Biofilter: Empty-Bed Contact Time, Loading and Elimination Capacity

Empty-bed contact time, bed area, surface and mass loading, elimination capacity and removal efficiency of a biofilter for odour or VOC control.

Method: Cooper and Alley; Air Pollution Control: A Design Approach; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas flow	20,000	m³/h
Bed volume	300.00	m³
Bed depth	1.2000	m
Inlet concentration	200.00	mg/m³
Outlet concentration	20.000	mg/m³

Calculated results

Parameter	Value	Unit
Empty-bed contact time	54.000	s
Bed area	250.00	m²
Surface loading	80.000	m/h
Mass loading	0.013333	kg/(m³·h)
Elimination capacity	0.012000	kg/(m³·h)
Removal efficiency	90.000	%

Notes for this case

- Typical design: EBCT 15–60 s for odour, 30–120 s for VOCs; bed 1–1.5 m; keep the medium at 40–60 % moisture and the inlet humidified.

Formula and method

$$EBCT = \frac{V}{Q}, \quad L_m = \frac{QC_{in}}{V}, \quad EC = \frac{Q(C_{in} - C_{out})}{V}, \quad \eta = 1 - \frac{C_{out}}{C_{in}}$$

Variables

Q	Gas flow	m³/s
V	Bed volume	m³
H	Bed depth	m
C_{in}	Inlet concentration	kg/m³
C_{out}	Outlet concentration	kg/m³
$EBCT$	Empty-bed contact time	s
A	Bed area	m²
q_s	Surface loading	m/s
L_m	Mass loading	kg/(m³·s)
EC	Elimination capacity	kg/(m³·s)
η	Removal efficiency	-

Method and standards

Biofilter definitions.

Assumptions and limits

- Steady loading.
- Loadings are shown in kg/(m³·h) (1 kg/(m³·h) = 1 000 g/(m³·h)); FPS in lb per 1 000 ft³ per day.

References

• Cooper and Alley
• Air Pollution Control: A Design Approach
• 4th ed. (Waveland, 2011)
• ch. 15 (biofiltration: EBCT, loading and elimination capacity)

Report details

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Release checks	2 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/air-pollution/biofilter-ebct

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.