Anaerobic oxidation of Methane to Short Chain Fatty Acids

Employing Methanotrophic Bacterial Consortium Rich Sediment

Social relevance: The fossil liquid petroleum fuel is fast depleting and proven global natural gas (containing 99–100% CH_4) reserves have increased from 3990 trillion m^3 in 1990 to 6973 trillion m^3 in 2012, and more is likely to be discovered in the future. Biosynthesis of methane from anaerobic digestion is also gaining importance throughout the world. These two factors thus make methane a more reliable source of energy for the near future. Though methane is a clean burning fuel with high calorific value, large scale storage and transportation across the continents is challenging. Adding to this challenge is the elevated risks of accidental leakage. Also, to have the liquid petroleum usage entirely replaced by methane, very high process modification costs would be involved. Rather, it is more logical to have methane converted to liquid petroleum fuel fractions. Though Fischer Tropsch gas to liquid (FT-GTL) process is already in use to chemically convert methane to liquid fuel fractions, the process itself is suitable only for large scale operations being energy intensive and a bioconversion process can be more cost effective for small gas volumes produced at anaerobic digestion plants

Technological Challenges: Anaerobic methanotrophic archaeal consortium are conjectured to bring about the bioconversion of methane to hydrocarbon fuels. Biomass chosen for this investigation is activated sludge from UASB and a deep sea sediment from the marine lake Grevelingen (Scharendijke Basin, the Netherlands) in the latter, anaerobic methane oxidation is likely to occur due to the presence of both sulphate and methane in the anaerobic layer. Recently, these sediments are thoroughly studied for the existence of 'cable bacteria', a *Desulfobulbaceae* that is capable of mediating electron transport over centimetre scale distance. However, steering the biochemical pathway towards conversion of Methane into acetate and higher fatty acids is crucial. The conversion will first be conformed and optimized in batches where the effects of electron donors and acceptors that are speculated to influence the conversion will be analysed, followed by a continuous reactor system like biotrickling filter. The bottle necks involve low solubility of methane in water phase, low biomass yield and slow conversion rate.

Name: Tejaswini Gowda Madapura Eregowda
Nationality: Indian
Contact: T.Eregowda@unesco-ihe.org; tejaswini.gowda.me@gmail.com
Promotor: *Prof. Dr. Piet N. L. Lens,* (UNESCO-IHE, the Netherlands; Tampere University of Technology, Finland)
Post-graduation: MTech in Environmental Engineering, Manipal University, Manipal, India (2013)