µg/L
Treatment objective	5.0000	µg/L
Multiple of the minimum air-to-water ratio (about 3.5)	3.5000	
Overall mass transfer coefficient (with safety factor)	0.007700	1/s
Tower diameter	3.0480	m

Calculated results

Parameter	Value	Unit
Minimum air-to-water ratio	2.3548	
Design air-to-water ratio	8.2418	
Air flow	0.82418	m³/s
Stripping factor	3.0000	
Tower cross-section	7.2966	m²
Height of a transfer unit	1.7799	m
Number of transfer units	2.4142	
Packed height	4.2969	m

Notes for this case

- Design on the compound with the lowest Henry's constant and at the coldest water. K_La comes from the Onda correlation or pilot data, usually with a 0.7–0.75 safety factor; the tower diameter is set by the allowable gas pressure drop.

Formula and method

$$\left(\frac{Q_a}{Q}\right)_{min} = \frac{C_0 - C_e}{HC_0}, \quad S = \frac{Q_a}{Q}H$$

$$NTU = \frac{S}{S-1}\ln\frac{1+\frac{C_0}{C_e}(S-1)}{S}, \quad HTU = \frac{Q}{AK_La}, \quad L = HTU \cdot NTU$$

Variables

Q	Water flow	m³/s
H	Dimensionless Henry's constant at the water temperature	-
C_0	Influent concentration	kg/m³
C_e	Treatment objective	kg/m³
f	Multiple of the minimum air-to-water ratio (about 3.5)	-

$K_L a$	Overall mass transfer coefficient (with safety factor)	1/s
D_t	Tower diameter	m
$(Q_a/Q)_{min}$	Minimum air-to-water ratio	-
Q_a/Q	Design air-to-water ratio	-
Q_a	Air flow	m³/s
S	Stripping factor	-
A	Tower cross-section	m²
HTU	Height of a transfer unit	m
NTU	Number of transfer units	-
L	Packed height	m

Method and standards

Countercurrent packed-tower design with constant Henry's law equilibrium.

Assumptions and limits

- Dilute solutions, clean air inlet, plug flow of both phases.

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/drinking-water/packed-tower-air-stripping

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.