Master Thesis project proposal

Title

Primary sludge hydrolysis for sustainable biological nitrogen and phosphorus removal

Background

Nitrogen removal from wastewater is accomplished by combination of biological processes of nitrification and denitrification. For denitrification, carbon source is needed to reduce nitrate to nitrogen gas. Coming stringent requirements on nitrogen removal are motivating for using post-denitrification as a polishing step of nitrogen removal. Post-denitrification relies on supply of external carbon source, often methanol produced from fossil origin oil and gas. The need for external carbon is especially high for diluted wastewater that has a low content of readily biodegradable organic substrate.

Phosphorus removal in Sweden is often accomplished by chemical precipitation. Biological phosphorus removal is however an interesting option since it does not rely on supply of precipitation chemicals and allows for easier phosphorus recovery. Biological phosphorus removal requires presence of readily available organic substrate in form of volatile fatty acids (VFA).

Carbon source for effective nitrogen and phosphorus removal can be produced by hydrolyzing/fermenting primary sludge. The process has been tested at a temperature of 36 C (with heating) in previous IVL projects and at ambient temperature in a project led by Sweden Water Research and Tekniska Verken in Linköping.

Project description

The aim of the project is to:

- Investigate the influence of temperature on VFA production by hydrolysis
- Investigate the influence of hydraulic retention time on VFA production
- Select the optimum combination of temperature and hydraulic retention time for maximizing the VFA yield while minimizing the energy requirement

The work is to be performed experimentally using bench scale reactors. Several sets of tests are to be performed, data analyzed and compared to the literature values. Possibly even several trials testing the produced carbon source can be performed. The work will be performed at Sjöstadsverket Water Innovation Center (SWIC), located in Stockholm.

Organization

The supervisor from IVL is Andriy Malovanyy.

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