

## The Impact of Oxytetracycline on the Aquaponic System, Biofilter, and Plants

**Authors :** Hassan Alhoujeiri, Angele Matrat, Sandra Beaufort, Claire Joaniss Cassan, Jerome Silvester

**Abstract :** Aquaponics is a sustainable food production technology, and its transition to industrial-scale systems has created several challenges that require further investigation in order to make it a robust process. One of the critical concerns is the potential accumulation of compounds from veterinary treatments, phytosanitary agents, fish feed, or simply from contaminated water sources. The accumulation of these substances could negatively impact fish health, microbial biofilters, and plant growth, thereby disrupting the system's overall balance and functionality. The lack of legislation and knowledge regarding the presence of such compounds in aquaponic systems raises concerns about their potential impact on both system balance and food safety. In this study, we focused on the effects of oxytetracycline (OTC), an antibiotic commonly used in aquaculture, on both the microbial biofilter and plant growth. Although OTC is rarely applied in aquaponics today, the fish compartment may need to be isolated from the system during treatment, as it inhibits specific bacterial populations, which could affect the microbial biofilter's efficiency. However, questions remain about the aquaponic system's tolerance threshold, particularly in cases of treatment or residual OTC traces post-treatment. This study results indicated a decline in microbial biofilter activity to 20% compared to the control, potentially corresponding to treatments of 41 mg/L of OTC. Analysis of microbial populations in the biofilter, using flow cytometry and microscopy (confocal and scanning electron microscopy), revealed an increase in bacterial mortality without disrupting the microbial biofilm. Additionally, OTC exposure led to noticeable changes in plant morphology (e.g., color) and growth, though it did not fully inhibit development. However, no significant effects were observed on seed germination at the tested concentrations despite a measurable impact on subsequent plant growth.

**Keywords :** aquaponic, oxytetracycline, nitrifying biofilter, plant, micropollutants, sustainability

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