

## Heavy metals in shrimp pond sludge, water and muscles

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**Abstract** Sarawak is a key producer of cultured black tiger shrimp (*Penaeus monodon*). However, knowledge on heavy metals in shrimp pond is scarce in literature. Therefore, concentrations of selected heavy metals (Zn, Cu, Mn, Cd) 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, though elevated, did not exceed the standard established. Cu in the sludge was significantly correlated with the feed and the soil. Pond water heavy metals were less than 0.2 mg/L except for Mn in Farm 2. Zn in the water was highly correlated with Zn in the feed. Even though Cu in the Farm 2 feed was six times that of Farm 1, there was no significant difference in the muscles. Furthermore, though Mn in sludge and water of Farm 2 were 4 and 20 times that of Farm 1, muscle Mn from Farm 2 was less than Farm 1 and concentrations were low. In the shrimp muscles, Zn concentration was the highest followed by Cu. The muscle concentrations of all heavy metals except Mn were not significantly correlated with that in the feed, sludge or water indicating the ability and selectivity of shrimp to regulate heavy metals. The concentrations of Zn, Cu and Cd in the shrimp muscle did not exceed the maximum permissible limits of the Malaysian Food Act.

**Keywords** shrimp culture – heavy metals – aquaculture – pond sludge

## INTRODUCTION

One of the fastest growing components of the aquaculture industry in the world is shrimp farming [1]. The major shrimp producing countries are in Asia, where the black tiger (*Penaeus monodon*) is the predominant farmed species and Central America where the western white (*Penaeus vannamei*) is the predominant species [2]. 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 [3, 4]. In 2004, there were 317 licensed farm operators operating 2,105 ponds covering an area of 1,125 hectares.

Shrimp pond nutrients and organic matter have been extensively studied [4-6]. 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. A wide variety of chemicals and biological products were used in semi-intensive and intensive South-East Asian shrimp of heavy metals were present in the shrimp muscles and pond water [10]. 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 [8]. The objective of this study

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