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Cent. Eur. J. Biol. • 9(1) • 2014 • 86-91
DOI: 10.2478/s11535-013-0167-4

Central European Journal of **Biology**

Effect of nitrite exposure on metabolic response in the freshwater prawn *Macrobrachium nipponense*

Research Article

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Received 31 August 2012; Accepted 11 February 2013

Abstract: The metabolic response of the freshwater prawn, *Macrobrachium nipponense* to nitrite toxicity was evaluated. The prawns were exposed to 0, 1, 2, 3 and 4 mg L^{-1} NO_2-N concentrations for 48 h. The metabolic parameters in muscle were measured after 12, 24 and 48 h. Glucose level significantly increased after 24 h. Exposure to lower nitrite concentrations (1 and 2 mg L^{-1}) resulted in significant increases in alanine aminotransferase (ALT) activities after 24 and 48 h. Aspartate aminotransferase (AST) activities treated with 2 and 3 mg L^{-1} nitrite-N at 48 h were significantly higher than those at 12 and 24 h. Intermediate sublethal nitrite concentrations produced significant elevations in lactate dehydrogenase (LDH) activities from 12 h up to 48 h. No significant changes were detected in any of the groups for triglycerides and creatine kinase (CK). To satisfy the increased energy demands caused by acute nitrite exposure, mobilization of lipids is not the main reason while utilization of amino acids seems to play a more important role. The results would be helpful for aquaculture farmers to prevent a potential depression of productivity caused by elevated nitrite levels.

Keywords: *Metabolic response* • *Macrobrachium nipponense*

1. Introduction

Water pollution and industrial waste usually elevate the nitrite concentrations due to ammonia oxidation [1,2]. Nitrite can easily accumulate to an unsafe level and become a serious problem in aquatic ecosystems such as recirculation systems, aquaria and aquaculture ponds [3,4]. In some eutrophic shallow lakes, an elevated concentration of nitrite usually occurs during the degradation of cyanobacterial blooms [5].

The toxicity of nitrite starts from the fact that nitrite is a competitive inhibitor of chloride uptake which can decrease extracellular and intracellular chloride and result in a serious electrolyte imbalance [6]. In crustaceans, the nitrite toxicity has been mainly tested on penaeids with a general understanding that the induction of methaemocyanin by nitrite can cause hypoxia in tissues and impair the respiratory metabolism [7,8]. Additionally, nitrite can cause environmental stress on aquatic animals, and thus retard growth, damage various organs, decrease the tolerance to bacterial or parasitic diseases and even cause high mortality [9,10].

The majority of these studies deal with the nitrite effect on ion exchange, nitrogenous excretion, immune response, *etc*., but very few deal with the metabolic response caused by nitrite. In crayfish, Hemolymph

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