MFC4Sludge is an industrial research EU funded project that involves European SMEs and first class RTDs.

This project aim is to provide an innovative solution consisting of a Microbial Fuel Cell (MFC) coupled to a hydrolytic-acidogenic Anaerobic Digestion process (HA-AD) in order to develop a new strategy for sewage sludge from wastewater treatment plants (WWTPs) valorisation.

Abstract

Project Participants

Objectives

FP7 – Capacities programme

MFC4Sludge has received funding from the European Union's Seventh Framework Programme managed by REA, Research Execution Agency (FP7/2007_2013) under Grant Agreement N. 605893.

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• Adapt HA-AD so it can be used as a pre-treatment of sludge for MFC, reduce the residence time of sludge to 7 days, keep the operating temperature below 30°C and avoid CH4 production while maximising concentrations of volatile fatty acids (VFA) and other suitable substrates for the MFC.

• Research and document the microbial community to be selected as for an optimal partial HA-AD and MFC processes combination and produce start-up cultures for the partial HA-AD processes to be developed herein.

• MFC development and performance: obtain power output ratings of at least 250W/m3, reduce MFC carbon impact in electricity generation to 0.3 kg CO2/kWh by an optimized design and usage of materials, develop novel stack configurations and increase the ratio of surface area of electrodes to volume by around 20%.

• MFC control and integration: development of a non-linear, grey-box mathematical model aimed to HA-AD-MFC process description (electrical performance, microbiology, mass and heat transfer, etc), develop a distributed control system (DCS) and implement a MPC controller.

• Prototype: research and document the scaling-up process of the HA-AD-MFC process for sludge treatment, construct a prototype with a 10L-volume MFC, achieve at least 90% of COD degradation, reduce sludge volumes at least 75% and generate a higher electricity output than required by the HA-AD. Initial estimations foresee a net energy generation of 140 W/m3 or more.

Contributions to technical progress

• Wastewater sludge pre-treatment using HA-AD;
• MFC system development aimed at improving system efficiency and cost-effectiveness;
• MFC control strategies design in order to reach an optimal performance;
• Integration of the different elements which compose the final solution.
• Demonstration of techno-economical and environmental feasibility of developed technologies for their implementation in wastewater treatment plants.
• Promotion of proposed solution application for distributed power production.
• Testing of the technological competitiveness as renewable and integrated technological solution. By valorising sewage sludge the wastewater treatment process can become more sustainable.