Zebrafish embryo bioassays for the assessment of microalgae efficiency in the removal of salicylic acid and its toxic effects from water

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1. Introduction – The removal of pharmaceuticals by microalgae-based treatments is gaining increasing attention due to their advantages, namely eco-friendliness, simultaneous fixation of CO_2 and production of high-value products, recovery and valorization of algal biomass, etc. The mechanisms by which microalgae remove pharmaceuticals from water include bioaccumulation, biosorption and, mainly, biodegradation [1]. Transformation products (TPs) may be generated from the biodegradation of pharmaceuticals. Still, it is not feasible to determine all TPs and their respective toxic effects. Therefore, in this work, the analytic quantification of salicylic acid after microalgae treatment was coupled with toxicity tests in order to comprehensively assess the removal efficiency of this pharmaceutical.

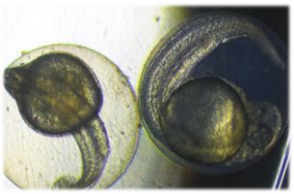

Image 1. Zebrafish embryos.

2. Experimental – Three different microalgae strains, namely *Chlorella sorokiniana*, *Chlorella vulgaris* and *Scenedesmus obliquus*, were used for the removal of salicylic acid from water under cultivation in bubbling column photobioreactors that were batch operated until the end of the exponential growth phase. Microalgae growth and salicylic acid concentration were monitored during the cultivation, the final effluents being tested for their toxic effects on zebrafish embryo (Image 1). These effects were compared with those suffered by embryo exposed to experimental solutions with known concentrations of salicylic acid.

3. Results and Discussion – While growing, microalgae were able to remove salicylic acid from water, *S. obliquus* being the most efficient strain with a 93 % removal. Furthermore, microalgae treatment allowed for the reduction of negative effects caused by salicylic acid on the embryonic development of zebrafish, namely mortality and morphological abnormalities. *S. obliquus* was confirmed to be the most efficient strain, allowing for reductions of 78% and 98 % in mortality rate and total abnormalities (at 144 h post fertilization) as compared with the feeding concentration. Furthermore, the observed effects on zebrafish embryo under exposure to effluents from microalgae treatment were equivalent to those caused by experimental solutions with the same concentration of salicylic acid.

4. Conclusions – Microalgae strains considered in this work were not only able to remove salicylic acid from water, but also to reduce the associated toxic effects on zebrafish embryo. Furthermore, the obtained results indicated that TPs from salicylic acid biodegradation by microalgae were not toxic for zebrafish embryo.

5. References

[1] J.-Q. Xiong, M.B. Kurade, B.-H. Jeon. *Trends Biotechnol.* 36(1), (2018) p. 30.