Emerging Topics in Water Reclamation Process

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Drought and global warming pressure every people on this planet, especially in Southern California where population overgrowth associated with low precipitation rates are evidenced. In addition, availability of current water resources from Colorado River and State Water Project are depleted. Therefore, Southern California must elevate local water supply sources by applying the toilet to tap strategy prior to increase local water resources availability from 41% to 65% by 2040. The performance of core (secondary) treatment in water reclamation facilities must be well understood to yield highest quality of reclaimed water, accordingly.

Traditional secondary treatment employs microorganisms to degrade carbon compounds and to transform nutrients (i.e., nitrogen and phosphorus) in wastewater into a form of cell biomass and/or nitrogen gas. Activated sludge is mostly implemented in biological process due to its capability to remove various organic and nutrients, redundancy and reliability of the system combined with fast contaminant removal rates and high efficiency. However, microbiomes of activated sludge have not been fully explored due to vacant genomic sequencing technology as well as existing microbial taxonomy. As a result, the biochemical mechanisms in activated sludge have not been completely examined.

Dr. Asvapathanagul's research applies molecular biology to explain relationships among bacterial populations and discovering factors promoting and suppressing process' performance. She started her research by discovering specific genomic information for a group of bacteria causing foaming incidents, solids separation problems, in activated sludge and anaerobic digestors. Consequently, she employed her developed molecular tools to identify and quantify foaming bacteria abundance (i.e., *Gordonia amarae*-like and *Skermania* spp.) and further performed multivariance analysis to reveal causes promoting foaming bacteria's growth as substrate completion during optimal temperature present. Similar study was conducted to determine the factors enhancing nitrogen removal at a treatment plant. The results indicated biomarkers successfully can be utilized as indicators to exhibit denitrifying bacteria's activities, which can be used to monitor plant performance.