

## Improved Methods and Systems for Wastewater and Sludge Treatment

**R**esearchers at the University of South Florida have developed two new classes of technologies for lowering the cost of biological wastewater and sludge treatment systems. Wastewater and sludge treatment systems are expensive due to the high capital and operating costs associated with inefficient biotransformations by different autotrophic microbial populations. These microbes have limited application due to their slow specific growth rate or doubling time that is often reported on the order of days. This exorbitant cost has led to an interest in finding a way to either increase their abundance or their specific growth rate so that they could be used to a greater effect in wastewater treatment systems.

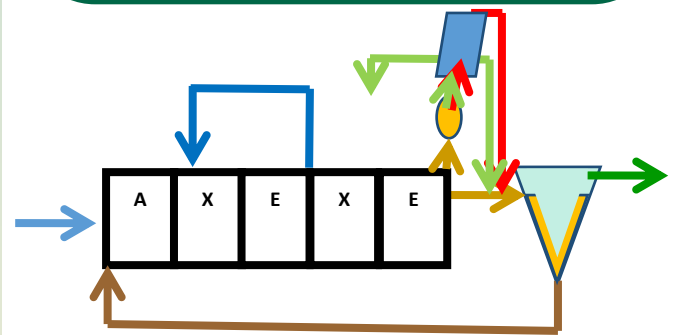
The first class of technology is the Selective Wasting System (SWS) that uncouples the solids retention time (SRT) of the targeted autotrophic microbial population from the bulk sludge. A modified inclined plate settler can be used to separate sludge by settling characteristics. For a biological nutrient removal (BNR) system, the use of the SWS increases the abundance (and SRT) of the nitrifying bacteria resulting in higher nitrification rate. Other autotrophic microbes, such as the Anammox and methanogens, could also be concentrated in biological wastewater or sludge systems for greater reaction rates, which would reduce the size of these systems.

The second class of technology is the CO<sub>2</sub> Optimization System (CO<sub>2</sub>-OS), which poises the soluble CO<sub>2</sub> concentration in biological wastewater and sludge systems for optimal specific growth rates of various autotrophic microbes. CO<sub>2</sub> removal systems that utilize a feedback control system can optimize growth conditions in a variety of bioreactor systems.

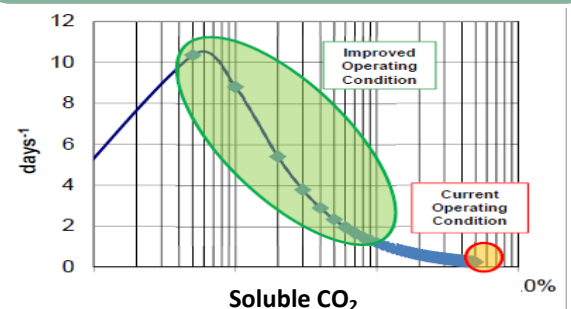
For both technology classes, new configurations for biological wastewater and sludge treatment systems have been provided. For some configurations, both technology classes can be combined for greater performance improvements. These new technology classes could also be used outside of municipal wastewater and sludge treatment plants for reducing the costs (capital and operating) of industrial wastewater and sludge treatment plants.

### ADVANTAGES:

- Inexpensive equipment for retrofit
- Lowers operating costs
- Smaller footprint
- Convert BioGas to BioMethane
- Use Anammox in BNR plants



**Selective Wasting System (SWS)**  
Nitrifying bacteria rich Type 3 sludge (red) reenters the system.  
Nitrifying bacteria poor Type 2 sludge is wasted. (green)  
A = Anaerobic, X = Anoxic, E = Aerobic



**CO<sub>2</sub> Optimization System (CO<sub>2</sub> - OS)**  
Superior growth of autotrophic microbes (Anammox, nitrifying bacteria and methanogens) through CO<sub>2</sub>

**Tech ID # 05A035, 06B079, 09A004, 09B121, 11A022, 11B187**

**Patent #: [7,641,796](#) / [7,655,143](#) / [8,545,700](#) / [8,940,159](#) / [8,535,534](#) / [8268,666](#) / [9,039,897](#)**