Diafiltration: Diavolumes, Buffer and Product Yield

Diavolumes and buffer needed in constant-volume diafiltration to wash out a solute to a target, the retained product yield and the processing time.

Method: Constant-volume diafiltration balance

Input parameters

Unit system: SI

Parameter	Value	Unit
Fraction of impurity to leave in (target)	0.10000	%
Impurity rejection	0	%
Product rejection	99.500	%
Retentate volume	0.50000	m³
Permeate flux	40.000	L/(m²·h)
Membrane area	20.000	m²

Calculated results

Parameter	Value	Unit
Diavolumes	6.9078	
Buffer volume	3.4539	m³
Product yield	96.605	%
Processing time	4.3173	h

Notes for this case

• Constant-volume diafiltration: C/C₀ = exp[−N(1 − σ)], N = buffer volume/retentate volume. A freely passing salt (σ = 0) falls 1,000-fold in about 7 diavolumes. Product leaks at the rate (1 − R_p) per diavolume, so a 99.5 % rejection loses about 3 % over 7 diavolumes.

Formula and method

$$N = \frac{-\ln f}{1-\sigma_i}, \quad V_b = NV, \quad Y = e^{-N(1-R_p)}, \quad t = \frac{NV}{JA}$$

Variables

f	Fraction of impurity to leave in (target)	-
σ_i	Impurity rejection	-
R_p	Product rejection	-
V	Retentate volume	m³
J	Permeate flux	m/s
A	Membrane area	m²
N	Diavolumes	-
V_b	Buffer volume	m³
Y	Product yield	-
t	Processing time	s

Method and standards

Diafiltration.

Assumptions and limits

- Constant volume and rejection; well mixed retentate.

References

Constant-volume diafiltration balance

Report details

Report reference	FCC-F6Z9-F7CQ (the same inputs always give the same reference)
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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/diafiltration-volumes

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.