RO Recovery, Reject Flow and Concentration

Recovery, reject flow, permeate and reject TDS and concentration factor of a reverse osmosis (RO) plant from feed and permeate flows, feed TDS and salt rejection.

Method: Reverse-osmosis mass balance (water and salt)

Input parameters

Unit system: SI

Parameter	Value	Unit
Feed flow	20.000	m³/h
Permeate flow	15.000	m³/h
Feed TDS	1,500.0	mg/L
Salt rejection	98.000	%

Calculated results

Parameter	Value	Unit
Recovery	75.000	%
Reject flow	5.0000	m³/h
Permeate TDS	30.000	mg/L
Reject TDS	5,910.0	mg/L
Concentration factor of the reject	3.9400	

Notes for this case

- Permeate TDS is on the feed concentration (optimistic). On the average of feed and reject, 3705 mg/L, it would be about 74.1 mg/L; membrane software uses a basis of that kind.

Formula and method

$$r = \frac{Q_p}{Q_f} \qquad Q_r = Q_f - Q_p \qquad C_p = (1 - R)\, C_f \qquad C_r = \frac{Q_f C_f - Q_p C_p}{Q_r} \qquad CF = \frac{C_r}{C_f}$$

Variables

Q_f	feed flow	m³/s
Q_p	permeate flow	m³/s
C_f	feed TDS	kg/m³
R	salt rejection	–
r	recovery	–
Q_r	reject flow	m³/s
C_p	permeate TDS	kg/m³
C_r	reject TDS	kg/m³
CF	concentration factor	–

Method and standards

Water and salt balances across the RO; permeate TDS from the salt rejection on the feed concentration (a simple, slightly optimistic basis; membrane software uses the average feed-concentrate concentration).

Assumptions and limits

- Steady state; rejection constant; no concentration polarisation.
- At high recovery the permeate TDS on the feed basis can be several times too low; the note gives the value on the average feed-reject concentration.
- The 85 % recovery warning is a screening level, not a sourced limit.

References

- Reverse-osmosis mass balance (water and salt)

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/boilers-power-plant/water-treatment/ro-recovery-reject

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.