DRYFLOC

Flocculants and Rheology Modifiers for Paste Thickening and Tailings Storage Facilities

SNF FLOMIN ™

DRYFLOC *Flocculants and*

Mining companies are facing many new challenges in our world today. One such challenge is the pressure from society for sustainable development leading to:

- The need to reduce water consumption.
- The need to increase the speed of water recovery from tails areas.
- The need for better distribution of fines and coarse materials in tails disposal areas to allow faster rehabilitation.
- The need to reduce energy use for pumping through improved mud rheology.
- The need for more effective and safer tailings disposal via stacking operations or mine backfilling.
- The need for more effective use of capital by processing minerals at higher pulp densities.

Thanks to the Research and Development carried out by SNF, important progress has been made towards satisfying these needs in the mineral processing industry. SNF, the worlds leading manufacturer of water soluble polymers is fully committed to this global effort to improve efficiency of water and energy use through effective use of flocculants in the mining industry. Indeed, SNF began to develop tailings disposal know-how in the late 70's within the phosphate industry in Florida and Tunisia. Fines distribution in impoundments fed with slurries containing both slime and sand fractions was perfected at about the same time in land reclamation operations for the port of Fos Sur Mer.

Our goal is to be a valuable partner for our customers. Our goal is achieved through proposing more than a product; SNF is there to help you find the most viable technical & economical solution for effective water use, processing conditions and tailings management in your equipment without compromising on Environment, Health & Safety requirements.

The only way to meet this goal is through people. We are dedicated to meeting our customers' needs through our highly skilled workforce. Our chemists, process engineers and metallurgists are there to understand your needs for water management, slurry processing requirements and ultimately tails disposal. Once these needs are fully understood, they will propose the best chemical solutions based around your equipment design and implement them in a team effort with your staff.

SNF is committed to maintaining efficient, green and flexible manufacturing capabilities. We offer the widest range of products produced in modern resource efficient plants to cover all mining flocculant and dispersant applications. Our product development is focused on meeting the ongoing and newly developing needs of the mining industry.

The DRYFLOC range of products has been developed to meet the specific goals of water management, tails management and paste thickening technology. These new products are complementary to our conventional range of copolymers.

- *DRYFLOC D* is a liquid that can be used as an efficient rheology modifier in combination with a conventional flocculant for thickening applications. This product has been tested successfully in the alumina and phosphate industry to increase the pumpability of high concentrated slurries. The use of these products provides a cost effective solution to pumping high concentration slurries.

- *DRYFLOC P* is primarily for application in paste thickeners. These products are used widely within the copper, gold and nickel industry. The polymers are designed with multiple anionic charges, multiple molecular weights and monomer combinations. They help to produce high density mud with low yield stress.

- The *DRYFLOC T* range of product is specifically dedicated to TSF (Tailings Storage Facilities) disposal applications.

Rheology Modifiers

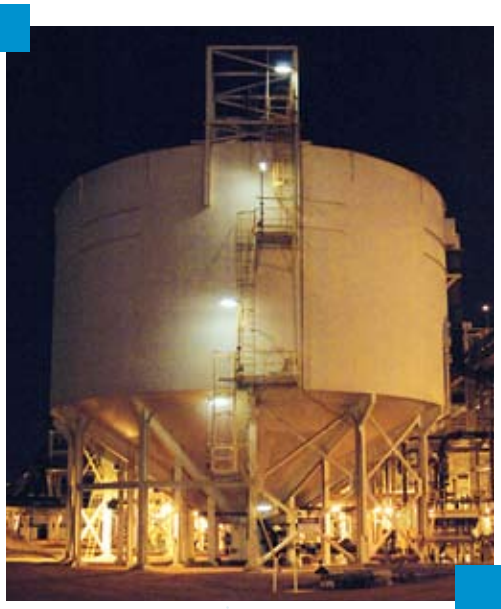
DRYFLOC D

Plant data is presented below for an alumina refinery. The results show the evolution of the yield stress vs. underflow solids concentration for the two deep thickeners operating in parallel.

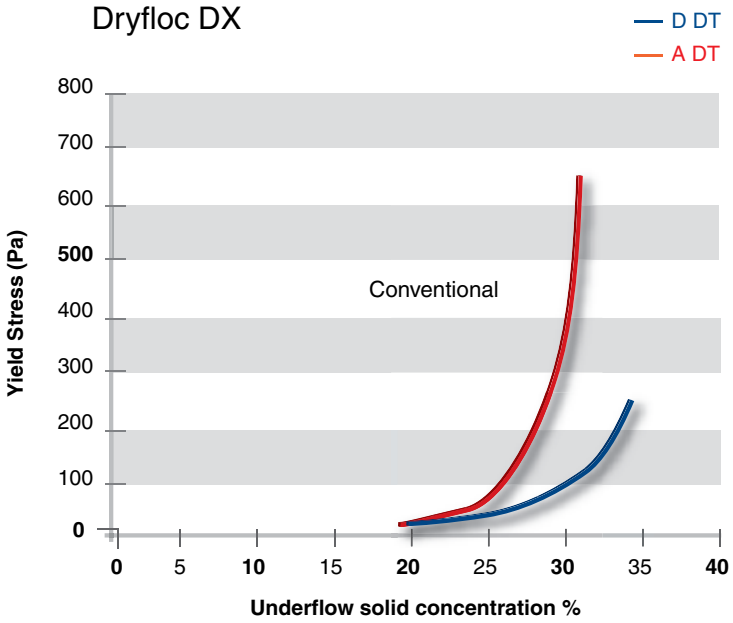
- Deep thickener A is flocculated using a conventional high molecular weight polymer.
- Deep thickener D is flocculated using a blend of DRYFLOC D and an anionic polymer.

As can be seen from the graph, the mud pumped from D Deep thickener exhibits a significantly lower yield stress than the mud pumped from A Deep thickener.
Thus the application of DRYFLOC D in combination with our trial thickener polymer has enabled the plant:

- To increase the underflow solids concentration pumped to the stacking area and recirculate more wash water back to the washer train.
- To reduce the yield stress of the mud, increasing its pumpability, thus giving more flexibility to the operation of the PD pumps which had been operating continuously at their maximum pressure.



Plant Data



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DRYFLOC for Paste

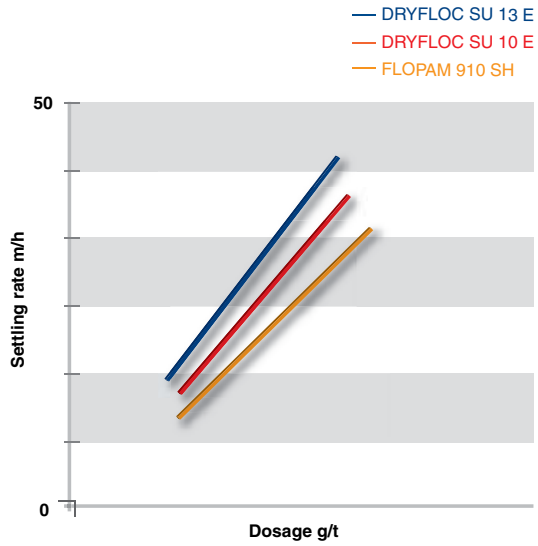
The DRYFLOC P range of products is targeted at Preleach thickeners or Tails thickeners where there is an economic driver for higher densities and low underflow yield stress. The product line consists of different anionic charges and molecular weights.

Their main characteristics are:

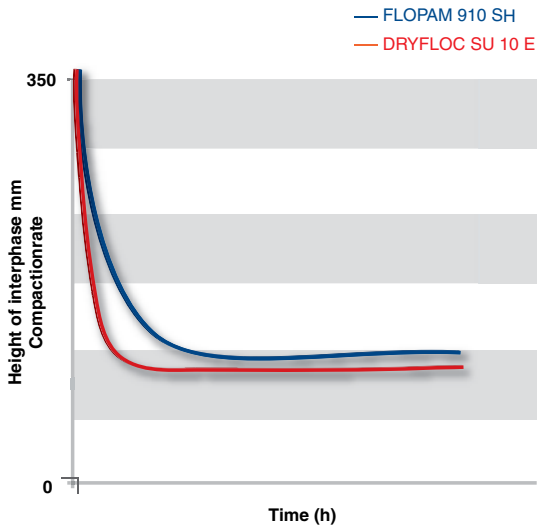
- High free settling rates for lower dosages
- High compaction rate which allows the process to reach higher underflow densities
- Lower yield stress compare to conventional flocculants

The graphs above illustrate the advantage of DRYFLOC

- The left picture is showing that higher free settling rates are obtained using DRYFLOC P, compared to the conventional polymer. This would contribute to reduced polymer usage for the same process outcome.

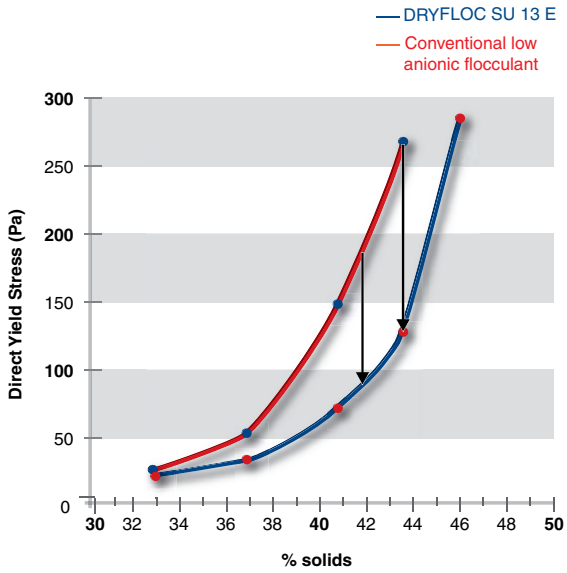


- The right picture is showing the compaction rate obtained during raking tests in two litre cylinders. For the same dosage, the use of DRYFLOC P allows to reach the final compaction faster than for a conventional flocculant.



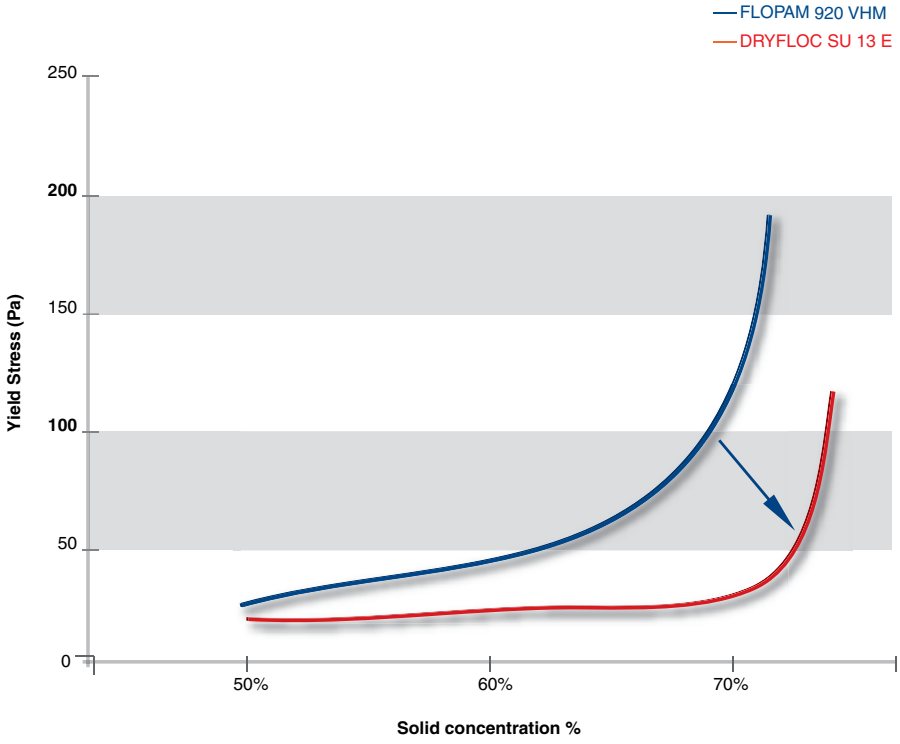
Nickel Operation - Saprolite circuit

The plant operates at 40 to 44 % underflow concentration from paste thickener. Using DRYFLOC P, the yield stress is reduced to values that are compatible with the pump capacity and normal torque operating range of the rake mechanism. As a result less water is sent to the plant and the ore throughput of the leaching area is maximized.



Rheology Modifiers

Copper Operation - South America



For this copper mine, saving water is a day to day challenge as it operates in a desert environment. The use of DRYFLOC P leads to the production of a higher underflow solid concentration which remains pumpable. This returns more water to the process immediately, reduces the evaporative losses at the tails dam and reduces freshwater requirements for the plant.

The DRYFLOC P flocculant selection is made on the basis of understanding the process specific application requirements by the SNF representative in consultation with the customers technical and operations staff.

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DRYFLOC for Tailings

These products are used to help the tailings disposal either on ground surface and underground disposal.

Mud disposal is greatly influenced using DRYFLOC T products. The application of these products in the field leads to tailings that drain more freely, have better distribution of fines and coarse material in the disposal area and increased beach angles. As with the DRYFLOC P range, the product selection and application is done by the SNF representative in consultation with the customer staff. The different pictures shown below illustrate the effect of DRYFLOC T on the slump and spread out on a mineral paste.

Depending on the product selection of application, the DRYFLOC T products would help the TSF operator in:

- Increasing the water recovery and the drying ability,
- Increase the homogeneity of the tails slurry in the disposal area and thus improve the mechanical properties of the slurry as it dewaters
- Help to reduce dust emissions from TSF

Without application of DRYFLOC T

With application of DRYFLOC T

Rheology Modifiers

Product Line

The DRYFLOC standard line of products consists of low and medium anionic charged polymers.

DRYFLOC	Bulk Density	Viscosity @ 5.0 g/l	Viscosity @ 2.5 g/l	Viscosity @1.0 g/l	Recommended operating concentration	Dissolution time in DI water @ 5g/l @25°C
DRYFLOC DX						
DRYFLOC 20 E	0.75	100	25	10	5	180
DRYFLOC 05 E	0.80	500	250	70	5	90
DRYFLOC 10 E	0.80	950	450	150	5	60
DRYFLOC 13 E	0.80	1300	500	150	5	60
DRYFLOC 23 E	0.80	1600	600	200	3	60
DRYFLOC 26 E	0.80	1700	650	250	3	60
DRYFLOC 34 E	0.80	1800	700	300	3	60
DRYFLOC 45 E	0.80	1820	700	280	3	60
DRYFLOC SU13 E	0,80	1300	500	150	5	60
DRYFLOC SU18 E	0,80	1500	550	170	5	60
DRYFLOC SU25 E	0,80	1700	650	250	3	60
DRYFLOC SU32 E	0,80	1800	700	300	3	60

NOTE: The letter at the end indicates the MW, it increases from A to F.

Technical Assistance

SNF'S field specialists are there to help you select the optimum product for your plant conditions and to provide you with technical assistance during all the steps of your project development.

Rheology and Settling Test

SNF standard procedures include:

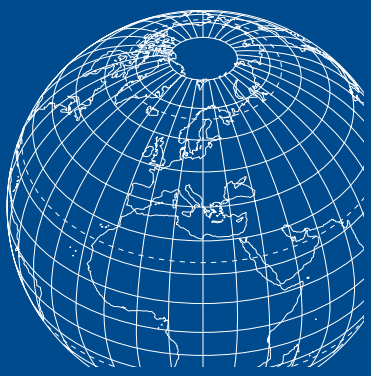
- Vane stress rheology measurements
- Static and Dynamic testing (dynamic rigs)
- Standardised procedures used by the cement and concrete industry to characterise the workability of pastes.

In our modern challenging world, being a world class manufacturer creates a number of obligations from us to our customers. SNF commitment has always been and continues to be:

- Manufacture our own products at the lowest possible cost;
  - without compromise on Environmental, Health and Safety standards,
  - with continuous quality improvement and
  - security of supply through vertical integration and geographical diversity.

- Being a partner not just a supplier, thus ensuring our customers that they get the right product for the right application. This ensures the lowest total cost of ownership of flocculants for the mineral processing industries

The DRYFLOC product line has been created as a result of adhering to these fundamental commitments of the SNF organisation.



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The information in this document is provided in good faith. To our knowledge it reflects the truth.