

Tailings Flocculant Selection: Match Slurry, Shear and Thickener Goal

By VCYCLETECH Technical Team • Published 14 October 2026

Choose a tailings flocculant by matching a representative slurry and water matrix to the separation job the plant must perform. Start with mineralogy or practical clay indicators, particle-size distribution, solids concentration, pH, salinity, hardness and upstream reagents. Then define whether the priority is overflow clarity, settling flux, bed stability, underflow rheology, filtration or transport; these outcomes can move in different directions. Screen polymer charge and form as candidate variables, not as a substitute for test work. Reproduce solution preparation, feed dilution, contact and the shear history around the thickener feedwell. Advance a promising bench result only when continuous or site testing confirms the selected endpoint under the real feed and equipment envelope.



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TL;DR A fast settling cylinder is a screening result, not a thickener design guarantee. Characterize the ore campaign and process water, hold sample preparation and test conditions constant, and compare overflow solids, settling behavior, bed or sediment development, underflow density and rheology, plus filtration or conveying where those are the plant constraints. Fine clays, changing grind, dissolved salts, pH, residual flotation reagents, polymer make-down, feed dilution and shear can change the result. Select the candidate that meets the plant's defined balance of outputs, then verify it in a continuous thickener or controlled operating trial. No polymer grade, dose or performance value transfers automatically between different tailings.

Define the tailings and water envelope before comparing polymers

“Tailings” is not a single feed. Ore domain, grind, classification, flotation and water circuits can change the solids arriving at a thickener. Record the sample location and time, ore or campaign context, solids concentration, particle-size distribution and the mineral or clay indicators that are available. Kaolinite, illite and swelling clays do not behave as interchangeable fines. A particle-size number alone may miss platy particles, agglomerates or a small colloidal fraction that controls overflow turbidity.

Measure the water that actually accompanies the feed. At minimum, keep pH, conductivity, temperature and a useful hardness or dissolved-ion profile with the sample. Include process reagents that may remain in the slurry when they could affect particle surfaces or polymer adsorption. The purpose is not to create an oversized laboratory panel: it is to explain the variables that can change the response and to reproduce their operating range. Liu and co-authors’ review of clay-rich tailings describes the combined influence of clay structure, salinity, polymer properties and shear, and cautions that laboratory preparation methods can make reported salinity effects difficult to compare.¹

Take paired samples when the plant varies by ore campaign, shift or upstream condition. Preserve the process-water fraction and record whether the sample settled, was agitated, or was diluted before testing. A composite may be useful for routine screening, but retain individual samples if a short-lived clay-rich or high-solids feed can control the operating risk.



Editorial illustration generated with AI. Different vessel appearances are illustrative and do not show measured product performance.

Measure the process objective, too. A thickener may be limited by overflow carryover, bed inventory, rake torque, underflow pumping, filtration capacity or water return quality. The feed and endpoint together define what counts as a useful floc.

Choose the separation endpoint before choosing a flocculant

Polymer screening is often reduced to “which sample settles fastest?” That question is incomplete. A large, open floc can settle rapidly but trap water, shear apart in a feedwell, produce a weak bed or create a difficult underflow. A denser, slower structure may improve compaction or pumping while leaving the overflow too cloudy. Metso’s thickener guidance treats particle properties, feed rate, bed depth, underflow withdrawal and measurable operating signals as a coupled system; it also notes that ore changes can alter settling and flocculant demand.²

Match the test evidence to the limiting plant outcome

Plant decision	Compare in screening	Confirm at scale	Common false positive
Overflow clarity	Supernatant turbidity or suspended solids using the same settling window	Overflow trend, sampling location, feed variation and carryover events	A clear upper layer in a quiet cylinder despite poor feedwell distribution
Settling capacity	Interface movement or settling response at controlled solids and mixing	Continuous solids loading, dilution, residence and feedwell conditions	Comparing velocity from tests with different solids concentration or timing
Bed and underflow	Sediment height, compaction time, solids content and rheology where relevant	Bed inventory, rake load, underflow pumpability and stable withdrawal	Maximizing underflow solids without checking torque or transport limits
Filtration or conveyance	Filter response, cake handling or slurry flow after defined conditioning	Actual downstream filter, pipeline and deposition constraints	Assuming fast settling proves a filterable cake or transportable paste
Return-water use	Overflow quality plus residual fine particles or treatment carryover	Next process unit’s water and metallurgy acceptance criteria	Calling recovered water suitable solely because it looks clear

FLSmith describes tailings test work that considers grind size, ultrafines, dewatering and conveyability, and its feedwell materials emphasize the effect of mixing and shear on floc growth.³ These supplier materials are useful equipment context, not universal specifications. Set priorities with operations, metallurgy and tailings handling together; an endpoint that improves water recovery can still be unacceptable if it overloads a rake, filter or pump.

Clear overflow	low carryover at the agreed sampling point	Track turbidity or suspended solids with feed conditions
Stable thickener bed	inventory and sediment structure remain controllable	Track bed level or mass, rake load and underflow withdrawal
Usable underflow	solids and rheology fit pumping, filtration or deposition	Track density, yield behavior and the real downstream step

The illustration compares evidence categories, not a ranked product test. A site may need a compromise among them rather than maximizing one endpoint.

Make the screening test represent preparation, contact and shear

Keep the sample, water and polymer preparation method consistent. Record whether the product is supplied as powder, emulsion or another form only after confirming the candidate's actual product documentation. Make-down concentration, wetting, maturation, dilution-water quality, solution age and transfer shear can change the active polymer presented to the slurry. Avoid assuming that a laboratory-prepared solution behaves like a plant solution merely because both carry the same generic PAM label.

Run an untreated control and vary one factor at a time during the first screen: polymer charge family, molecular structure or form when documented; addition point; dilution; contact; mixing intensity; or the shear step. Use fresh, representative aliquots and the actual process water. Hold the solids basis, addition sequence and observation times constant. If a coagulant or pH adjustment is under consideration, test it as an explicit sequence and compare it with polymer alone; do not assume a second chemical is automatically beneficial.

Small jar and cylinder tests cannot reproduce every feedwell, pipe, pump and thickener condition. They are useful for eliminating poor candidates and identifying response trends. A test with gentle hand mixing may preserve floc that would break in a transfer line; an aggressive stirrer may destroy aggregates that would survive the actual process. Include a shear step only when it represents a real process location, then observe whether the floc reforms or the separation endpoint remains changed.



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Metso's feedwell discussion and a peer-reviewed study on clay tailings in seawater and industrial water both reinforce that mixing, particle surface state and water chemistry interact; that study's results are specific to its tested clay mixtures and waters, not a transferable field dose.⁴

Advance from bench screening to continuous and site evidence

Use a staged decision. First, repeat the best candidates on independently collected samples that span the expected feed variation. Then use dynamic or continuous testing when the selected outcome depends on solids loading, feedwell dilution, residence, bed compression or underflow withdrawal. A continuous unit provides more representative material and water balances than a single cylinder, but it still needs the plant's relevant feed, shear and equipment context. Confirm the operating envelope with a controlled site trial before turning a screening result into a set point.

During a trial, log feed solids and rate, ore or process state, make-down conditions, solution age, dilution, addition point, mixing or shear changes, overflow quality, bed level or mass, rake load, underflow solids and rheology. Add filtration, pipeline or deposition evidence when that is the limiting endpoint. Record both the desired improvement and any adverse movement in the other metrics.

Use the results to select a route, not just a product label

Choose the candidate that meets the pre-agreed acceptance criteria across the plant's limiting outcomes and remains stable across the feed conditions tested. If settling improves but clarity worsens, investigate fines carryover, charge demand, dose sequence and separation rather than increasing polymer by reflex. If the bench result is strong but the continuous test fails, check preparation, feed dilution, residence, short-circuiting and shear history before blaming the polymer family. If underflow performance is the constraint, include pumpability, rake load and downstream filtration in the same comparison.

The current coagulant and flocculant range and PAM product page establish relevant product routes; they do not establish a mine-specific grade, charge, dose or outcome. See the Mining and Municipal Water Treatment application, review the video and evidence library, then send a technical inquiry with the ore or tailings source, process-water data, equipment, limiting metric and test conditions. That information makes the next product discussion more useful than a request for a universal dose.

Frequently asked questions

Is the fastest settling flocculant the best choice for tailings?

Not by itself. Compare overflow clarity, bed behavior, underflow rheology, filtration or transport, and the operating constraint that matters to the site.

Should I choose anionic, cationic or nonionic PAM from mineral type alone?

No. Mineralogy can guide screening, but polymer response also depends on particle size and surface state, process water, pH, solids, preparation, shear and the separation endpoint.

Can a jar test predict thickener performance?

A controlled jar or cylinder test can screen candidates. Continuous or dynamic testing and a controlled site trial are needed when feedwell mixing, solids loading, bed compression or underflow handling govern performance.

What should be recorded during a tailings flocculant trial?

Record representative feed and water conditions, solids rate, polymer preparation and age, dilution, addition point, mixing and shear, overflow quality, bed or inventory, rake load, underflow solids and rheology, plus any relevant filtration or transport response.

Does a clearer thickener overflow prove the recovered water is suitable for flotation?

No. Visual clarity does not establish dissolved-ion or residual-reagent compatibility. Test the returned water in the intended process and track its effect on the next operation.

Technical references

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3. FLSmidth, "Tailings management," 2019. Supplier brochure covering tailings dewatering, feedwell mixing and shear; product claims are supplier statements.

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