

Master thesis

Coupling of ozonation and nanofiltration for wastewater reuse: Life Cycle Analysis.

General context:

SAWARE is a four year French project which objective is to develop a tertiary treatment of municipal wastewater coupling nanofiltration (NF) and ozonation for a safe wastewater reuse. Nowadays, water scarcity and quality are big challenges facing humanity in many places around the world. To solve this problem, municipal wastewater (WW) is thus considered to be an alternative water source for various applications after proper treatment. Nonetheless, urban WWs are increasingly contaminated with organic micropollutants (OMPs). Although their concentration in urban WWs is often very low (10 µg/L), their effects can be disastrous because of their potential persistence in the environment, their possible endocrine disrupting effect and their accumulation in biological bodies. These toxic compounds have become a major issue for the Water Utilities (REACH 2006, WFD 2000 and 2012) and legislations in European Union in the coming years will be tightened with regard to OMPS in municipal WW and to their discharge. These evolutions are driving the WW treatment to come up with advanced technologies. In this view, membrane processes are widely used but they are only a separation step, they must be coupled with techniques for the efficient destruction of pollutants and then provide new hybrid processes as a posttreatment step. With this aim in mind, Ozonation (O_3) and Peroxone processes ($O_3 + H_2O_2$) are also investigated, as they generate highly active species, hydroxyl radicals. Coupling of membrane processes and Advanced Oxidation Processes (AOP) could thus be a promising treatment for WW reuse.

SAWARE is a project of applied research which objective is to develop an innovative and advanced integrated “membrane and oxidation” system for the treatment of municipal WW coupling membrane bioreactor (MBR), nanofiltration (NF) using organic and innovative inorganic material and ozonation (O_3) for a safe and affordable WW reuse. The main innovation of the SAWARE project lies in the MBR/ O_3 / NF expected synergistic effect for advanced treatment of secondary effluent containing a cocktail of priority substances targeted by the legislation.

Objectives of the Master

The objective of the master is the evaluation of the environmental benefits of these processes through Life Cycle Assessment (LCA) method.. Two types of operation train will be studied : i) MBR and nanofiltration alone ii) MBR/ O_3 /Nanofiltration. The work requires a good comprehension of the processes, calculation of material and energy balances and design of the main operations. The results will be then used for LCA completion with the help of dedicated software (Umberto).

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The efficiency and sustainability of the proposed solutions will be thus evaluated by a global analysis.

Beginning of the Master : first semester of year 2020. This master thesis result from a collaboration between INSA Toulouse and IEM, it will be located at INSA Toulouse TBI (SOPHYE team, http://www.toulouse-biotechnology-institute.fr/fr/la_recherche/pole-genie-des-procedes-durables/sophye.html).

Required competences:

The candidate, level Master or Engineer, must have completed a course in Process Engineering and have good knowledge of chemistry. Notions about LCA method are necessary. In addition, the candidate must possess good interpersonal and communication skills, both written and oral.

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