EXECUTIVE SUMMARY

DESCRIPTION

The LO2X project aims to demonstrate the environmental and socio-economic benefits of a synergic co-treatment of sewage sludge and wastes (raw, digested manure, high load food processing wastes, pesticides, leachates and others) with energy and phosphorus recovery through supercritical water oxidation (SCWcO).

The oxidation process using water in supercritical conditions is a recently developed technology that turns to be and interesting alternative to treat some wastes.

The technology is based on the particular properties of water under temperature and pressure conditions beyond its critical point (T>374ºC and P>200 atm). In such conditions, water may oxidise completely (efficiency 100%) any organic compound to simple molecules: water (H2O), carbon dioxide (CO2), nitrogen (N), etc.

By means of this technology organic pollutants do not requiring further inertisation treatment facilitating final disposal of a small fraction. Furthermore, the process shows a net positive energetic balance due to is possible to use the heat produced by the exothermic reactions and the expansion energy of water under supercritical conditions.

LO2X project involves the construction and operation of a demonstrative scale prototype for the treatment of a significant fraction of the raw sludge generated in a representative medium sized urban WWTP and wastes collected from the surrounding area.

The prototype will be constructed and operated in Paterna (Valencia, Spain).
The consortium includes representatives of several sectors and it is performed through a cross border collaborative model between Ireland and Spain: AINIA technological centre as coordinator of the project with more than 25 year of experience in supercritical fluids and environmental technologies, IMECAL specialist in equipment construction, ISOLUX company with large experience in the construction of water management facilities worldwide, IVEM responsible of the Paterna urban WWTP and SCFI an Irish hi-tech company with expertise in supercritical water oxidation.

OBJECTIVES

The objectives set to demonstrate the technology performance are:

1. Design and construction of a prototype for the oxidation in supercritical water of mixtures of sludge (main matrix with phosphorus (P) and embedded energy from organic content) and other wastes for synergistic enhanced performance: manure (for ammonia elimination and P recovery), food wastes (for extra carbon) and complete destruction of organic toxic substances (pesticides and leachates), contributing to the water quality objectives of the Water Framework Directive and the Urban Waste Water Directive and the Nitrates Directive.

2. Determination of Operating conditions and mix ratios for best process yield and energy balance, linking water/energy and contributing the achievement of climate

neutral waste water systems and a 20% energy improvement in wastewater treatment for 2020.

3. Determination of Operating conditions to optimise P recovery from wastes. Contributing to the objectives of the Resource Efficiency Roadmap (Wastewater Treatment Plants WWTP as resource factories).

4. Determination of Reduction in the final amount of waste generated in a WWTP and better quality for safe disposal, contributing to the objectives of the Waste Directive and the phasing out of land filling of organic wastes.

5. Determination of Economic balance linking environment, innovation & socioeconomic growth, particularly:

    - Reduction of costs of sludge management versus current sludge management scheme.
    - P cost of recovery compared to current market prices and tendencies of P from P-rock
    - Cost of the treatment wastes compared to current treatment/disposal pathways.
    - Economic balance of energy.
    - Local socioeconomic assessment
    - Dissemination effectiveness and social awareness assessment

RESULTS

The main expected results are:

1. Current WWTP can't treat pesticides. The SCWO opens a new pathway for its safe elimination. The project will avoid the emission of a quantity of pesticides: those contained in the sludge to be measured. Complementary it is of interest to test other wastes highly polluted with pesticides, e.g. waste liquors from agricultural activities and industries in the surroundings. This can't be considered as an environmental improvement unless evidence is collected during the project.

2. The prototytpe should treat 100 kg DM/day. For a mixture 50:50 of thickened sludge:pig manure it would avoide the application of 30751 kg of Nitrogen/year. More N may be eliminated from wastes rich in N.

3. The SCWO process needs the feed to between some operating ranges to provide stability and a positive energy balance regarding organic and solid content of feed (positive process if >8% organic matter or COD >70,000 mg/L). The data to calculate the energy balance will be obtained and compared vs. baseline.

4. Considering the prototype capacity it would recover around 5000 kg of P per year. P will be part of the inorganic residue and will be present as iron phosphate. Such residue may, subject to meeting legislated standards, be applied directly as a fertiliser to land or as an additive to a fertiliser mix. Otherwise the residue isequivalent to medium grade phosphate rock and can be processed further to recover the P as H2PO4. Phosphate rock supply is limited and the phosphate industry is keen to find alternative supplies.

5. The actual quantity of sludge treated at the prototype will depend on the ratios of the mixture of waste at the feed of the prototype. Considering that it may be around 50-90 kg DM per day from TS it would mean that 18250-32850 kg DM per year would be reduced to 1800-3200 kg of inerts instead of 91-162 tones of dewatered sludge (20% DM)

6. All the data resulting from the demonstration activities will be used to assess the economic cost effectiveness of the new system.

PARTNERS

AINIA (www.ainia.es) is a Spanish non-profit technological centre formed by companies in the food manufacturing sector and related industries, whose objective is the promotion of innovation and technological development.

Industrias Mecánicas Alcudia S.A., **IMECAL**, is a SME which was founded in 1979 as an engineering Company in the metal sector. IMECAL has a highly innovative vision that has allowed the Company to expand the market and increase its manufacturing volume in the recent years.

URBASER is a company leader in waste management and treatment, specialised in street cleaning, waste removal and transporting, urban waste treatment and recycling and comprehensive management of the water cycle.

IVEM is formed by a group of engineers that have focused their activity on the development of electric and mechanical projects, automation of installations, control and supervision systems, water treatment and industrial safety.

SCFI is an Irish company that develops technologies to treat organic wastes and generate renewable energy for industrial and municipal markets. SCFI's patented technology, AquaCritox, uses supercritical water oxidation to destruct highly contaminated organic waste waters and wet sludges while producing renewable energy.