Antibiotics removal from aquaculture effluents by ozonation: chemical and toxicity descriptors

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Sub-Theme 3: "Emerging pollutants and managing wastewater and waste"

1. Introduction

Antibiotics (ABs) are often applied in aquaculture to prevent fish diseases, which can be released in their effluents due to the poor elimination by wastewater treatments. ABs and their metabolites can bring serious threats to ecosystems and human health, namely the proliferation of antibiotic-resistant bacteria and their related genes. Although ozonation has been used to improve water quality in aquaculture, applications for ABs removal are still scarce.

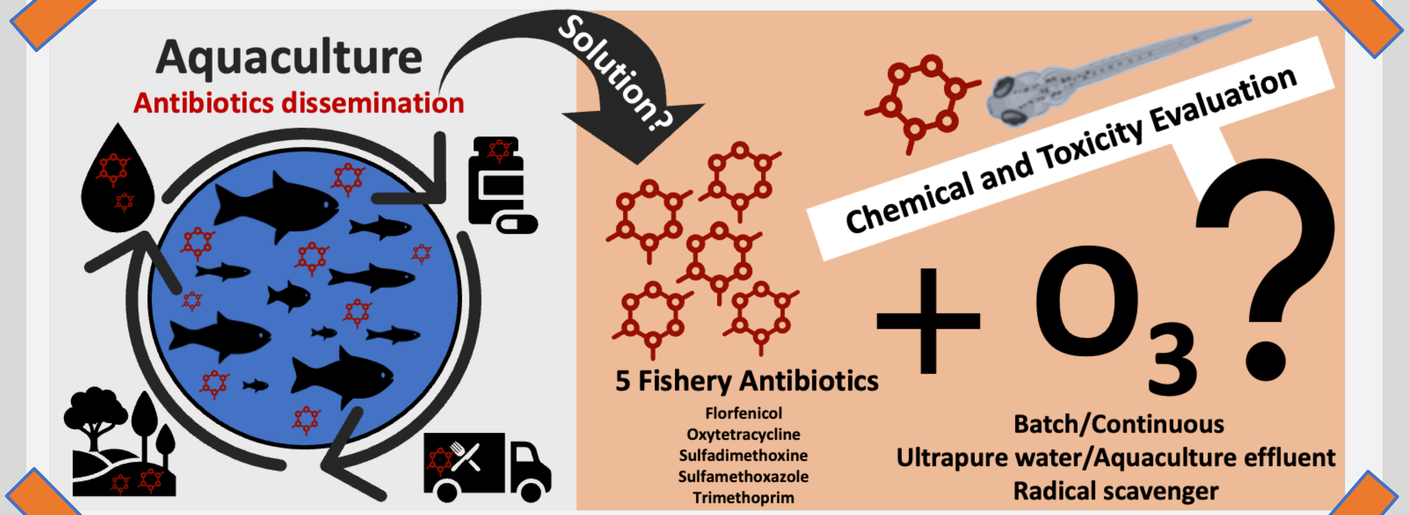


Figure 1. Topic of study

2. Objectives

Study of ozone (O_3) as a possible oxidizing agent to remove emerging pollutants, specifically fishery ABs, from aquaculture effluents: florfenicol (FF), oxytetracycline (OTC), sulfadimethoxine (SDM), sulfamethoxazole (SMX), and trimethoprim (TMP), bringing important information on the degradation of ABs by O_3 and its potential toxicity.

3. Methodology

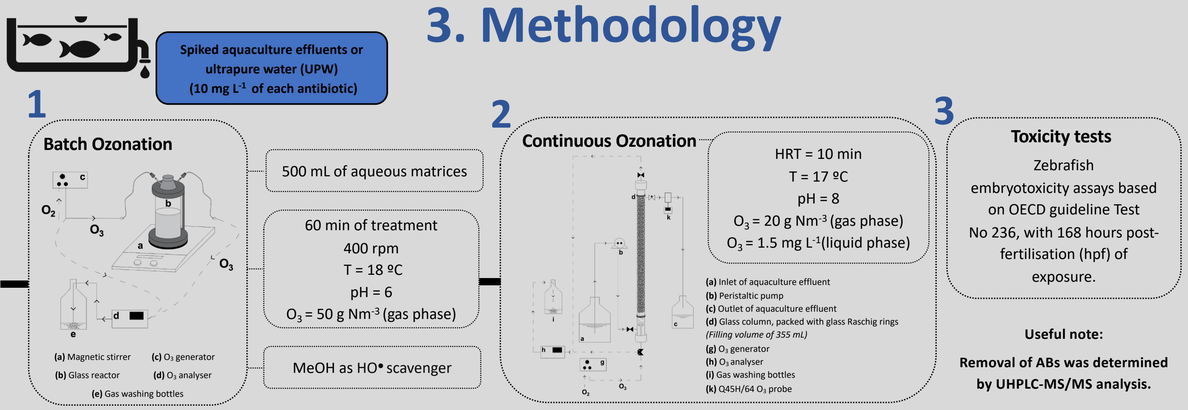
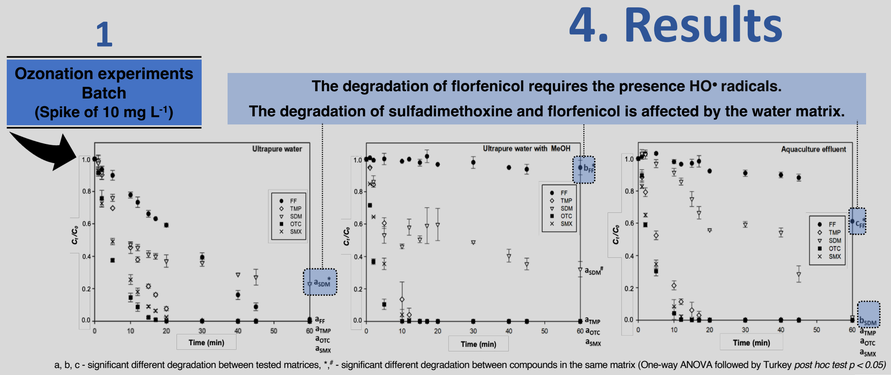


Figure 2. Scheme of performed experiments (*set-up and conditions*)

4. Results



a, b, c - significant different degradation between tested matrices, *,# - significant different degradation between compounds in the same matrix (One-way ANOVA followed by Turkey *post hoc test* $p < 0.05$)

Figure 3. Degradation of target antibiotics under batch ozonation

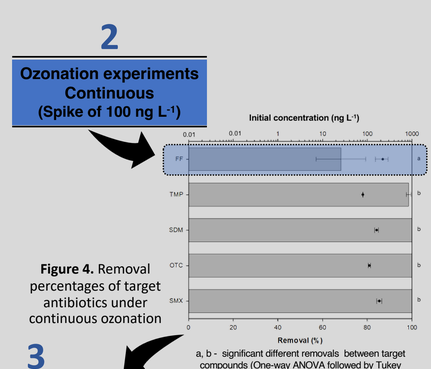


Figure 4. Removal percentages of target antibiotics under continuous ozonation

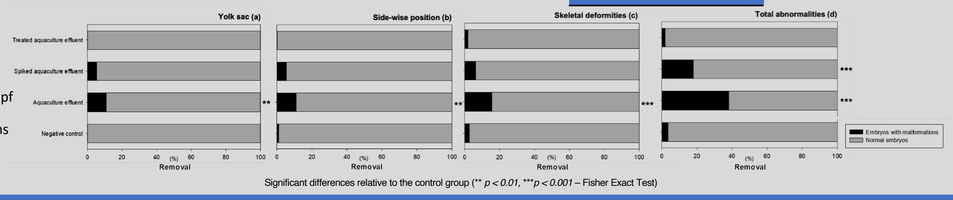


Figure 5. Rate of embryonic malformations detected at 168 hpf in embryos exposed to the different experimental conditions (continuous ozonation)

Significant differences relative to the control group (** $p < 0.01$, *** $p < 0.001$ – Fisher Exact Test)

5. Conclusions

- Ozonation was an efficient solution for removing ABs widely used in aquaculture, except for FF;
- Florfenicol degradation requires HO•, being highly dependent on the type of water matrix;
- Endpoints of the zebrafish assays did not reveal toxicity potential compared to negative and positive controls, in clear contrast with the untreated effluent.

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