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Impact of Water Quality on Aquaculture: Target and Non-Target Analysis of Trace Organic Substances and their Transformation Products

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Abstract

Aquaculture is a major source of livelihood in the Philippines. Foods derived from aquaculture have high market share and has a lot of export potential. However, aquaculture is under threat due to the deteriorating water quality and pollution from various sources. The situation of the Seven Lakes of San Pablo in Laguna Province exemplifies the problems and efforts being undertaken to maintain water quality for sustainable fresh water aquaculture.

Our research focuses on the target and non-target analysis of trace organic substances and their transformation products in three of the Seven Lakes: Palakpakin, Sampaloc and Pandin. We also study the entry and the elimination of the compounds to and from the lakes. Fish antibiotics sulfadiazine and sulfamethoxazole, and hypertension drug telmisartan were found at concentrations 126, 175 and 76 ng/L, respectively in Lake Sampaloc. Due to the presence of rice fields and fruit plantations in the surrounding area, pesticides like chlorpyrifos, cyprodinil, disulfoton, endosulfan-B, fenoxaprop-ethyl, pendimethalin, picolinafen and quinoxyfen were found in the lake water samples taken during the rainy season (July – October 2015) at concentrations between 40 to 110 $ng\,L^{-1}$. Insect repellant diethyltoluamide (DEET), and phosphate-based fire retardants were also detected. The fire retardants were also found in the materials from the houses in the lakes' coast. The pesticides, fire retardants and DEET were all below the limit set by the US Environmental Protection Agency for bodies of water or by the World Health Organisation for safe drinking. Biodegradation tests using the fixed-bed bioreactor are being done to study the elimination of representative pollutants by the natural microorganisms of Lake Palakpakin.

Emerging organic pollutants including microplastics will be determined in future studies. The impact of these organic pollutants on aquaculture and on the health of people living in the vicinity of the lake (for example, toxicity) will additionally be assessed. This collaborative work of Hochschule Fresenius and Ateneo de Manila University with the help of the German Federal Ministry for Education and Research is part of a bigger interdisciplinary project that aims to develop holistic, science-based and sustainable methodologies for the fishing communities, especially in the tropical regions.

Keywords: Aquaculture, water quality

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