Linking the role of carbon and nitrogen on the fate of organic micropollutants in aquatic systems

The water sector is struggling worldwide, including Denmark, with water scarcity and access to potable water. Contamination of different water sources by organic micropollutants jeopardize the efforts to increase water reuse. Organic micropollutants are chemical compounds such as pharmaceuticals, pesticides and biocides that are present in our surface and coastal waters, and are not removed in the wastewater treatment plants, but continuously emitted to the environment. Thus, research to fully characterize their fate in the different aquatic systems is needed.

The researchers Pedro N. Carvalho and Ulla E. Bollmann from Aarhus University, Department of Environmental Sciences (AU-ENVS), sought support to acquire a state-of-the-art total organic carbon (TOC) analyser with in-built capacity to simultaneously measure total nitrogen (TN) in aqueous samples. They are both young researchers looking forward starting their own research projects and groups within AU-ENVS. Such an equipment will be essential for them to initiate environmental chemistry studies, exploring the link and role of carbon and nitrogen on the fate of organic micropollutants in aquatic systems:

Pedro N. Carvalho is developing work in the optimization of eco-technology for water treatment, specifically targeting the efficient removal of organic micropollutants. Fixed-bed biofilm solutions, operates with a high surface area of support material allowing microorganisms to attach and form a biofilm. Biofilm microbial communities are able to degrade and metabolize not only the typical wastewater organic carbon and nitrogen but also the organic micropollutants. Carbon and nitrogen may be critical players to promote the co-degradation of the organic micropollutants in the biofilm reactors.

Ulla E. Bollmann is investigating the fate of organic micropollutants in the natural ecosystems, in particular coastal environments. Carbon and nitrogen are expected to play an important role in that process. The organic matter content (carbon) in the water phase is a critical factor for the sorption/sink of the compounds leading to their persistency. Besides biodegradation, photodegradation is another critical pathway for the removal or persistency of organic micropollutants in the environment. For certain compounds, dissolved organic matter is an important factor for the formation of reactive species by sunlight.

A 1.5-year (July 2018 – December 2019) project is framed by Pedro Carvalho and Ulla Bollmann to set up the equipment and develop each their own studies. The long-term goals of their research accommodate i) development of low-cost and reliable technology, with potential gains for the water sector and ii) understanding the fate of the current contaminants in natural ecosystems and being prepared to intervene on regulation or development of protective measurements. Both research lines comprise wide economic and societal direct impacts to population.