

# Applying the sunlight to pharmaceuticals removal from aquaculture's waters

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Water quality is a question which causes a great concern for both scientific community and industries. The goal of this work is use the sunlight to remove organic contaminants from aquaculture's water through the photo-degradation process. This work is focused on a specific class of water contaminants – the antibiotics, among which stands out the oxytetracycline. Oxytetracycline, OTC (Figure 1) is a broad spectrum antibiotic adopted for treatment and control of a wide variety of bacterial infections. Its use in aquaculture is allowed in almost all countries of European Union but its effects on water, fish and the environment are still little explored. In the case of intensive aquaculture, when this contaminant is not completely removed from water, it may be released through effluent discharge, affecting the surrounding environment, or may accumulate along the water treatment circuit (in semi-closed circuits), endangering the species produced.

The work is supported by a set of OTC photo-degradation experiments in different aqueous solutions. All irradiation experiments were done using a sunlight simulator (a Solarbox 1500 equipped with a 1500 W arc xenon lamp, 550 W/m<sup>2</sup>) and OTC initial concentrations of 8.0x10<sup>-6</sup> M. The quantification of OTC was made by HPLC-DAD and the photo-degradations experiments were also followed by molecular fluorescence, UV-vis spectroscopy and carbon analyser.

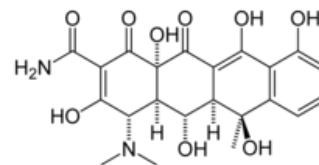


Figure 1. Oxytetracycline structure

For the photo-degradation studies in natural waters, several water samples from aquaculture were collected at different water treatment steps in two independent companies of intensive fish production. The aquaculture water samples were spiked with OTC so that all samples have the same concentration of the antibiotic. The overall quantum efficiency of photoreactions, as well as, the outdoor half-life times of OTC in water at 40 degrees north of latitude, at sea level are estimated for the first time. The results obtained are very promising to adopt the photo-degradation to remediation of aquaculture's waters – for instance, for a midsummer day, the outdoor half-life times are lower than 30 minutes in these natural waters, approximately five times faster than the photo-degradation of OTC in distilled water.

The different behaviour observed on OTC photo-degradation in distilled water and in aquaculture's water may be justified by the influence of several constituents of aquaculture's waters and their properties, such as, variations of pH and oxygen levels, organic matter, suspended particles, salinity, dissolved ions and ionic strength. The effect of all these parameters were evaluated on OTC photo-degradation and some of them contribute significantly to increase the kinetics of OTC photo-degradation. The results obtained reveal that the natural conditions of aquaculture's waters are particularly favourable to the OTC photo-degradation.