Overcoming sludge stickiness during the drying process with PAX pre-conditioning

THE STICKY CONDITION OF WASTEWATER SLUDGE CAUSES MANY ISSUES DURING DRYING AND DEWATERING OPERATIONS.

CHALLENGE: THE STICKY BEHAVIOR OF SLUDGE DURING THE DRYING PROCESS

The worldwide issue with dewatering and drying of activated sludge is the sticky behavior it exhibits when being partially dewatered, due to the so-called sticky phase of sludge. This is also the case in the Centridry® installation at the Monsanto Antwerp Wastewater Treatment Plant in Belgium. This specific technology combines a decanter centrifuge and a flash dryer in one enclosed compact system to reduce the sludge volume.

In the past, the system capacity was significantly reduced due to partially dried sludge sticking on the screw conveyor of the decanter centrifuge and/or onto the dryer wall. The sludge feed needed to be stopped and the system had to be flushed some periods as frequently as every 8 hours. In cases where the sludge dewatered in the centrifuge to such an extent that it already reached the dryness range wherein it behaves as a sticky product, the torque on the shaft of the screw conveyor peaked to such significant levels that the sludge feed needed to be reduced to prevent mechanical damage.

SOLUTION: CREATING AN AQUAPLANING EFFECT WITH PAX-14

Based on experience in practice, and further evidenced by a statistical analysis of the performance of the drying system, it was shown that occasional mixing of the plant’s flotation sludge (containing PAX-14) with the standard excess sludge from the clarifier underflow resulted in a lower fouling frequency on the dryer wall. PAX-14 obviously has a positive impact on the sludge properties, especially in that particular dryness area in which the stickiness occurs. As a result, it was decided to add pure PAX-14 into the excess sludge feed upfront the centrifuge-dryer installation.

KEY BENEFITS

- REDUCED MAINTENANCE CYCLES
- HIGHER CAPACITY THANKS TO STICKINESS MITIGATING EFFECT OF PAX-14
- IMPROVED PROCESS AND OPEX EFFICIENCY

“The benefit of this innovative pre-treatment is a combination of improved process reliability and significant cost savings thanks to the higher solids throughput.”

Dr. Ir. Ing. Bart Peeters - Manufacturing Technologist at Monsanto WWTP, Antwerp/ Belgium

Where water meets chemistry™
Bart Peeters, Manufacturing Technologist at Monsanto Antwerp’s WWTP gave the following hypothesis for his doctoral thesis:

When added to water, polyaluminumchloride creates compound-like super molecules, which chemically bind the free sludge water into hydrates. These hydrates act as a stable water layer for the sludge particles. While the free sludge water is removed during the process of dewatering and drying, the sludge essentially becomes sticky and therefore the chemically-bound hydrate water can stand significantly longer. This results in an aquaplaning-like effect, enabling the sludge particles to more easily glide on the dryer surface.

RESULT: MAXIMUM EFFICIENCY WITH MINIMUM SYSTEM DOWNTIME

As a result of the direct PAX-14 addition (typically at a rate of 10 L/h of pure PAX-14 to 5 m³/h sludge) in the waste sludge feed, the torque of the centrifuge’s screw conveyor is kept under control and the solids build-up on the dryer wall are almost completely eliminated, yielding a significant annual centrifuge-dryer capacity increase of 50%.

“This new application of PAX-14 – as a conditioner for waste activated sludge prior to sending it to our dewatering-drying installation – has really resulted in a breakthrough of our installation’s capacity for more than 5 years now”, says Bart Peeters.
The stickiness-mitigating effect of the PAX-14 pre-conditioning was demonstrated with a shear test-based lab protocol, see figure 2. PAX-14 treated sludge shows by far less shear stress (indicative for the lower adhesiveness of this sludge), what results in a smoother dewatering/drying operation, exemplified by a much lower torque of the screw conveyor in the decanter centrifuge, than in case of untreated sludge.

It can be expected that PAX-14 conditioning can also be beneficial to other types of sludge dryers (such as paddle dryers) which usually have to be equipped with high-torque motors to be able to deal with the high torque caused by the stickiness of the sludge.

REFERENCES:
WFC11 (11th World Filtration Congress), Graz, Austria (April 16-20, 2012)

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