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HEAVY METALS IN SHRIMP POND AND SHRIMP MUSCLES

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ABSTRACT

Sarawak is a key producer of cultured black tiger shrimp (*Penaeus monodon)* in Malaysia. However, knowledge on the heavy metals in shrimp and culture ponds were lacking in literature. Therefore, in this study, concentrations of selected heavy metals in shrimp pond sludge, pond water, shrimp feed, and shrimp muscles from two farms in different locations were investigated. Results indicated that heavy metals concentrations of sludge nearer to the center of the pond were higher than those at the edge of the pond and Zn and Mn concentrations were higher than Cu and Cd. In pond water, concentrations of heavy metals were less than 0.2 mg/L except for Mn in Farm 2 which was much higher. For shrimp feed, Zn and Mn concentrations were higher than Cu and Cd. The concentration of Cu in feed was different between the two farms. In the shrimp muscles, Zn concentration was the highest followed by Cu. The concentration of heavy metals such as Zn and Cu in the shrimp muscles was not significantly correlated with that in the feed, sludge or water. The concentrations of Zn, Cu and Cd in the shrimp muscle did not exceed the maximum permissible limits of the Malaysian Food Act.

INTRODUCTION

One of the fastest growing components of the global aquaculture industry is shrimp farming (Hossain et al. 2004). Major shrimp producing countries are in Asia, where black tiger (*Penaeus monodon*) is the predominant farmed species and Central America where the western white (*Penaeus vannamei*) is the predominant species (Flaherty et al. 2000). Malaysia produced a total of 12,000 metric tons of tiger shrimps in 2000. From 1998 to 2004, there was a drastic increase in shrimp culture in Sarawak due to the abundant aquatic resources, underdeveloped coastal land and relatively unpolluted water resources, cheap and easily trained labour forces, existing government policies and natural conditions (Chang 1999, Nyanti et al. 2002). In 2004, there were 317 licensed farm operators operating 2,105 ponds covering an area of 1,125 hectares (Anonymous 2004).

Shrimp pond nutrients and organic matter have been extensively studied (Smith, 1996; Nyanti et al. 2002; Avnimelech and Ritvo, 2003). However, not as much studies were conducted on heavy metals content of pond sludge, feed and shrimp muscles. Other than the feed input, other factors may contribute to the presence of heavy metals in the pond. They include the water used for the shrimp culture which is usually from the estuary where the ponds are located and the shrimp farm management practices. Coastal zones and estuaries are also regions frequently contaminated with heavy metals. According to Graslund and Bengtsson (2001), a wide variety of chemicals and biological products were used in semi-intensive and intensive South-East Asian shrimp farming. Some of those chemicals have the potential to contribute heavy metals in the pond. In Australia, pond sediment heavy metals enrichment was reported (Smith, 1996) and heavy metals such as Cadmium (Cd) was detected in shrimp hepatopancreas (Darmono and Denton, 1990). In India, Guhathakurta and Kaviraj (2000) found that heavy metals were present in pond sediments, pond water and muscles. In Sabah, studies conducted in two farms indicated that a number of heavy metals were present in the shrimp muscles and pond water (Hashmi, 2002). Some of the heavy metals such as zinc (Zn), copper (Cu) and manganese (Mn) are essential nutrients for the shrimp but others such as Cd have no known use in physiological process (Darmono and Denton, 1990). Therefore, the objective of this study was to investigate the presence of selected heavy metals in pond water, pond sludge, shrimp feed and shrimp muscles.