Flotation Recovery against Time: First-Order, Klimpel, Fast/Slow

Batch flotation recovery at a time by the first-order model with maximum recovery, the Klimpel model and the fast/slow two-component model, with time to 95 %.

Method: Wills and Finch; Wills' Mineral Processing Technology; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Maximum (infinite-time) recovery	97.620	%
Rate constant	0.95000	1/min
Flotation time	5.0000	min
Fast-floating fraction	80.000	%
Fast rate constant	1.5000	1/min
Slow rate constant	0.15000	1/min

Calculated results

Parameter	Value	Unit
Recovery, first-order with R∞	96.775	%
Recovery, Klimpel (rectangular k distribution)	77.246	%
Recovery, fast/slow components	90.508	%
Time to 95 % of R∞ (first-order)	3.1534	min

Notes for this case

• Batch (plug-flow) kinetics from a laboratory test; fit the parameters to cumulative recovery against time. For continuous cells use the bank calculator; plant retention is usually the laboratory time times 2–2.5.

Formula and method

$$R_1 = R_\infty(1-e^{-kt}),\quad R_2 = R_\infty\left[1-\frac{1-e^{-kt}}{kt}\right],\quad R_3 = \phi_f(1-e^{-k_f t})+(1-\phi_f)(1-e^{-k_s t})$$

Variables

R_∞	Maximum (infinite-time) recovery	-
k	Rate constant	1/s
t	Flotation time	s
ϕ_f	Fast-floating fraction	-
k_f	Fast rate constant	1/s
k_s	Slow rate constant	1/s
R_1	Recovery, first-order with R∞	-
R_2	Recovery, Klimpel (rectangular k distribution)	-
R_3	Recovery, fast/slow components	-
t_{95}	Time to 95 % of R∞ (first-order)	s

Method and standards

First-order flotation kinetics.

Assumptions and limits

- First-order kinetics.

References

• Wills and Finch
• Wills' Mineral Processing Technology
• 8th ed. (Butterworth-Heinemann, 2016)
• ch. 12
• eqs. 12.22-12.26 and 12.51-12.53 (Klimpel, 1980)

Report details

Report reference	FCC-4PR8-F7GT (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/civil/mining-minerals/flotation-recovery-time-models

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.