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The Indigenous Qatari Marine Copepod, Euterpina Acutifrons: A Promising Marine Invertebrate Model Organism for Aquatic Eco-Toxicological Studies

Nandita Deb[1], Suhur Saeed[1], Sarah Bacha[2], Christopher Warren[1], Jennifer Dupont[1]

[1]ExxonMobil Research Qatar, QA
[2]Environmental Science Centre, Qatar University, QA

Email: nandita.deb@exxonmobil.com

An important objective of aquatic toxicological assessments is to evaluate the effects of water-borne toxic compounds on organisms which play a crucial role in aquatic communities. In marine ecosystems, copepods have a major impact on essential ecological processes: they exert grazing pressure on phytoplankton, and are a significant food source for several fish and macro crustaceans. Euterpina acutifrons, a harpacticoid copepod, is an abundant species in the Arabian Gulf, including the coast of Qatari peninsula. Its high content of poly unsaturated fatty acids make it a nutritionally superior live feed for larval fish in aquaculture, an industry developing fast in Qatar. With its ubiquitous distribution worldwide, inter-and intra-sexual dimorphism, well-defined life cycle, short generation time, and anamorphic developmental stages, this species meets many of the criteria to become a suitable model for toxicity studies. The present study defines protocols for establishing a successful laboratory culture of Euterpina acutifrons and for its acute toxicity testing with four toxicants. This study will add to the refinement of a suite of bioassay techniques being developed at ExxonMobil Research Qatar using a gamut of vertebrate and invertebrate indigenous marine species.

A sustainable culture of Euterpina acutifrons was established by rearing ovigerous individuals of this native species isolated from local waters. A few gravid individuals were used to include the natural genetic variability in the population. Through a series of planned trials, a simple protocol was established for culturing and maintaining the species in the laboratory. A temperature of 22 ± 2°C, photoperiod of 12 h light: 12 h darkness, salinity at 40 ± 2 ppt, and a 3:1 microalgal mixture of Chaetoceros sp. (diatom) and Synechococcus sp. (blue-green algae) as food, fed twice every week, was found to give an optimum survival and fecundity in the laboratory.

In order to investigate the efficacy of this species as a ecotoxicity test organism, a series of static, acute 24 h and 48 h toxicity tests were performed using three widely used reference toxicants, sodium dodecyl sulfate (SDS, an anionic

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surfactant used widely in cleaning and hygiene products), 3, 4-dichloroaniline (DCA, a metabolite of several herbicides), and Zinc (heavy metal) at 22 ± 2°C. Impact of chlorine, an anti-biofouling agent used in industrial cooling waters globally, was tested in a semi-static set up, where chlorine dose was renewed at regular intervals. Similar-sized copepodite stages used for these tests were procured through laboratory culture synchronization. The 24 h/48 h LC50 values were calculated based on the end point of the tests, which was mortality or total cessation of mobility. The copepod showed dose-dependent responses and different sensitivity towards the four toxicants; toxicity ranking increasing from DCA, SDS, Zinc to Chlorine. The differences in toxicities can be attributed to different mechanisms of action of the four compounds. The sensitivity of this species compared favorably with other established marine invertebrate models for ecotoxicity testing. Given, the feasibility of culturing, continuous egg production throughout the year, and high reproducibility of the toxicity responses in this study, it is advocated to further explore the use of Euterpina acutifrons as a model organism to assess long- and short-term effects of potential water-borne contaminants in the Arabian Gulf.