FACT SHEET

Solids Pretreatment Methods to Enhance Dewatering Performance

By: David Oerke

Attempts have been made to enhance solids dewatering performance beyond the addition of coagulants and flocculants. Heating, pressurization, ultrasonication, invasive electrocoagulation, addition of caustic and strong oxidants and other processes have changed feed solids characteristics and affected dewaterability. Some processes like thermal hydrolysis, thermochemical hydrolysis, and phosphorous removal upstream of dewatering have improved dewaterability at full-scale. However, other pretreatment processes have had issues with scale-up and technical implementation and have not been cost effective.

This factsheet addresses two relatively new full-scale solids pretreatment methods that may enhance dewatering performance and address some operational issues: Orège SLG™ and HydroFLOW™. Both of these processes profess to change solids characteristics in unique ways and could be considered within a suite of options by facilities seeking to improve dewaterability. Due to limited installations and operational history, it is recommended that any facilities interested in these technologies conduct pilot tests to assess whether their specific solids stream's dewatering characteristics can be improved sufficiently for further consideration.

Orège SLG™

The Orège SLG™ pretreatment process applies compressed air to digested biosolids and breaks up colloids to release trapped water. The pressurization and rapid depressurization is thought to replace some water with air and disrupt extracellular polymeric substances (EPS) allowing for more free water release from the biosolids floc. The Orège SLG™ equipment consists of a skidded reactor and deaerator that has a small installed footprint (approximately 4 feet by 6 feet) for a capacity of 100 gpm as shown in Figure 1.

Figure 1 – Orège SLG™ skid. Source: David Oerke

Full scale operational data, in addition to bench-scale and pilot-scale tests, have indicated that this pretreatment process can increase the belt filter press (BFP) dewatered cake solids concentration from digested biosolids by up to 3.5 percent (see Table 1). Some results have also indicated lower polymer consumption and clearer filtrate. One potential disadvantage is that the process creates a foul air off-gas source.

Orège SLG™ has currently shown dewatering improvements only with BFPs in the US and one German centrifuge installation. A summary of U.S. Orège SLG™ installations or full scale demonstrations is shown in Table 1. It is recommended that bench or

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pilot tests be performed on each plant's specific solids to predict performance. The current Orège SLG™ business model is unique and it is suggested that facilities request proposals with terms and conditions to allow contractual assessment of the system in conjunction with the system's potential operational improvements.

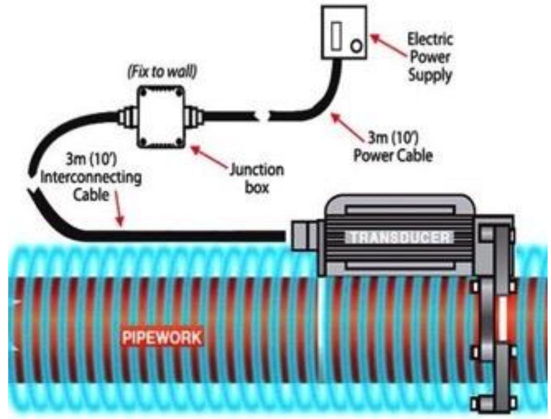
WWTP Location	% Cake Increase	Polymer Decrease (%)	Capture rate (%)	Through-put Increase	Net Present Value Return on Investment (years)
Allentown, PA	+3.0	25	99.3	Increased	2
Gresham, OR	+2.0	10	96.5	No Change	4.5
2 Rivers, NJ	+1.4	5	97	+100%	2
Anne Arundel County, MD	+2.7	35	99	No change	3
Deland, FL	+3.5	No Change	98.5	No change	10
Gloucester County, NJ	+3.5	No Change	99	+25%	4

Table 1 – Summary of Orege SLG™ BFP Installations in the United States. Source: Kevin Dunlap, Orège.

HydroFLOW™

The HydroFLOW™ technology is a non-invasive electrocoagulation process that has shown promise as a struvite mitigation technology. The technology induces an electrical signal of approximately 150 kHz in the liquid inside any pipe material on which it is installed as shown in Figures 2 and 3. The electric signal dissolves the struvite deposits without the use of chemicals. Each unit consumes approximately 0.011 kW of power.

Originally designed for residential systems to remove calcium carbonate scale on pipes and boilers in domestic heating applications, the technology's application has expanded to wastewater treatment facilities where it has been applied to reduce struvite and other scale formation. The unit is installed around an existing pipe, and no plumbing or cutting of the piping system is required. The HydroFLOW™ unit can be mounted at locations within a WWTP where struvite formation potential is high and pipes flow full. Common locations are in the dewatering feed pipelines and centrate or filtrate recirculation pipelines.



Figures 2 and 3: HydroFLOW™ device schematic and mounted on sludge pipe. Source: Miller et al., 2017.

HydroFLOW™ Technology Case Studies

The HydroFLOW™ technology's first WWTP application was at the 5 MGD Walla Walla WWTP, WA in the summer of 2013. Eight weeks after the HydroFLOW™ device was energized, struvite layers began to dissolve and no further accumulation on the clean sections was observed.

In the Fall of 2013, HydroFLOW™ equipment was installed at the Orlando, Florida, Water Conserv II Water Reclamation Facility (WRF) for struvite removal. The results showed that after 5 months of installation, significant reduction of struvite was observed as shown in Figures 4 (before) and 5 (after).

Figures 4 and 5: Struvite accumulation on a belt filter press drum before (top photo) and after (bottom photo) 5 months of HydroFLOW™ operation at the Orlando, Florida, Water Conserv II Water Reclamation Facility.
Source: Miller et al., 2017.

Limited installations and tests of HydroFLOW™ units have also found improvements in dewatered cake dryness and/or lower polymer use. This improved cake dryness and/or reduction in polymer consumption may be due to charge neutralization. HydroFLOW™ units installed in November 2015 at the Somersworth WWTP, NH, ran six testing sequences over a span of 45 days. Results indicated a reduction of 25 percent in centrifuge polymer use and a cake solids increase of 3 percent with acceptable centrate quality. A separate polymer reduction trial performed at the Central WWTP in Nashville, TN, showed a 27.5 percent reduction in centrifuge dewatering polymer.

Jacobs Engineering has performed third-party verification for the HydroFLOW ™ equipment at the 46 mgd J.B. Messerly Water Pollution Control Plant (WPCP), Augusta, GA; the 42 mgd Southside WWTP, Tulsa, OK; and at the 220 mgd Robert W. Hite Treatment Facility (RWHTF), in Denver, CO in 2017 and 2018. At the Augusta Messerly WPCP, the struvite scale on a BFP drum became soft and easy to remove by spraying with high pressure water after a six month application and eliminated $48,000/year of anti-scalant chemical use The HydroFLOW ™ equipment was found to be effective in softening the existing scale and preventing the formation of new scale on BFP rollers at the Tulsa Southside WWTP after 3 months of application. The HydroFLOW ™ equipment was also effective in softening the existing scale and preventing the formation of new scale on a centrate line making the scale easy to remove by the flowing liquid after a 60-day test period according to RWHTF staff.

Summary

It is recommended that bench or pilot tests be performed on each specific sludge to predict performance of the Orège SLG™ or HydroFLOW™ process. Installations and tests to date are limited and results may not be widely applicable. Further information is needed to determine if these pretreatment processes are effective for a broad range of sludges and types of dewatering equipment.

Reviewers

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Further Reading

1. Rickermann, John H. (Jacobs Engineering) and Charles E. Volk (Lehigh County Authority), Innovative Biosolids Conditioning Ahead of Belt Filter Presses to Improve Cake Solids Dewatering, 2017 WEFRBC, Portland, Oregon
2. Miller, Douglas L. (HydroFLOW) and Chuck Glessner (HydroFLOW), A Triple Bottom Line Solution for Non-Chemical Struvite Mitigation – Case Studies Review, 2017 WEFRBC, Portland, Oregon
3. Miller, Douglas L. (HydroFLOW), Polymer Reduction and Drier Cake Solids in Centrifuge Dewatering Result from HydroFLOW™ Struvite Control Investigation at Somersworth, NH, February 19, 2016.
4. [WEF Dewatering Fact Sheet Series](#) (2019)

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