

16.ª EDIÇÃO

**ENCONTRO DE
INVESTIGAÇÃO
JOVEM
UNIVERSIDADE
DO PORTO**



**10.11.12
MAIO 2023**

REITORIA DA
UNIVERSIDADE
DO PORTO

U.PORTO



TÍTULO | TITLE

Livro de Resumos do 16.º Encontro de Investigação Jovem da U.Porto / *Book of Abstracts Young Researchers Meeting of U.Porto*

Universidade do Porto

Vice-Reitor para a investigação e Inovação

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ISBN

978-989-746-356-3

Design

Serviço de Comunicação e Imagem da U.Porto

20862 | Development of a bioremediation system for the removal of PFAS from aquatic environments

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Abstract

Among the many pollutants that afflict aquatic ecosystems, PFAS (per- and polyfluoroalkyl substances) stand out due to their distribution, environmental persistence and ecotoxicity. Currently, there are no suitable remediation technologies capable of mitigating PFAS-related pollution in these ecosystems. Yet, the combination of nanophotocatalysis (NPC) and bioremediation (BRMD) may prove useful in combating PFAS aquatic pollution. NPC has shown promising results for the breakdown of persistent pollutants, while BRMD processes can benefit from the high degree of redundancy and promiscuity of bacterial catabolism to efficiently degrade various pollutants and their sub-products. As such, this work aims to develop an efficient BRMD unit, based on a synthetic bacterial consortium with orthogonal defluorination capacity, and explore its potential to act as a secondary water treatment step in tandem with a TiO₂-based NPC treatment, to remove PFAS from aquatic matrices.

The first development step, currently ongoing, is set on screening different bacterial strains enriched with fluorinated pollutants, petroleum hydrocarbons or cyanotoxins. This sorting is being achieved by validating the degradative capabilities of the strains based on their bacterial growth and defluorination performances. So far, these preliminary tests led to the selection of two prospective consortium members, *Delftia acidovorans* MFA5 and *Labrys portucalensis* F11, based on their capacity to defluorinate 50 mgL⁻¹ of fluoroacetate and fluorobenzene in 8 days, respectively.

Once all strains are selected and their co-cultivation dynamics are ascertained, a synthetic bacterial consortium will be assembled and tested as a BRMD step coupled to a primary NPC treatment against two different PFAS in quasi-real aquatic matrices.

Keywords: Environmental pollution, PFAS, defluorination, nanophotocatalysis, bioremediation

Acknowledgements

This research was conducted in the scope of the project Xenohybrid, funded by Fundação Amélia da Silva de Mello. This work was also supported by the Strategic Funding UIDB/04423/2020 and UIDP/04423/2020, through national funds provided by Fundação para a Ciência e Tecnologia and European Regional Development Fund.