NUSANTARA BIOSCIENCE
Vol. 1, No. 1, pp. 18-22
February 2017

ISSN: 2087-3948
E-ISSN: 2087-3956
DOI: 10.13057/nusbiosci/n090104

Accumulation and elimination of mercury in Nile Tilapia (*Oreochromis niloticus*) under an elevated temperature and its ambient concentrations

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Manuscript received: 8 October 2016. Revision accepted: 15 December 2016.

Abstract. *Sunardi, Astari AJ, Pribadi TDK, Rosada KK. 2017. Accumulation and elimination of mercury in Nile Tilapia (*Oreochromis niloticus*) under an elevated temperature and its ambient concentrations. Nusantara Bioscience 9: 18-22.* The problems of heavy metal pollution combined with the issue of climate warming has attracted a growing international concern, particularly to those exert very toxic effects to organisms and human, e.g. mercury. There have been evidences for temperature effect on metal uptake, accumulation and toxicity; but only few of those on metal elimination. An experimental work was set up to investigate the effect of higher water temperature and ambient concentration on both accumulation and elimination of mercury in Nile Tilapia (*Oreochromis niloticus*). Using 50-L aquarium, fish were exposed to room and 32°C temperature combined with 10 and 20 µg/kg Hg concentration. Test fish were treated for 28 days for accumulation phase, and then transferred to Hg-free water for 7 days for elimination. Data of the Hg accumulation and elimination from the flesh, liver and kidney were analyzed using one-way Anova. The results indicated that higher water temperature and ambient mercury have increased accumulation in the liver and the kidney, but not in the flesh. Higher rate of Hg elimination occurred in higher water temperature resulting Hg deposits did not differ among treatments. However, the Hg deposits remained higher compared to those in the original state representing a potential risk to either fish or human. The kidney and the liver of Nile Tilapia seemed to be the preferable depository organs for mercury.

Keywords: Ambient concentration, mercury contamination, Nile Tilapia, water temperature

INTRODUCTION

Post Minamata incident, there was a great awareness on the effects of mercury pollution on human and environmental health. However, the environmental problems caused by the mercury contamination seems to be a continual bout since mercury-pollution has been occurring for years, and most probably will continue in the upcoming years. The agricultural drainage water containing pesticides and fertilizers and effluents of industrial activities and runoffs in addition to sewage effluents supply the water bodies and sediment with huge quantities of inorganic anions and heavy metals (ECDG 2002). Reasonably, contamination of the aquatic environment by mercury, and heavy metals in general, has been considered a major threat to the aquatic organisms including fishes.

Fish living in polluted waters tend to accumulate heavy metals in their tissues (Jezierska and Witeska 2006), and studies of metal accumulation in fish living in polluted waters show that considerable amounts of various metals may be deposited in fish tissues without causing mortality (Akan et al. 2012). Heavy metal, such mercury, can be incorporated into food chains and absorbed by aquatic organisms to a level that might affects their physiological state.

However, there is almost no single contaminant works independently in the environment; a contaminant together with a variety of biological and environmental factors may jointly pose adverse effects to organisms. It is regarded that global warming will also amplify the already existing toxicity of many contaminants. IPCC (2001) has employed several models and found an increased likelihood of a 1-7°C increase in mean global temperature within the next hundred years. In addition, Ficke et al. (2007) suggested that the general effects of climate change on freshwater systems will likely be increased water temperatures, decreased dissolved oxygen levels, and the increased toxicity of pollutants.

Like most ectoterms, fish cannot regulate their body temperature in accordance with surrounding environment; as a result most physiological and biochemical processes are temperature dependent (Dame 1996; Heugens et al. 2003). Fish physiology is inextricably linked to temperature, thereby their physiology and life histories will be affected by alterations induced by climate warming. Differences in the ambient temperature, for instance, may affect uptake, elimination, and detoxication rates because of changes in metabolic, locomotory, and feeding activity of organisms (Donker et al. 1998; Fisher et al. 1999; Smit and Van Gestel 1997). Increased global warming may result in higher mercury concentrations in fish through increased water temperatures (Evans et al. 2005).

There is a bulk of literature showing evidence for temperature effects on metal uptake, accumulation and toxicity, but unfortunately we lack data on heavy metal elimination from fish body (see Mubiana and Blust, 2007).