DOCTORAL POSITION - THESIS PROGRAM
2020-2023

Title  Coupled processes for the treatment of micropollutants present in high salinity waters.

Keywords  Micropollutants, Analyzes, Salinity, Adsorption, UV Photolysis, membranes.

Contextual elements
Due to human activities generating pollution and the leaching of soils, seawater in coastal areas is subject to an increase in the concentration of nutrients and micropollutants. This change in the quality of seawater can disrupt the marine environment but also aquaculture (oyster farming, shellfish farming, mussel farming, etc.). In order to minimize the impact of undesirable compounds on aquaculture production these harmful micropollutants have to be removed.

Few studies concern very saline waters whose high ionic strength can affect the operating and performance of treatment processes. Similarly, the few existing hatchery water treatment processes have not been subject of optimization studies both in their design and in their operation.

General SOAP program
It is within the framework of the "Securing Shellfish Hatchery by Process Coupling“ (SOAP), funded by the European Maritime and Fisheries Fund (EMFF) that this study will take place. This research and development project brings together three academic laboratories (Aix-Marseille University, ENSC Rennes, IMT Atlantique), a public research center IFREMER (Bouin, Vendée, France) and two private companies Vendée Naissain and Novostrea).

The SOAP program as a whole consists of the design and study of water treatment processes in terms of performance, operating conditions and generation of by-products. The effects of current disinfection systems implemented in shellfish hatcheries, in particular UV irradiation which can lead to the formation of toxic metabolites in the presence of organic micropollutants, will be studied. An innovative process combining active carbon and membrane processes, which does not generate by-products, will be developed.

While the study will be carried out separately on the disinfection and the decontamination treatment, the whole process will be evaluated (i) at pilot scale with controlled input and operational parameters, (ii) transferred to the hatcheries of the two socio-economic partners in order to assess performance according to the variability of the waters.

The purpose of this project is the transfer of an optimized disinfection / decontamination technology after a validation process in two hatcheries, to the project partners and further to the socio-economic world.

Objectives of the thesis
The objective of this study is to study the performances of coupled treatment processes (adsorption, UV disinfection, membrane filtration) against targeted organic micropollutants.
Specific thesis program
The specific thesis program has three parts:
- A laboratory phase allowing (i) the implementation of an analytical strategy and a multi-residue analysis method to assess the contamination of water resources used in aquaculture by organic micropollutants. (ii) experiments of micropollutant adsorption on activated carbon and UV oxidations. The kinetics and the adsorption - oxidation capacities will be determined. Any by-products will be identified.
- The membrane-activated carbon coupling to eliminate organic micropollutants will be studied on a laboratory pilot scale. Two configurations will be tested: (i) an ultrafiltration loop serving as an adsorption reactor and the membrane allowing the retention of suspended matter (ii) a configuration with an adsorption reactor (CAG -grain activated carbon) upstream or downstream of the membrane process.
- A study of UV coupled processes - Ultrafiltration - Adsorption carried out on a pilot scale under controlled conditions on the IFREMER’s platform (Bouin - Vendée). An analytical follow-up will be carried out to verify the effectiveness of the whole process according to the operating conditions.

Skills requested
The candidate will have knowledges and skills in the fields of water chemistry, chemical engineering or environmental engineering. He (She) must be autonomous in his (her) work. French language will be appreciated.

Location
Ecole Nationale Supérieure de Chimie de Rennes
UMR 6226 Institut des Sciences Chimiques de Rennes – Equipe Chimie et Ingénierie des Procédés de l’environnement

Duration - Funding
3-years with an ENSCR doctoral contract
Thesis start date: September 2020
Doctoral specialty: Chemistry: Environmental Processes
Monthly remuneration: € 1 894 gross – amount defined by the doctoral contract

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