Oxygen Transfer Coefficient kLa by the Van 't Riet Correlation

Volumetric oxygen transfer coefficient of a stirred aerated vessel from power per volume and gas velocity (Van 't Riet), and the oxygen transfer rate.

Method: Van 't Riet kLa correlations

Input parameters

Unit system: SI

Parameter	Value	Unit
Gassed power per volume	1.5000	kW/m³
Superficial gas velocity	10.000	mm/s
Medium	Coalescing (pure water-like)	
Saturation dissolved oxygen	7.0000	mg/L
Dissolved oxygen in the liquid	2.0000	mg/L

Calculated results

Parameter	Value	Unit
Volumetric mass transfer coefficient	174.47	1/h
Oxygen transfer rate	0.87233	g/(L·h)

Notes for this case

• Van 't Riet (SI units: P/V in W/m³, v_s in m/s, k_La in 1/s): coalescing k_La = 0.026(P/V)^0.4v_s^0.5; non-coalescing 0.002(P/V)^0.7v_s^0.2. Fits within about ±20–40 % for vessels up to several m³ with water-like viscosity; viscous or mycelial broths transfer much less. OTR = k_La(C* − C_L).

Formula and method

$$k_L a = 0.026 \left(\frac{P}{V}\right)^{0.4} v_s^{0.5} \ (\text{coalescing}), \quad k_L a = 0.002 \left(\frac{P}{V}\right)^{0.7} v_s^{0.2} \ (\text{non} - \text{coalescing})$$

Variables

P/V	Gassed power per volume	W/m³
v_s	Superficial gas velocity	m/s
medium	Medium	-
C^*	Saturation dissolved oxygen	kg/m³
C_L	Dissolved oxygen in the liquid	kg/m³
$k_L a$	Volumetric mass transfer coefficient	1/s
OTR	Oxygen transfer rate	kg/(m³·s)

Method and standards

kLa estimate.

Assumptions and limits

- Water-like viscosity; SI units in the correlation.

References

Van 't Riet kLa correlations

Report details

Report reference	FCC-7QB2-3GET (the same inputs always give the same reference)
Generated	23 November 2026, 17:51 UTC
Calculator	Oxygen Transfer Coefficient kLa by the Van 't Riet Correlation
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/chemical/bioprocess/kla-vant-riet-correlation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.