Two-Stage Flotation Circuit Recovery with Recycle

Overall recovery of a valuable mineral and gangue, separation efficiency and circulating load of a rougher–cleaner or cleaner–scavenger circuit with recycle.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Circuit	Rougher–cleaner, cleaner tails to rougher feed	
Stage 1 recovery of the valuable mineral (rougher or cleaner)	92.000	%
Stage 2 recovery of the valuable mineral (cleaner or scavenger)	85.000	%
Stage 1 recovery of gangue	20.000	%
Stage 2 recovery of gangue	30.000	%

Calculated results

Parameter	Value	Unit
Circuit recovery of the valuable mineral	90.719	%
Circuit recovery of gangue	6.9767	%
Separation efficiency	83.743	%
Circulating load of the valuable mineral (recycle / feed)	16.009	%

Notes for this case

- Steady state with recycled material assumed to float like fresh feed (Wills notes this exaggerates the gain). Stage recoveries come from bank kinetics or plant surveys.

Formula and method

$$R_{circ} = \frac{R_1 R_2}{1 - R_1 + R_1 R_2} \ \text{(rougher–cleaner)}, \quad R_{circ} = \frac{R_1}{1 - R_2(1 - R_1)} \ \text{(cleaner–scavenger)}$$

Variables

$\mathrm{circuit}$	Circuit	-
R_{1A}	Stage 1 recovery of the valuable mineral (rougher or cleaner)	-
R_{2A}	Stage 2 recovery of the valuable mineral (cleaner or scavenger)	-
R_{1B}	Stage 1 recovery of gangue	-
R_{2B}	Stage 2 recovery of gangue	-
R_A	Circuit recovery of the valuable mineral	-
R_B	Circuit recovery of gangue	-
SE	Separation efficiency	-
CL_A	Circulating load of the valuable mineral (recycle / feed)	-

Method and standards

Mass balance around a two-stage circuit.

Assumptions and limits

- Recycle floats like fresh feed.

References

- Wills and Finch
- Wills' Mineral Processing Technology

- 8th ed. (Butterworth-Heinemann, 2016)
- ch. 10
- eqs. 10.5-10.6 and ch. 12
- eqs. 12.48-12.50

Report details

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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-circuit-recovery

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.