DOCKETED	
Docket Number:	19-ERDD-01
Project Title:	Research Idea Exchange
TN #:	235632
Document Title:	Caliskaner Water Technologies, Inc. Comments - Comments for Indoor Ag and Advanced Wastewater– request for information
Description:	N/A
Filer:	System
Organization:	Caliskaner Water Technologies, Inc.
Submitter Role:	Applicant
Submission Date:	11/17/2020 8:08:58 AM
Docketed Date:	11/17/2020

Comment Received From: Caliskaner Water Technologies, Inc.
Submitted On: 11/17/2020
Docket Number: 19-ERDD-01

Comments for Indoor Ag and Advanced Wastewaterâ€“ request for information

(Comments are provided for Area B only)
Area B: Advanced Primary and Advanced Secondary Treatment Processes for Municipal Wastewater Plants
1. The following will help us target our specific research:
a. Are there emerging advanced primary and advanced secondary treatment technologies ready for demonstration at a California WWTP? If yes, which ones are of the highest priority for Californiaâ€™s WWTPs?
Comment:
There are several emerging advanced primary and advanced secondary treatment technologies that can be demonstrated at a California WWTP. In previous CEC projects cloth disk and compressible medium filters have shown to be very successful in terms of treatment performance compared to conventional primary treatment. Both primary filtration (PF) technologies are ready to be demonstrated (in larger scale and for longer duration) to provide advanced primary treatment (APT) at a CA WWTP. In addition to the filtration technologies, micro-screen and rotating belt filter/screen technologies are also ready to be demonstrated at a CA WWTP to provide APT.
Intensified biological treatment systems such as aerobic granular sludge and Microvi Biotech and short-cut nitrogen removal systems are amongst the highest priority advanced secondary treatment (AST) technologies that are ready to be demonstrated at a CA WWTP.

b. What are major barriers (technical, economical, and other) for wide adoption of the technologies listed in items 1a above?
Comment:
Even though the treatment performances of the PF systems are superior compared to the conventional primary treatment, the thickening requirement for the PF backwash reject stream can sometimes pose a technical and economical barrier for the implementation of the PF technology. Thickening process of PF can be optimized to reduce its size and operational requirements. The other technical and economical barrier associated with PF technology is associated with the denitrification process of the downstream secondary treatment system. PF removes greater amounts of carbon (compared to the conventional primary treatment method) prior to the secondary treatment step, which may have a negative impact on denitrification process in secondary treatment. This could impact the ability of WWTPs to remain within their nitrate effluent limits. Potential solutions include optimized addition of chemicals (with high content of readily biodegradable carbon) or coupling with some of the emerging AST processes.
Operational optimization and/or chemical addition are economical and technical barriers for the Micro-screen and rotating belt filter/screen APT technologies to produce

comparable performance to the PF-APT technologies.
Secondary treatment intensification systems or short curt nitrogen removal system mentioned above have been shown to be more effective compared to conventional secondary treatment in terms of energy efficiency and treatment performance. These AST biological systems require careful and skilled operation to stay within their target design and performance metrics. Additional capital investment is typically required to convert/upgrade an existing conventional secondary treatment system to AST technology. This economical barrier should be overcome in terms of added benefits of the AST technology such as energy efficiency, higher treatment performance, or space savings.

c. What are major technical challenges that could result from implementation of advanced primary treatment combined with advanced secondary technologies?
Comment:
Major technical barrier associated with implementation of APT combined with AST would be the increased design and operational complexity compared to the conventional system. The increase in design and operational complexity is well balanced when considered against the significant potential energy, environmental, and cost benefits. The complexity perception would also diminish overtime as these systems are successfully implemented and operated at CA WWTPs.

d. As our goal is to increase widespread deployment of advanced technologies, what research and demonstration is needed to eliminate these barriers and technical challenges and result in adoption of advanced primary and advanced secondary technologies in WWTPs?
Comment:
One major barrier is the industry acceptance of emerging systems in a quite conservative industry. Long-term and full-scale demonstration (preferably in more than one WWTP) is a very efficient way to overcome this barrier. Long term operation of the demonstration system should clearly identify the benefits, challenges, and disadvantages of the emerging APT and AST system compared to the conventional system in terms of treatment performance, energy requirements, operational needs, and costs.

e. What is the level of interest by WWTP on future research and development on advanced primary and advanced secondary treatment technologies? On the combination of the two advanced treatment technologies?
Comment:
The most efficient way of increasing the performance of any secondary treatment process is improving the primary treatment effluent characteristics. The most efficient way of advancing secondary treatment process is also achieved by improving the primary effluent characteristics. Primary filtration, primary effluent filtration, and biofiltration are the best technologies to improve the primary effluent characteristics as demonstrated by the previous CEC research and development projects. It should also be noted that primary filtration, primary effluent and biofiltration are the only APT technologies to increase the efficiency of secondary treatment processes for the first

three benefits listed above (i.e., decrease aeration power consumption, increase secondary treatment capacity, and enhance biological treatment kinetics).
Research and development of an AST technology downstream of an APT system (especially primary filtration or biofiltration) therefore has a high level of interest by WWTP managers, engineers, and operators. Most of the AST technologies would operate more efficiently when they treat primary effluent composed of soluble organics (instead of a mixture of particulate and soluble organics). As demonstrated in previous CEC project, primary filtration removes most of the particulate organics (i.e., up to 90 percent) leaving mainly soluble content in primary effluent, which then becomes ideal for secondary biological treatment. And, the remaining particulate organics have a much smaller particle size distribution (compared to conventional primary treatment effluent) again increasing the biological kinetics (e.g., up to four-fold). Main benefits of the emerging AST technologies include aeration energy savings, capital cost savings, and footprint reduction which are similar benefits of APT. Coupling these advanced primary and secondary treatment technologies would increase the total wastewater treatment plant energy and capital savings significantly. For example, some of the AST processes have the potential of reducing the aeration energy consumption of biological treatment by 30 to 50 percent. Primary filtration was already shown to reduce the secondary treatment aeration energy consumption by 20 to 30 percent. Therefore, overall combined aeration energy savings would be approximately 40 to 65 percent.

APT followed by AST would be the wastewater treatment plant of the future to minimize energy consumption (or even to achieve net zero energy with increased digester gas energy production) while decreasing the footprint and capital cost requirements.

2. The following will help us establish performance metrics and technology status in California:
For any of the technologies listed in item 1a:
a. What are the maximum solids and organic removal efficiencies to be expected from advanced primary treatment technologies compared to current best practices (i.e. primary clarifiers)?
Comment:
As concluded from previous CEC APT projects, with either PEF or PF the overall total suspended solids (TSS) removal will be in the range from 82 to 85% versus 45 to 65% in a conventional primary clarifier, depending on the hydraulic detention time. The corresponding organic removal, expressed as biochemical oxygen demand (BOD), with either PEF or PF will be in the range from 50 to 60% as compared to 30 to 40% in a conventional primary clarifier, depending on the degree of solubilization in the collect system and the hydraulic detention time (Caliskaner et.al., 2020).
Caliskaner, O, Tchobanoglous, G, Imani, L, Davis, B. (2020) Performance evaluation of first fullâ€□scale primary filtration using a fine pore cloth media disk filter. Water Environ Res. 2020; 00: 1â€“ 18. https://doi.org/10.1002/wer.1358

b. What is the maximum reductions in secondary aeration energy and chemical usage (if applicable) to be expected from advanced secondary treatment technologies over current best practices (i.e. activated sludge basins)?

Comment:
Some of the AST processes (e.g., aerobic granular sludge, Microvi Biotech, short-cut nitrogen removal systems) have the potential of reducing the aeration energy consumption of biological treatment by 30 to 50 percent.

c. For a demonstration project that combines advanced primary and advanced secondary treatment what should be the minimum performance goals?
Comment:
The reduction in the energy needed for biological secondary treatment downstream of either PEF or PF will be in the range from 20 to 30%, depending on the degree of solubilization of organic matter in the collection system. As mentioned in response to question above, expected savings for aeration energy consumption of AST is between 30 to 50 percent. Therefore, overall combined (i.e., AST followed by APT) aeration energy savings would be approximately 40 to 65 percent compared to conventional primary and secondary treatment system. In addition to the aeration energy savings, following treatment performance metrics can be used for APT systems:
TSS reduction = 80%, BOD reduction = 50%, Oil and grease reduction = 35%, and Giardia cysts and Cryptosporidium oocysts removal (see response to question e, below). Also, for AST following PEF or PF type APT systems more stable operation with predictable treatment performance is expected compared to conventional systems.

d. What is the minimum rate of return, simple payback or other economic metric needed by advanced technologies over current practices in order for them to be considered by WWTPs?
Comment:
Lifetime of main WWTP process systems/technologies range between 20 and 40 years depending on the specific system and site-specific conditions. A payback period less than 7-10 years is typically considered as a good investment by most WWTPs. A technology with a payback period less than 5 to 7 years is favored by WWTPs.

e. Are there other performance and metrics that should be researched and/or demonstrated?
Comment:
As interest in potable reuse of wastewater increases, a variety of processes have been proposed for advanced water treatment following conventional wastewater treatment. In all cases, the performance of advanced water treatment processes is improved when the quality of the treated wastewater feed is the best that can be achieved. One proven method of optimizing the performance of wastewater treatment facilities is constant flow operation with no extraneous return flows other than internal process recycle flows, such as return settled solids (Tchobanoglous et al., 2020 in press).

The benefits of constant flow and loading on treatment plant performance and the removal of specific constituents including microorganisms, inorganic constituents, organic constituents should be demonstrated. More specifically, the removal of Giardia cysts and Cryptosporidium oocysts by PEF and PF, and their subsequent removal through the biological treatment process. With constant flow it should be possible to demonstrate and establish the log removal credits (LRCs) achieved by the overall treatment process, which is extremely important in meeting the required LRCs for the advanced treatment of water for potable reuse.