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PhD Thesis

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"Study of Monoacylglycerides production in microalgae and their anticancer activity"

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Abstract

Marine microalgae represent an interesting and sustainable source for the study and production of valuable molecules with potential biotechnological applications.

Additionally, marine microalgae have high photosynthetic efficiency and biomass production rates, which make them an attractive source of renewable energy and bio-based products.

These microorganisms produce, indeed, a wide range of high-value compounds, including polyunsaturated fatty acids (PUFAs), pigments, proteins, vitamins, polyphenols, phytosterols and hormones. These molecules in turn exhibit bioactive properties like antioxidant, antihypertensive, anticancer, antimicrobic, antiviral activities. Despite the potential of marine microalgae for biotechnological applications, there are several challenges that need to be addressed to optimize their study and production. My PhD project focused on the study of bioactive lipids from microalgae, in particular investigating the presence of monoacylglicerides (MAGs) in different species and their antiproliferative effect on cancer cells. For this purpose, twelve selected species, including diatoms and dinoflagellates, were cultured and examined for the presence of MAGs. An LC-MS approach was used to identify the most productive species for further studies approached to optimize the production of these compounds.

The antiproliferative effect of MAGs was assessed evaluating cell viability of two different types of cancer cells: HCT-116 wild type colorectal cancer cells and U-937 blood cells for acute myeloid leukaemia. The most promising molecules, in term of bioactivity, were then further analysed to investigate the molecular pathways activated in response to the treatment. To this aim, cells treated with the bioactive MAGs were subjected to RNA extraction and transcriptome analysis to identify differentially expressed genes. By analysing gene expression patterns, genes involved in specific biological processes, such as development, differentiation, and cancer were identified.

These findings confirmed the great potential of marine sources for the production of high-value compounds and the possibility to identify new therapies and develop personalized medicine approaches.