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Ecotoxicological assays to determine the median lethal concentration (LC_{50}) of formalin for fish

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Abstract
The aim of this study was to determine the median lethal concentration LC_{50} 24 h of formalin in *Xiphophorus maculatus*, *Xiphophorus heleri*, *Oreochromis niloticus*, *Danio rerio*, and *Carassius auratus*. The concentrations of 100, 150, and 200 mg L^{-1} were tested in each fish species separately. Fish behavior was observed in the first 6 h after exposure to formalin. The 200 mg L^{-1} concentration was the most lethal for all species in less than 24 h. Tilapia was the most resistant species with a LC_{50} 24 h achieving 191.34 mg L^{-1}. In the first 2 h, the behaviors of fish on the higher concentration were agglomeration near the aeration input in the tanks and agitated swimming with fast movement of opening and closing of both mouth and operculum. With more than 4 h exposure, an increase in mucus production was observed, promoting a change in water color, reduction of operculum beating, and slow swimming until the beginning of the first deaths. We recommend using 100 mg L^{-1} of formalin for prophylactic baths during 1 h or two baths with 50 mg L^{-1} for 30 min for juvenile fish, in two consecutive days to ensure the fish welfare post-bath, as well as the health of those who will manipulate the formalin.

Keywords Aquaculture · Fish farm · Behavior · Formalin · Treatment

Introduction

Since the beginning of the activity, aquaculture has faced the challenge of adapting itself to the concept of sustainability, which implies adding new values to the production of knowledge and practices in the sector. One of the major concerns in creating these for aquatic animals is the possible introduction of highly pathogenic organisms in nature (Eler and Millani 2007).

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