

2013-2014 Task List

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1 Reactor Construction

Construct five more reactors with tube settler GLS separators

1.1 Order Supplies by 9/13/13

1.2 Complete Construction by 9/25/13

2 Measurement Procedures

Learn necessary measurement procedures for the characterization of wastewater and microbial community

Complete majority of techniques during week of 9/16/13

2.1 Gas Chromatography

2.2 COD Assay

2.3 Microscopy

2.4 Nitrate

2.5 Dissolved Oxygen

2.6 pH

2.7 Dissolved Methane

3 Reactor Preparation

Testing of reactors for air and water tightness and preparation of Process controller file to run multiple reactors from one computer

Complete by 10/2/13

3.1 Media identification and selection – complete by 10/2/13

Develop model of media with biofilm. The model will include settling velocities of media with variable density and size during biofilm development.

Develop model for surface shear on fluidized particles. This model will serve to determine under what conditions bacteria can adhere to and grow upon a support material.

4 Inoculation

Reactors will be inoculated during the week of 10/7/13

5 Operation

Operation will continue throughout the semester. Likely three reactors will have support media and three will not.

During operation, biofilm development and granule characteristics will be monitored. Additionally, the team will investigate methods to agitate the reactor in order to prevent the rise of large clumps of granules. During the first weeks of operation, it will be determined how to best control the large number of reactors using the fewest number of computers.

Later operation will investigate the pros and cons of operation will a coagulant dose into the reactor.

5.1 Investigate new reactor designs

Recycle of substrate and biomass – more treatment and greater SRT

The challenge of recycle will be doing so with little energy input.

6 Investigate Methane Production and Capture

The methane capture during the summer was very low in comparison to the COD removed from the wastewater. Methane production and capture need to be optimized, but first the methane gas production pathway must be characterized through the following methods.

This research will also include modeling an energy balance for reactor operation. This will serve as a goal for the balance between energy to pump wastewater and energy attained from methane production.

6.1 Measure dissolved methane

6.2 Measure VFAs

6.3 Microbial community characterization – microscopy and quantitative DNA techniques

7 Determination of rate limiting step of COD destruction

Calculate amount of active biomass needed for COD removal and surface area for more mass transfer. This may elucidate whether or not there is simply a need for more contact time between substrate and biomass.

8 Pathogen Removal

This research will likely not take place until the Spring Semester. Pathogens will be modeled through the use of a tracer organism to determine whether pathogens can be directly removed during COD removal or in a polishing step.

9 Honduras Trip

Develop a “fact sheet” for the trip to Honduras. This must be finished before the end of the Fall semester.