Height of a Transfer Unit from Film Coefficients

Gas- and liquid-film heights of a transfer unit from fluxes and volumetric coefficients, the overall HTU, and packed height for a number of transfer units.

Method: Perry's Chemical Engineers' Handbook; 9th ed. (McGraw-Hill, 2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas molar flux, kmol/(m²·s) kmol/(m²·s); use the same kmol basis as the coefficients.	0.030000	
Liquid molar flux, kmol/(m²·s) kmol/(m²·s); use the same kmol basis as the coefficients.	0.15000	
Gas-film coefficient, kmol/(m³·s) kmol/(m³·s)	0.060000	
Liquid-film coefficient, kmol/(m³·s) kmol/(m³·s)	0.80000	
Equilibrium slope (y = mx)	1.5000	
Overall gas transfer units	6.0000	

Calculated results

Parameter	Value	Unit
Gas-film HTU	0.50000	m
Liquid-film HTU	0.18750	m
mG/L	0.30000	
Overall gas HTU	0.55625	m
Packed height	3.3375	m

Notes for this case

- Dilute systems with constant molar flows. Get N_OG from the Colburn calculator; film coefficients from packing correlations or vendor data.

Formula and method

$$H_G = \frac{G_m}{k_y a}, \quad H_L = \frac{L_m}{k_x a}, \quad H_{OG} = H_G + \frac{m G_m}{L_m} H_L, \quad Z = H_{OG} N_{OG}$$

Variables

G_m	Gas molar flux	-
L_m	Liquid molar flux	-
$k_y a$	Gas-film coefficient	-
$k_x a$	Liquid-film coefficient	-
m	Equilibrium slope (y = mx)	-
N_{OG}	Overall gas transfer units	-
H_G	Gas-film HTU	m
H_L	Liquid-film HTU	m
λ	mG/L	-
H_{OG}	Overall gas HTU	m
Z	Packed height	m

Method and standards

Two-film theory.

Assumptions and limits

- Dilute; straight equilibrium line.
- Fluxes and coefficients are plain numbers in kmol/(m²·s) and kmol/(m³·s), with no unit lists; they must share the kmol basis, or the HTU is out by a factor of 1000.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 14 (H_OG = H_G + λH_L)

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/chemical/separation/htu-from-coefficients

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.