Sludge Dewatering Balance: Cake, Filtrate and Polymer

Mass balance of a belt press, filter press or centrifuge: cake mass and volume, filtrate flow and solids, solids capture and polymer use.

Method: Metcalf & Eddy; Wastewater Engineering: Treatment and Resource Recovery; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Feed sludge flow	100.00	m³/d
Feed solids	3.0000	%
Cake solids	22.000	%
Solids capture	95.000	%
Polymer dose (kg per tonne dry solids)	5.0000	
Cake bulk density	1,050.0	kg/m³

Calculated results

Parameter	Value	Unit
Dry solids fed	3,000.0	kg/d
Wet cake	12.955	t/d
Cake volume	12.338	m³/d
Filtrate flow	87.045	m³/d
Filtrate solids	1,723.2	mg/L
Polymer	15.000	kg/d

Notes for this case

- Feed density taken as 1,000 kg/m³ and wash water excluded. Typical cake solids: belt press 15–25 %, centrifuge 20–30 %, filter press 30–45 %.

Formula and method

$$\dot{m}_{DS} = Q_f \rho s_f, \quad \dot{m}_c = \frac{\eta_c \dot{m}_{DS}}{s_c}, \quad \dot{V}_f = \frac{Q_f \rho - \dot{m}_c}{\rho_w}, \quad TSS_f = \frac{(1-\eta_c)\dot{m}_{DS}}{\dot{V}_f}$$

$$\dot{V}_c = \frac{\dot{m}_c}{\rho_c}, \quad \dot{m}_p = \frac{d_p \dot{m}_{DS}}{1000}$$

Variables

Q_f	Feed sludge flow	m³/s
s_f	Feed solids	-
s_c	Cake solids	-
η_c	Solids capture	-
d_p	Polymer dose (kg per tonne dry solids)	-
ρ_c	Cake bulk density	kg/m³
ρ	Feed sludge density, taken as 1 000	kg/m³
ρ_w	Filtrate density, taken as 1 000	kg/m³
$\dot{m}_{DS}$	Dry solids fed	kg/s
$\dot{m}_c$	Wet cake	kg/s

$\dot{V}_c$	Cake volume	m³/s
$\dot{V}_f$	Filtrate flow	m³/s
TSS_f	Filtrate solids	kg/m³
$\dot{m}_p$	Polymer	kg/s

Method and standards

Mass balance.

Assumptions and limits

- Feed and filtrate densities are both taken as 1 000 kg/m³ (water); the cake bulk density is used only for the cake volume.

References

• Metcalf & Eddy
• Wastewater Engineering: Treatment and Resource Recovery
• 5th ed. (McGraw-Hill, 2014)
• ch. 14 (dewatering mass balances, solids capture)

Report details

Report reference	FCC-VNEM-BD96 (the same inputs always give the same reference)
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Release checks	2 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/environmental/wastewater/sludge-dewatering-balance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.