

Ensuring efficient tailings treatment: the importance of optimal flocculant dissolution

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Abstract

Mining activities generate large quantities of tailings that require effective treatment before disposal to minimise environmental impact. Flocculants play a critical role in this treatment, by improving solid–liquid separation (such as thickening or filtration), and by enhancing water clarification. While proper preparation is crucial for all forms of flocculant, this paper focuses on powder and the importance of optimised dissolution for an efficient treatment. State-of-the-art preparation techniques ensure all available polymer is working effectively, translating into enhanced flocculant efficiency, reduced consumption, and improved overall process stability. Conventional flocculant makedown systems have been used for decades with various methods of mixing (eductor, wetting head, etc.) and often perform adequately. However, inefficient dissolution of powder flocculants can occur in a non-negligible number of cases (limitation of conventional dissolving technologies, increase of tailings flow to treat, low-temperature water, etc.) and leads to several drawbacks. Undissolved clumps (known as fisheye) form, reducing the available active polymer and hindering particle bridging. The required dissolution time can be lengthy, impacting process efficiency and increasing capital and operational costs. Additionally, inconsistent flocculant concentration occurs over time and disturbs the dewatering process. These issues ultimately lead to increased flocculant consumption and reduced treatment performances. While various factors can impact dissolution, such as water quality, temperature, type of flocculant and concentration of preparation, a novel piece of equipment – the Polymer Slicing Unit (PSU™) – offers a promising solution. The PSU addresses these challenges by ensuring proper dispersion and wetting of powder flocculant in water (generally 50% faster than conventional systems), even at high concentration (up to 1.5%), eliminating fisheyes and maintaining a stable concentration for consistent dewatering. In summary, optimised flocculant dissolution is essential for efficient tailings treatment, particularly for powder flocculants. Implementing proper preparation techniques and exploring innovative technologies like PSU can significantly improve treatment performances and associated costs.

Keywords: flocculant, dissolution, makedown system, tailings, solid–liquid separation

1 Introduction

The mining industry plays a crucial role in our modern world, providing essential resources for various sectors. Mining activities are essential for the extraction of valuable minerals, but they also generate substantial quantities of waste materials known as tailings. The proper disposal and management of tailings are critical to minimise environmental impacts and ensure responsible mining practices. Effective treatment of tailings is essential before disposal, and flocculation has become a cornerstone technology in this process.

In the context of tailings treatment, powder or emulsion-based flocculants are used to improve the thickening and dewatering of the solids. Flocculants enhance the aggregation of fine particles in a suspension (flocs). As explained in Figure 1, by promoting particle bridging, flocculants create larger flocs that settle faster and separate more efficiently from the liquid phase in the tailing's slurry. This enhanced solid–liquid separation allows an efficient water recovery and facilitates the disposal of the thickened tailings with minimal environmental impact.

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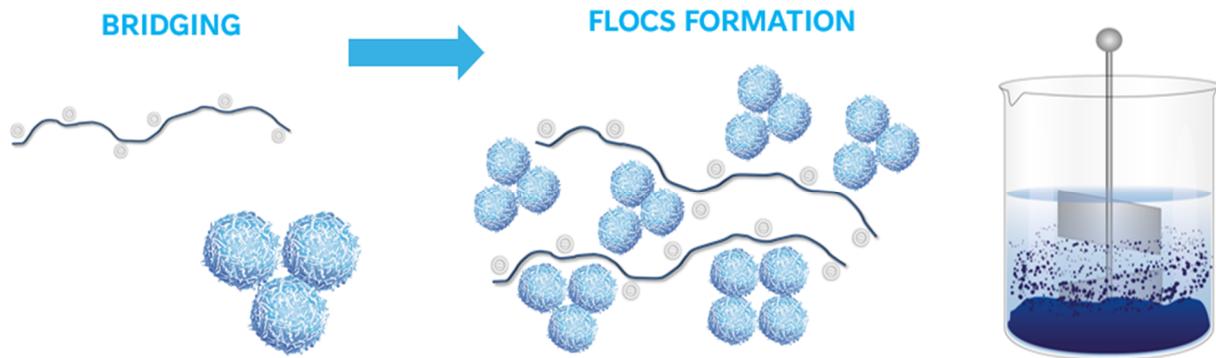


Figure 1 Mechanism of creation of flocs (flocculation)

Flocculants are available in various forms, with powder and emulsion being the most common. Both forms require proper preparation to ensure their effectiveness, but this paper focuses specifically on powder flocculants. Optimised dissolution of powder flocculants is crucial for enhancing their performance, reducing consumption, and improving the overall stability of the treatment process.

2 Importance of a good dissolution of flocculant

Flocculants are long, chain-like polymers crucial for water and wastewater treatment. They work by destabilising and bridging suspended particles, causing them to clump together (flocs) for easier removal.

While flocculants themselves are powerful tools, their effectiveness hinges heavily on proper preparation techniques. When prepared correctly, all available polymer within the flocculant works effectively, leading to enhanced flocculant efficiency. This translates to several benefits, including:

- **Enhanced flocculant efficiency:** proper preparation maximises the utilisation of the active polymer in the flocculant, leading to more efficient particle bridging and improved solids–liquid separation.
- **Reduced consumption:** by ensuring complete utilisation of the flocculant, less material is required to achieve the desired treatment outcome. This translates to operational cost savings and a more sustainable operation.
- **Improved process stability:** consistent and well-prepared flocculant solutions lead to a more stable and predictable tailings treatment process. This minimises fluctuations in performance and ensures reliable outcomes.

Conversely, improper preparation can result in significant drawbacks, such as the formation of undissolved clumps (fisheyes), inefficient polymer usage, and inconsistent flocculant concentration, which can disrupt the dewatering process (Brown 1987).

2.1 Dissolution process

The process of dissolving a flocculant powder into water is not as simple as dissolution of other type of powder. Flocculant powders, with their hygroscopic behaviour, always requires a specific care when mixed with water, to ensure that chains of polymer, that compose it, can uncoil totally to release all their efficiency. Figure 2 shows a simplified version of this flocculant powder dissolution.

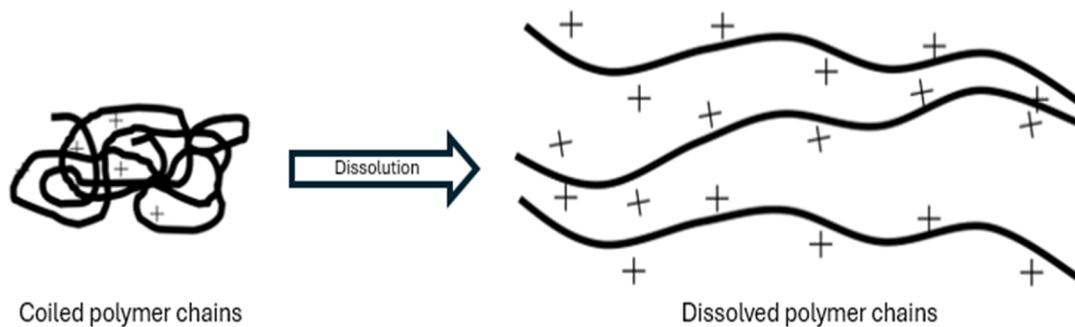


Figure 2 Principle of flocculant powder dissolution

Dissolution of powder-based flocculant always involves two steps that cannot be avoided so polymer chains are uniformly dissolved into water.

- Slow dosage of the powder into turbulent water, where particles of flocculant are ‘wetted’ and dispersed. Mixing intensity is crucial and ensures even distribution of the flocculant throughout the water, accelerating dissolution. An example of proper dosage of powder into water is shown in Figure 3.



Figure 3 Slow dosage of flocculant powder on water stream to ensure proper wetting

- Maturation phase under moderate agitation to achieve complete dissolution. Gentle stirring promotes hydration, while excessive agitation can breakdown polymer chains. Figure 4 shows an example of the inside of an agitated maturation tank.



Figure 4 Inside of maturation tank with low-speed agitator

When dissolution systems are not properly designed or because of specific operational conditions (low temperature, large capacities, humid environment, etc.), lack of performances of one those two steps (or both) can occur, resulting in poorly hydrated flocculant:

- Problems in the first step will generally result in the creation of large clumps of gels, as shown in Figure 5.



Figure 5 Example of large clumps of gels generated by poorly designed dissolution equipment

- Problems in the second step will generally result in the creation of fisheyes (as shown in Figure 6), which occur because the water hasn't fully penetrated the granule of polymer. The outside of the granule is opaque, and the centre remains whiteish, suggesting more time is required to dissolve the polymer or that this part of polymer will not be dissolved at all.



Figure 6 Example of large fisheyes in maturation tank

2.2 Factors affecting dissolution

Equipment is of course a key parameter, but several other factors influence the rate and efficient dissolution of powder flocculants, including water quality, temperature, type of flocculant, and concentration of preparation (Owen et al. 2007). Understanding these factors is crucial for optimising the dissolution process and achieving efficient tailings treatment.

2.2.1 *Water quality and composition*

Water quality plays a significant role in the dissolution of powder flocculants. Impurities and variations in water chemistry can affect the solubility and performance of flocculants. For instance:

- High levels of dissolved solids or the presence of certain bivalent ions can hinder the dissolution process, leading to longer dissolution time.
- Suspended solids will be flocculated in the preparation tank, creating skins and potential blockage of pumps or pipes.

Other characteristics of the water, even if not directly impacting quality of dissolution, can also have a large influence on the flocculant efficiency:

- High pH can cause hydrolysis of cationic polymers, low pH can cause precipitation of anionic polymers.
- Residual oxidiser, hydrogen sulphide (H₂S), some divalent ions (Fe²⁺, Cu²⁺), and ultraviolet can lead to the creation of free radicals that will degrade polymer chains.
- Bacterial growth will produce odour issues and rapid degradation of polymers.
- Conductivity: high conductivity (>10,000 μS/cm) decreases the dissolution speed and polymer solution viscosity.

Hardness (recommended TH <300 mg/L CaCO₃):

- hydrolysis of cationic polymers (high buffer effect on pH)
- precipitation of anionic polymers (especially high charge).

2.2.2 Temperature

Temperature is another critical factor influencing flocculant dissolution. Low temperatures can slow down the dissolution process, resulting in longer mixing times and potential formation of undissolved clumps. It is normally recommended to use water with temperature above 10°C and preferably around 20°C. Conversely, higher temperatures generally promote faster dissolution, enhancing the overall efficiency of the flocculant. In industry it is generally recommended to operate with a temperature of water below 40°C and preferably below 30°C, as higher temperature could lead to vapour that can create lumps and increase hydrolysis of cationic products.

2.2.3 Type of flocculant

Different types of flocculants have varying solubility characteristics:

- Ionic charge: the greater ionic charge, the faster the dissolution
- Monomers: various monomers exist to manufacture flocculants, with various impact on dissolution time
- Molecular weight: higher molecular weight polyacrylamides generally dissolve more slowly due to larger chain size and increased entanglement.

Those characteristics shall be taken into consideration for proper design and selection of dissolution equipment.

2.2.4 Concentration of preparation

The concentration of flocculant preparation also affects the dissolution process. Higher concentrations will normally enhance dissolution process. It will also lead to more viscous solutions, making it challenging to achieve complete dissolution with mixing device not suitable for higher viscosity. Balancing the concentration to ensure efficient mixing and dissolution is crucial for effective tailings treatment.

2.3 Consequences of poor dissolution

When dissolution is poor, it creates a cascade of negative effects that compromise the overall system's performance (Castillo et al. 2023; Owen et al. 2002). The various consequences associated with inadequate flocculant dissolution are detailed in the following.

2.3.1 Significant loss of product: increased opex

One of the most immediate and measurable consequences of poor dissolution is the substantial loss of the flocculant itself. In some cases, more than 50% of the product can be wasted, trapped in lumps and fisheyes. This occurs because undissolved flocculants either remain inactive or clump together, rendering them ineffective for the intended process. Such losses lead to increased operational costs, as more product is required to achieve the desired treatment results.

2.3.2 Reduced flocculant efficiency

When flocculants do not dissolve properly, their ability to bind particles and facilitate sedimentation or filtration decreases. Poor flocculant efficiency directly affects the process of solid–liquid separation, making it difficult to remove suspended solids or other impurities from the water or slurry. This inefficiency can result in lower process water quality and greater reliance on additional chemicals or treatments to achieve the desired clarity.

2.3.3 Unstable dewatering operations

The instability of the dewatering process is another major drawback of poor flocculant dissolution. As undissolved or improperly dissolved flocculants fail to perform their function, the entire process becomes unpredictable. Poor quality of flocculation can affect pumping systems downstream of thickeners and pumps can become the bottleneck. This can lead to a decrease in the discharge of clean water from the thickeners, affecting water recovery. This can also lead to variations in the consistency of the treated output, causing fluctuations in both water clarity and solids concentration, and potential causing environmental risks associated with inadequately treated tailings. Such instability can force operators to continuously adjust the system, reducing operational reliability.

2.3.4 Limited treatment capacity

Poor dissolution means that the system cannot handle the full flow the flocculants are supposed to produce. This limitation puts a strain on the plant's ability to meet processing demands, resulting in bottlenecks and decreased throughput, which further impacts profitability and efficiency.

2.3.5 Increased cleaning and maintenance requirements

One of the more labour-intensive consequences of poor flocculant dissolution is the frequent need for cleaning and maintenance. Undissolved flocculants can form deposits in pipes, tanks, and filters, leading to blockages and reduced equipment performance. This necessitates regular cleaning operations to maintain system efficiency, which increases downtime and reduces productivity. Additionally, the buildup of residue can accelerate wear and tear on equipment, resulting in higher maintenance costs and potential system failures over time.

3 Conventional dissolution systems

3.1 Technologies

For decades, conventional powder flocculant solution systems have been employed in the mining industry. These systems typically involve various methods of mixing, such as eductor and wetting head techniques. While these methods often function adequately, they are not without limitations. Inefficient dissolution of powder flocculants can occur in a non-negligible number of cases due to several factors, related with the site conditions or process changes, such as increased tailings flow to treat and low-temperature water.

The following list (and related schematics/photos in Figure 7) is a non-exhaustive summary of conventional existing technologies. Selection of the technology is driven by different factors, such as local habits (wetting heads are widely used in Europe and Australia, eductors in North America), site configuration, capacity, etc.

These technologies, which are the first step of the polymer dissolution, are always used with mixing tanks, to provide enough time for the flocculant powder to completely dissolve.

- Vacuum eductor: the high-velocity stream of water will create a vacuum that draws the powdered material into the mixing chamber, ensuring rapid and efficient blending (SNF 2019)
- Water eductor: the momentum of flowing water generated by the eductor will ensure an efficient mixing of the powder with it (SNF 2019)
- Wetting wear: a specifically designed device will create a film of water that helps to individually incorporate and wet the powder stream into water (SNF 2019)
- Wetting head: a set of nozzles, fed by water will create local sprays that will evenly disperse the particle powder delivered by a dedicated pneumatic transfer (Croft 1975).

Most conventional dry polymer systems work well with concentrations between 0.1–0.5%. Dissolution time can vary from 60 minutes to several hours depending on several parameters already described.

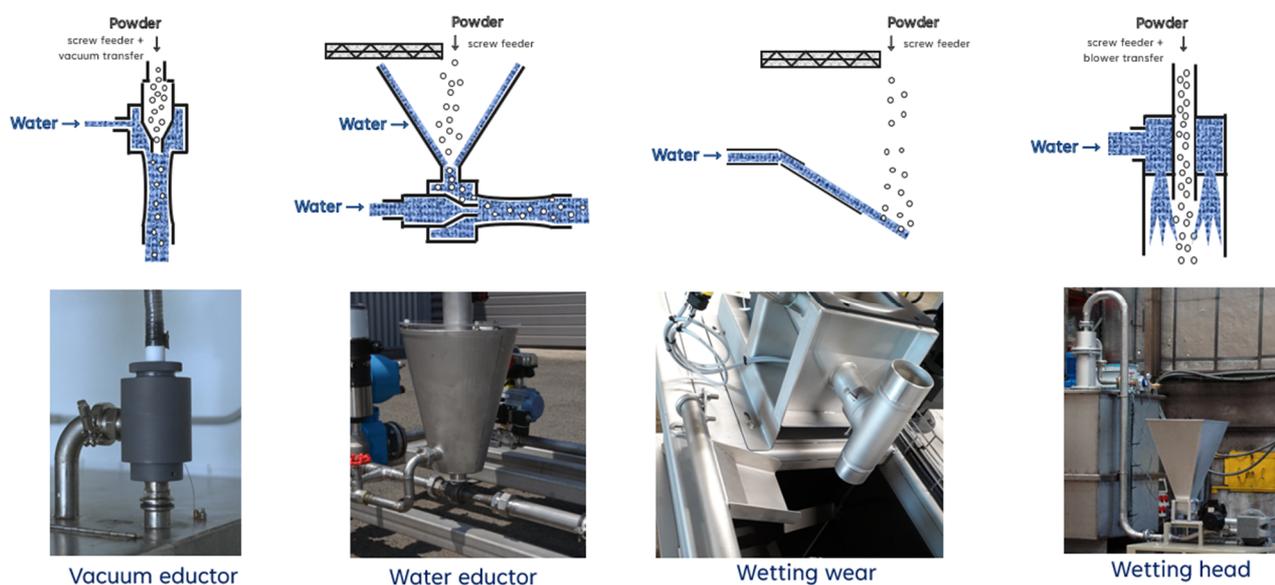


Figure 7 Various technologies of conventional dissolution systems

3.2 Challenges of conventional dissolution systems

While these systems can function adequately in many cases, they often encounter limitations that can hinder flocculant effectiveness. These limitations include:

- Inefficient dissolution and limited capacities: conventional systems may struggle to achieve complete dissolution of the powder flocculant, leading to the formation of undissolved clumps, or fisheyes. This can be caused by insufficient energy of mixing during the introduction of powder into water, by inefficient agitation in the mixing tank, by the inadequate concentration of the preparation and its related high viscosity. They have also, generally speaking, limited capacities and cannot handle very a large flow of powder without impairing quality of dissolution. Systems using pneumatic transfer can also be largely impacted by ambient humidity that will enhance the chance of creating deposits of the highly hygroscopic polymer powder.
- Slow dissolution time: conventional systems in some cases require a lengthy period for complete dissolution of the powder flocculant. This is especially the case with cold water and high level of dissolved solids. Changes of the flocculant type may also increase the time and create troubles which were not present during first phases of the project.

- Large footprint and increased capex: conventional systems can be very large units, especially when required capacity of flocculant is big (several hundred kg per hour of powder) and because of limited concentration (0.5% max) and long dissolution time. In that case, mixing tanks of hundreds of cubic metres are not rare. This will first impact the footprint at site and secondly lead to inefficient agitation in the tanks.
- Inconsistent flocculant concentration: over time, some conventional systems may experience fluctuations in the final concentration of the prepared flocculant solution. This can be caused by accumulation of flocculant lumps in some areas, by fluctuation of the powder feed because of humidity, etc.

4 Novel approach: Polymer Slicing Unit

By understanding the principles of flocculant dissolution, the factors affecting it and the drawback of conventional dissolution equipment, this crucial step can be improved, ensuring efficient floc formation and successful solids–liquid separation.

A novel technology, the PSU, offers a promising solution (Rivas & Bonnier 2021). The PSU addresses the limitations and challenges associated with conventional systems and offers several advantages, by significantly improving the dissolution process. Figure 8 shows one of the PSU models, the PSU 100, able to mix up to 100 kg/h of powder.



Figure 8 Floquip Polymer Slicing Unit, PSU 100

4.1 Principle of operation

The polymer is first pre-wetted with a limited quantity of water, and falls into the centre of the cutting rotor and strikes the inner exposed edges of the stator with great centrifugal velocity. The dispersion and wet grinding is nearly instantaneous and results in a reduction of the polymer particle size to less than 500 microns (as shown in Figure 9). The slices are so thin that the surrounding water penetrates the polymer almost immediately. The premixed polymer is then diluted with the residual quantity of water necessary to produce a minimum 1% mother solution (10 g/l). The resulting solution is then transferred and sent to a maturation tank.

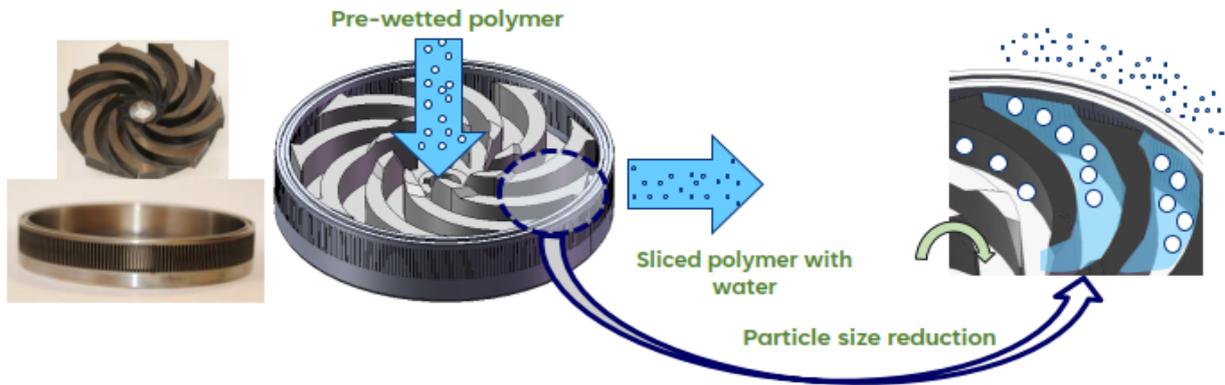


Figure 9 Principle of operation of Polymer Slicing Unit

4.2 Key features

4.2.1 Faster dissolution

One of the primary advantages of the PSU is its ability to dissolve powder flocculants faster than any conventional systems. It can achieve dissolution rates that are generally 50% faster, even at high concentrations of up to 1.5% (as shown on Figure 10). This ability comes first from its grinding capacity that results in smaller particles of powder, which offer a much larger surface of contact with water. It comes also from the high energy given by the rotor/stator assembly, that ensures better contact of powder with water.

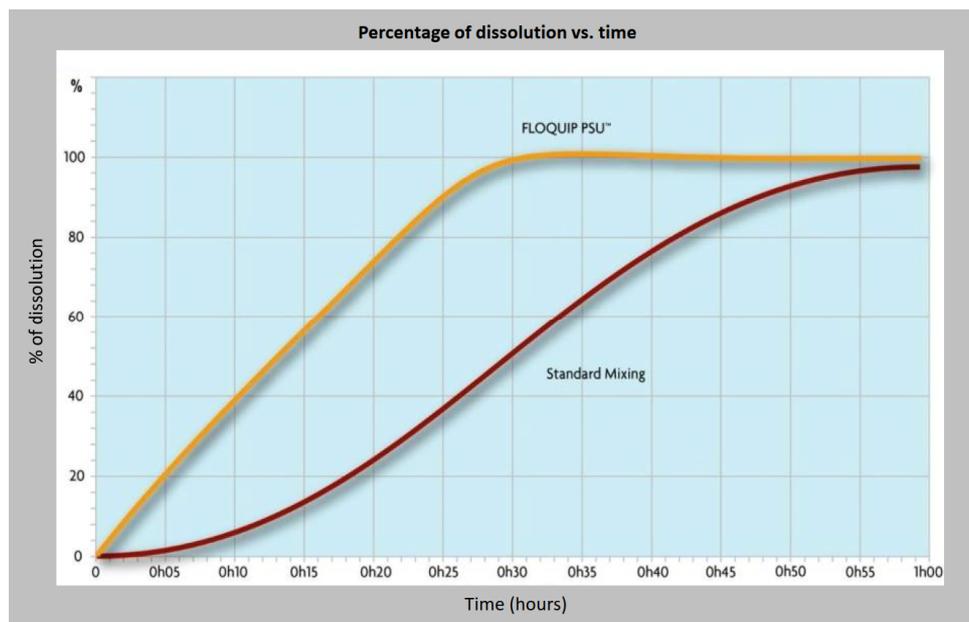


Figure 10 Typical difference of dissolution time between conventional (standard) and Polymer Slicing Unit systems

4.2.2 Increased concentration of dissolution

The second main benefit of such high-speed equipment is its ability to mix flocculant powder into water at much higher concentration than conventional system, without impairing the quality of dissolution. It can easily handle concentration of 1–1.5% (10–15 g/l) and even 2% under specific conditions, when conventional system generally operates between 0.1 and 0.5%. This is achieved thanks to the high shear through the unit that prevents the particles of flocculant from bridging and creating lumps and fisheyes.

4.2.3 Elimination of fisheyes

The PSU's design effectively eliminates the formation of fisheyes. Thanks to advanced mixing and dispersion techniques that prevent the formation of undissolved clumps or fisheyes, the overall performance of the flocculant is improved.

4.2.4 Stable flocculant concentration

In many conventional flocculant dissolution systems, maintaining a consistent flocculant concentration over time can be challenging, for example, by the creation of lumps or fisheyes that will retain some active flocculant. By ensuring that all flocculant is properly dissolved in time and that solution is perfectly homogenous, PSU addresses this issue and provides stable flocculant concentration throughout the treatment process. This stability is crucial for consistent dewatering and optimal treatment outcomes.

4.3 Benefits of optimised flocculant dissolution with Polymer Slicing Unit

Optimised flocculant dissolution with PSU offers several significant benefits for tailings treatment in mining operations. These benefits include enhanced flocculant efficiency, reduced consumption, improved process stability, better overall treatment outcomes and reduced footprint of flocculant facilities.

4.3.1 Enhanced flocculant efficiency

Proper dissolution ensures that all available polymer within the flocculant is effectively utilised. This enhanced efficiency leads to better particle aggregation and more efficient dewatering, resulting in clearer water overflow and more stable tailings properties.

4.3.2 Reduced flocculant consumption

When flocculants are dissolved efficiently, less product is required to achieve the desired treatment outcomes. This reduction in flocculant consumption translates to operational cost savings for mining operations, as well as a decrease in the environmental impact associated with flocculant production and logistic.

4.3.3 Reduced freshwater consumption

As preparation of the mother flocculant solution is done at higher concentration (10–15 g/l), the need for freshwater is reduced by at least 2–3 times, which is an important parameter for mines, especially ones operating in drought areas. Post-dilution of the mother solution, which is required to achieve proper concentration of injection into the process, is then done by lower quality water.

4.3.4 Improved process stability

Consistent and stable flocculant dissolution contributes to improved process stability. Stable flocculant concentration ensures that the dewatering process operates smoothly, reducing the risk of disruptions and ensuring continuous and reliable tailings treatment.

4.3.5 Better treatment outcomes

Ultimately, optimised flocculant dissolution leads to better treatment outcomes. By minimising the formation of fisheyes, ensuring rapid dissolution, and maintaining stable concentrations, mining operations can achieve more efficient and effective tailings treatment. This results in clearer water, reduced environmental impact, and enhanced operational efficiency.

4.3.6 Optimised capex and footprint

Reduction of dissolution time and higher concentration of preparation have a direct impact on the sizes of downstream equipment such as maturation tanks and application pumps, generally a reduction of 2–4 times. This will lead to a reduction of the overall footprint of the flocculant facilities, that can be quite large due to

the large capacities. Table 1 and Figure 11 demonstrate this on a simple example for an overall capacity of 100 kg/h of dry polymer.

Table 1 Comparison of equipment sizes with conventional and Polymer Slicing Unit (PSU) systems

	Conventional system	PSU system	Gain
Mother solution concentration	5 g/l	10 g/l	
Maturation time	120 minutes	60 minutes	
Maturation tank size	40 m ³	10 m ³	Div. by 4
Application pump size	20 m ³ /h	10 m ³ /h	Div. by 2

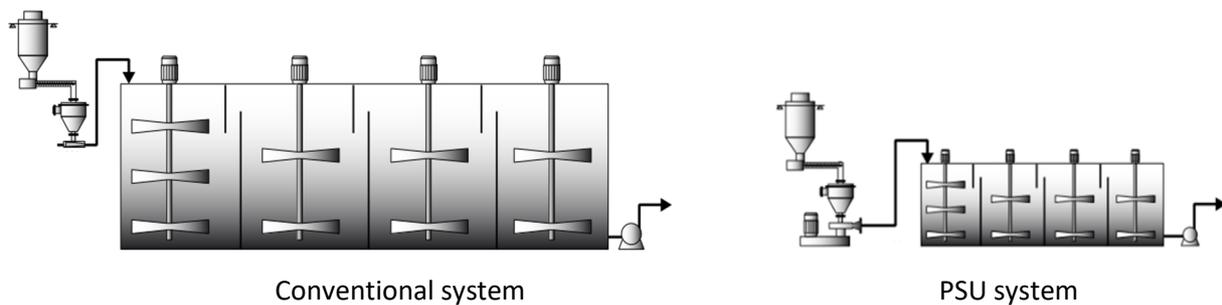


Figure 11 Comparison of equipment sizes with conventional and Polymer Slicing Unit (PSU) systems

In terms of economics, the savings will depend on the site configuration and the process parameters. If we consider the same capacity that is given as an example in Table 1, and based on some fair assumptions, the following capex and opex estimations (shown in Table 2) will give a good view of the economics savings with PSU. The capex considers only supply of dissolution equipment, agitated tank and related electrical and control system. The opex consider only the cost of flocculant (based on an average 15% reduction of consumption).

Table 2 Comparison of capex and opex with conventional and Polymer Slicing Unit systems

	Conventional system	PSU system	Gain
Capex	USD 420,000	USD 380,000	USD 40,000 9.5%
Opex (1 year)	USD 2,200,000	USD 1,900,000	USD 300,000 15%

5 Cases studies

5.1 Copper mine in Chile

The first case study is about a flocculant plant installed in a copper mine in Chile in 2017 for the treatment of tailings. The existing system was not giving satisfactory results in terms of dissolution, time, flocculant consumption and stability of flocculant solution concentration. The PSU 100 unit (shown in Figure 12) has been installed in place of the existing conventional unit and benefits were shown very rapidly.



Figure 12 Polymer Slicing Unit system installed in a copper mine in Chile

Figure 13 shows the concentration of the flocculant solution measured in the client’s laboratory with the old conventional system and with the PSU. This clearly shows a significant difference between the two systems. The PSU shows a more stable concentration overtime, meaning a more stable operation of the dewatering process.

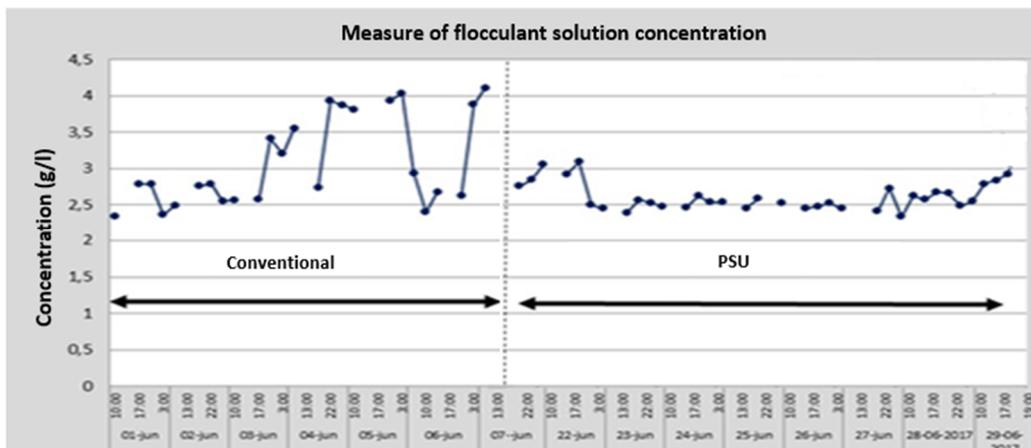


Figure 13 Comparison of flocculant solution concentration between conventional and Polymer Slicing Unit systems (PSU)

Ultimately, all major key performances indicators required by the customer and described in Table 3 have been achieved by the PSU, in a very short time.

Table 3 Major key performances indicators achieved by Polymer Slicing Unit

Item	Objectives	Compliance
1	Preparation time < 10 minutes	☑
2	No fisheyes	☑
3	Stability of flocculant viscosities compared to laboratory preparation	☑
4	Stability of flocculant concentrations compared to laboratory preparation	☑
5	Maintain operational continuity	☑
6	Work fully automatic	☑
7	Reduce flocculant consumption (>15%)	☑

The latest feedback from 2024 is still positive after seven years of operation: low maturation time, lower flocculant consumption, no fisheyes and the thickeners operate well. Flocculant consumption is reduced from 16 to 12 g/t with the PSU, and the solids discharge from the thickeners has increased between 2–3 points.

5.2 Gold mine in Canada

The second case study is about a flocculant plant installed in a gold mine in Ontario, Canada, in 2021 for treatment of tailings from thickener. Again, the existing system was not giving satisfactory results. The PSU 300 unit (shown in Figure 14) has been installed in parallel with the existing conventional unit, to facilitate comparison. During trial period, units were used alternatively and delivering flocculant solution to the same mix tank.

The main conclusions from the tests made by the client were clearly in favour of the PSU-based system.

- With PSU, 30 minutes of mixing is needed instead of three hours with a conventional system with anionic flocculant and high molecular weight.
- The PSU can prepare a batch up to 10 g/l (1%) to compare with 5 g/l (0.5%) with conventional system.
- The PSU is not really affected by the water temperature during the batch which is important in the cold area where the mine is located.
- There was an improvement through the big reduction of fisheyes in the solution compared to the conventional system, which was important as the thickener underflow goes to a filtration unit.
- The PSU has been installed since January 2021, just beside the old unit—wetting head type (45 minutes mix time with a lot of fisheyes). After only four weeks of operation, a dosage reduction of 44% has been observed by going from 25 to 14 g/t. The mine is feeding the thickener at 33,000 t/day.

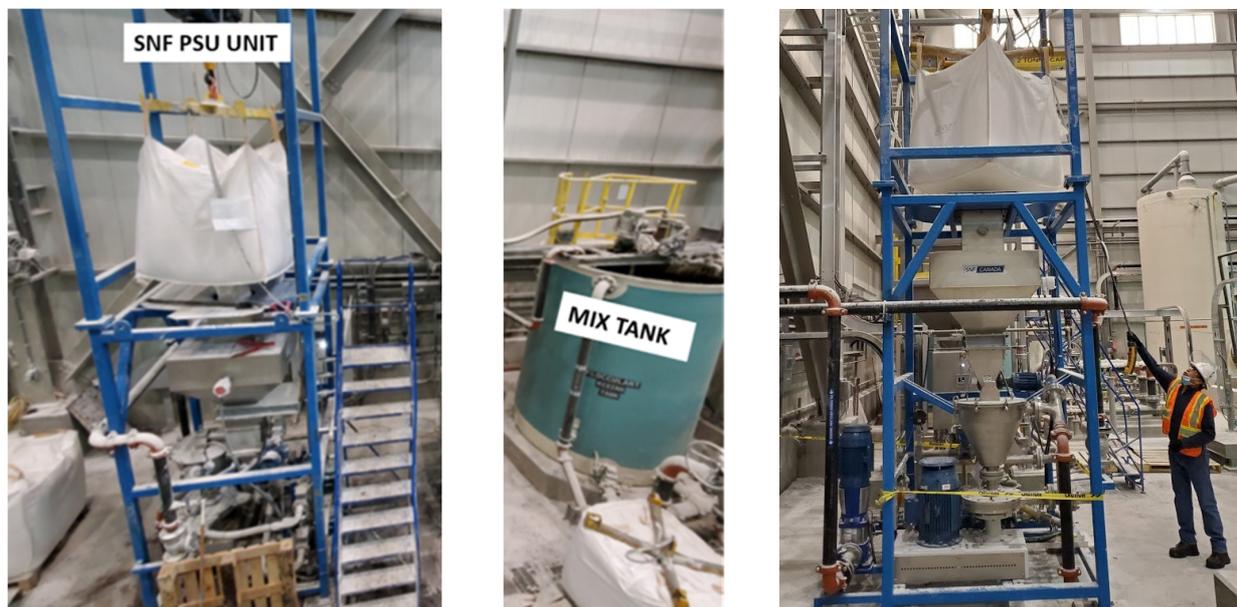


Figure 14 Polymer Slicing Unit system installed in gold mine, Canada

Since its start-up in 2021, the PSU has continued to operate with consistent performance in terms of quality of dissolution and flocculant consumption.

Besides this mine in Ontario, two other PSU-based units are in operations in two gold mines in Quebec; one since 2009 and the other since 2013. The feedback is similar, with improved quality of flocculant solution

and optimised flocculant consumption. By using a PSU instead of the standard equipment, they have saved a lot of space in the building (smaller tanks, smaller pumps, etc.).

5.3 Gold mine in Dominican Republic

This case study is related to two units installed in 2019 and 2023 in a gold mine in the Dominican Republic. Both units are equipped with a PSU 300. Unit 1 doses directly into the grinding thickener, unit 2 (shown on Figure 15) injects flocculant into the floatation tails thickener. The main drivers for using PSU-based units were space and price.

The latest feedback from the site is:

- Unit 1: the thickener is currently at an average of 1,200 tph from 750 tph design. The original/traditional hydration station could not deliver the required floc dosage. Unit 1 was easily integrated with a small footprint. No performance issues were observed nor reported/associated from flocculant hydration.
- Unit 2: thanks to the reliable operation of unit 1, unit 2 has been selected for a new thickener associated with the expansion project. Again, no performance issues were observed nor reported/associated from flocculant hydration.



Figure 15 Polymer Slicing Unit system installed in a gold mine in the Dominican Republic

6 Conclusion

Efficient tailings treatment is a critical aspect of responsible mining operations. Flocculants play a vital role in this process by promoting particle aggregation and facilitating the separation of solids from water. While conventional powder flocculant solution systems have been used for decades, they are not without limitations. Inefficient dissolution of powder flocculants can lead to several drawbacks, including the formation of fisheyes, prolonged dissolution times, and inconsistent flocculant concentrations.

Optimising flocculant dissolution is essential for achieving efficient tailings treatment, particularly for powder-based flocculants. Proper preparation techniques ensure that all available polymer is effectively utilised, enhancing flocculant efficiency, reducing consumption, and improving overall process stability.

The introduction of innovative technologies, such as the PSU, offers promising solutions to the challenges associated with conventional systems. The PSU provides faster dissolution, eliminates fisheyes, and maintains stable flocculant concentrations resulting in improved treatment outcomes. Using a PSU will optimise costs by reducing downstream equipment size and lowering operational expenses, particularly with flocculant consumption reduced by over 15%.

In conclusion, mining operations can significantly benefit from optimising flocculant dissolution. By implementing proper preparation techniques and exploring innovative technologies like the PSU, mining companies can achieve more efficient and effective tailings treatment, ultimately contributing to a more sustainable and environmentally responsible industry.

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