Distillation Column Material Balance

Distillate and bottoms flows and the recoveries of light and heavy components from feed flow and the feed, distillate and bottoms compositions of a binary column.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Feed	100.00	kmol/h
Light component in the feed (mole fraction)	40.000	%
Light component in the distillate	95.000	%
Light component in the bottoms	5.0000	%

Calculated results

Parameter	Value	Unit
Distillate	38.889	kmol/h
Bottoms	61.111	kmol/h
Light component recovered in the distillate	92.361	%
Heavy component recovered in the bottoms	96.759	%

Formula and method

$$D = F\frac{x_F - x_B}{x_D - x_B}, \quad B = F - D, \quad \eta_L = \frac{Dx_D}{Fx_F}, \quad \eta_H = \frac{B(1-x_B)}{F(1-x_F)}$$

Variables

F	Feed	mol/s
x_F	Light component in the feed (mole fraction)	-
x_D	Light component in the distillate	-
x_B	Light component in the bottoms	-
D	Distillate	mol/s
B	Bottoms	mol/s
η_L	Light component recovered in the distillate	-
η_H	Heavy component recovered in the bottoms	-

Method and standards

Overall and component balances.

Assumptions and limits

- Steady state; binary or pseudo-binary.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 13 (distillation)
- overall balances
- Mass Transfer Tutorial: Distillation (McCabe–Thiele example)

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/distillation-material-balance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.