Gravity Concentration Criterion and Equal-Settling Ratios

Concentration criterion of a heavy and a light mineral in a fluid, with free-settling (Stokes, Newton) and hindered-settling ratios of equal-settling particles.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Density of the heavy mineral	7.5000	g/cm³
Density of the light mineral	2.6500	g/cm³
Density of the fluid	1.0000	g/cm³
Pulp density (for hindered settling)	1.5000	g/cm³

Calculated results

Parameter	Value	Unit
Concentration criterion	3.9394	
Free-settling ratio, Stokes (laminar) region	1.9848	
Free-settling ratio, Newton (turbulent) region	3.9394	
Hindered-settling ratio in the pulp	5.2174	

Notes for this case

- Above 2.5: gravity separation is relatively easy, down to fine sizes.
- The size ratios are the diameter of a light particle that settles at the same rate as a heavy one; a feed sized closer than this ratio can be sorted by density.

Formula and method

$$CC = \frac{\rho_h - \rho_f}{\rho_l - \rho_f}, \quad \frac{d_l}{d_h}|_{Stokes} = \sqrt{CC}, \quad \frac{d_l}{d_h}|_{Newton} = CC, \quad \frac{d_l}{d_h}|_{hindered} = \frac{\rho_h - \rho_p}{\rho_l - \rho_p}$$

Variables

ρ_h	Density of the heavy mineral	kg/m³
ρ_l	Density of the light mineral	kg/m³
ρ_f	Density of the fluid	kg/m³
ρ_p	Pulp density (for hindered settling)	kg/m³
CC	Concentration criterion	-
d_l/d_h	Free-settling ratio, Stokes (laminar) region	-

Method and standards

Equal settling of spheres.

Assumptions and limits

- Spherical particles; Stokes or Newton drag.

References

- Wills and Finch
- Wills' Mineral Processing Technology
- 8th ed. (Butterworth-Heinemann, 2016)
- ch. 9
- eqs. 9.12-9.15 and ch. 10
- eq. 10.1

Report details

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Calculator	Gravity Concentration Criterion and Equal-Settling Ratios
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Release checks	4 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/gravity-concentration-criterion

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.