ABSTRACT

There are many types of chemicals/contaminants present in the environment, ranging from synthetic chemicals to trace metals that are required for life. When an organism is exposed to a toxicant, adverse effects are generally first at the sub-organismal level. There is thus a need for physiological and biochemical indicators of organismal health and sub-lethal toxicant effects. A bio-indicator, or biomarker, is a response of a living organism to environmental changes or because of exposure to contaminants.

The main objectives of this study were to evaluate and investigate the possible use of biomarkers as indicators of sub-lethal (chronic) effects induced by certain chemicals/pollutants on the Mozambique tilapia, *Oreochromis mossambicus*. The biomarkers were evaluated as a possible sensitive and reliable measure of effects due to exposure to pollutants. This study was divided into laboratory experiments and field evaluations. The laboratory experiments consisted of the evaluation of biomarkers in exposure studies on 18-24 day old *O. mossambicus* juvenile fish, to determine the sub-lethal effects induced by chemicals. Acetylcholinestrase (AChE), Ethoxyresorufin-*O*-deethylase (EROD) and glucose levels acted as the battery of biomarkers evaluated. Thirty (30) juvenile fish were exposed for 24 and 96-hours to sub-lethal concentrations of cadmium, zinc, pentachlorophenol (PCP) and cyanide.

For the field evaluation, mature *Oreochromis mossambicus* of both sexes, were caught during the summer and winter at the Rust de Winter Dam, Loskop Dam

and Hartebeespoort Dam. Rust de Winter Dam acted as the reference site. The biomarkers evaluated during the field studies include: erythrocyte AChE, ∗-Aminolevulinic acid dehydratase (ALAD) and plasma glucose levels, EROD and liver glycogen.

The laboratory (exposure) test used during this study was not sensitive enough to obtain reliable, repeatable results. But standardised procedures were established for possible use in future studies. During the field studies, ALAD, EROD and plasma glucose showed significant results and differences between the reference and polluted sites. More accurate results could be obtained at impoundments with higher levels of pollution. Although, erythrocyte AChE and liver glycogen did not show significant results during this study, they might also show more accurate and reliable results at higher levels of pollution. In future, chemical water analysis should be carried out during field evaluation to determine what chemicals/toxicants are present in the aquatic environment. Biomarkers will show the level of effects of the toxicant on the organism, while chemical analysis will determine the specific pollutant present in the water.