Flotation Bank Recovery and Selectivity of Two Minerals

Recovery of a valuable mineral and gangue in plug flow, one mixed cell and a bank of N cells from rate constants and retention time, with separation efficiency.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Rate constant of the valuable mineral	0.95000	1/min
Rate constant of the gangue	0.080000	1/min
Total bank retention time	12.500	min
Number of cells in the bank	7.0000	

Calculated results

Parameter	Value	Unit
Relative rate constant k_A/k_B	11.875	
Valuable recovery, plug flow	99.999	%
Gangue recovery, plug flow	63.212	%
Valuable recovery, one mixed cell	92.233	%
Gangue recovery, one mixed cell	50.000	%
Valuable recovery, bank of N cells	99.904	%
Gangue recovery, bank of N cells	60.730	%
Separation efficiency of the bank	39.173	%

Notes for this case

• Equal, perfectly mixed cells; as N grows the bank approaches plug flow. Gangue recovered by entrainment is not modelled. Separation efficiency is the difference of the two recoveries (Wills eq. 12.43).

Formula and method

$$R_{plug} = 1 - e^{-kT}, \quad R_1 = \frac{kT}{1+kT}, \quad R_N = 1 - \left(1 + \frac{kT}{N}\right)^{-N}, \quad SE = R_A - R_B$$

Variables

k_A	Rate constant of the valuable mineral	1/s
k_B	Rate constant of the gangue	1/s
T	Total bank retention time	s
N	Number of cells in the bank	-
S	Relative rate constant k_A/k_B	-
$R_{A,plug}$	Valuable recovery, plug flow	-
$R_{B,plug}$	Gangue recovery, plug flow	-
$R_{A,1}$	Valuable recovery, one mixed cell	-
$R_{B,1}$	Gangue recovery, one mixed cell	-
$R_{A,N}$	Valuable recovery, bank of N cells	-
$R_{B,N}$	Gangue recovery, bank of N cells	-
SE	Separation efficiency of the bank	-

Method and standards

Tanks-in-series flotation kinetics.

Assumptions and limits

- Equal mixed cells; first-order kinetics.

References

- Wills and Finch
- Wills' Mineral Processing Technology
- 8th ed. (Butterworth-Heinemann, 2016)
- ch. 12
- eqs. 12.27
- 12.28
- 12.43 and 12.46

Report details

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This calculator online

https://calc.firecad.com/civil/mining-minerals/flotation-bank-recovery-selectivity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.