Tray Column Overall Efficiency (O'Connell)

Overall tray efficiency of a distillation column from liquid viscosity and relative volatility (O'Connell), and the actual trays for the theoretical stages.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Liquid viscosity at average column conditions	0.30000	cP
Relative volatility of the key components	2.5000	
Theoretical stages (excluding reboiler)	20.000	

Calculated results

Parameter	Value	Unit
Overall efficiency	52.793	%
Actual trays	38.000	

Notes for this case

• O'Connell's correlation is based on bubble-cap and sieve trays in commercial columns; it is a first estimate (±10–20 %). Viscosity in mPa·s in the correlation.

Formula and method

$$E_o = 0.492(\mu_L \alpha)^{-0.245} \ (\mu_L \text{ mPa s}), \quad N_a = \frac{N_t}{E_o}$$

Variables

μ_L	Liquid viscosity at average column conditions	Pa·s
α	Relative volatility of the key components	-
N_t	Theoretical stages (excluding reboiler)	-
E_o	Overall efficiency	-
N_a	Actual trays	-

Method and standards

O'Connell correlation.

Assumptions and limits

- Commercial bubble-cap and sieve trays.
- An empirical fit to plant data: far from the μα of those columns the result is an extrapolation. Below μα of about 0.055 mPa·s the formula exceeds 100 %; the page caps it and says so.

References

• Perry's Chemical Engineers' Handbook
• 9th ed. (McGraw-Hill, 2019)
• sec. 14 (O'Connell correlation, E_o = 0.492(μα)^−0.245)

Report details

Report reference	FCC-95N5-2V8A (the same inputs always give the same reference)
Generated	17 November 2026, 19:44 UTC
Calculator	Tray Column Overall Efficiency (O'Connell)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/oconnell-tray-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.