Abstract

Nowadays, the presence of pharmaceutical products in aquatic environments is not only common, but is also of significant concern regarding the adverse effect they may produce to aquatic biota. In order to determine the adverse effects of caffeine (CAF), ibuprofen (IBU), carbamazepine (CBZ) and novobiocin (NOV), at environmental occurring concentrations, standardized endpoints applied in current guidelines were evaluated in four organisms including bioluminescence response in *Vibrio fischeri*, growth inhibition in *Isochrysis galbana* (marine water) and *Pseudokirchneriella subcapitata* (fresh water) and fertilization and embryo-larval development in *Paracentrotus lividus*. To reach this aim bioassays were implemented by exposing organisms to water spiked with drugs dissolved in DMSO (0.001% v/v). Risk characterization was performed, calculating the environmental impact of drugs by calculating environmental concentration and predicted no effect concentration ratio (MEC/PNEC). Results indicate that acute toxicity was found above environmental concentrations in the order of mg L^{-1} for bacteria bioluminescence, microalgae growth inhibition and sea urchin fertilization. However, teratogenicity was observed on sea urchin after exposure to environmental concentrations of drugs at 0.00001 mg L^{-1}; at this concentration CBZ and IBU were found to reduce significantly the embryo-larval development compared to controls ($p < 0.01$). The risk calculated for selected drugs suggested they are harmless for aquatic environment except when applying the embryo-larval development endpoint. Endpoints applied in this study showed the necessity of using more sensitive responses, when assessing risk of pharmaceuticals in aquatic environments, since endpoints applied in current guidelines may not be suitable.