# 学 位 論 文 要 旨

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| 題　目 | Nutritional study of dietary astaxanthin on performances of kuruma shrimp *Marsupenaeus japonicus*<br>(クルマエビにおける飼料性アスタキサンチンの栄養学的研究) |


The color of kuruma shrimp flesh is an important criterion of flesh quality and affects consumer choice thus determines its price in the Japanese market. Since cultured shrimp are less colorful than the wild shrimp, a necessary to provide a dietary pigment source in the diet is considered. Astaxanthin (Ax) is a pigment producing a red color for many aquatic animals was certified as one of the most useful pigment for shrimp. To provide the proper rations of Ax, in aqua-feed, it is necessary to reveal the optimum supplemental amounts and the interactions between Ax and other additives.

Fist part of the studies were aimed to determine the optimum supplemental amounts of chemically synthesized astaxanthin (Ax) in larval, post-larval, and juvenile kuruma shrimp. An 8-day and a 30-day feeding trials were conducted on larval and post-larval kuruma shrimp, respectively. Six dietary levels of Ax (0, 50, 100, 200, 400, and 800 mg $kg^{-1}$ diet) were added to a baseline diet. Broken-line regression analysis indicated that the optimal levels for growth and stress resistance of larvae were 168.9 mg $kg^{-1}$ and 82.1 mg $kg^{-1}$ diet, respectively. Broken-line regression analysis indicated that the optimal levels for growth and stress resistance of post-larvae were 108.7 mg $kg^{-1}$ and 178.1 mg $kg^{-1}$ diet, respectively. Then a 56-day feeding trial was conducted on juvenile kuruma shrimp. Six dietary levels of Ax (0, 200, 400, 800, 1200, and 1600 mg $kg^{-1}$ diet) were added to a baseline diet. Broken-line regression analysis indicated that the optimal levels for growth, immune responses, and pigmentation were 401, 420, and 404 mg $kg^{-1}$ diet, respectively.

Second part of the studies were conducted to evaluate the interaction of vitamin E (α-Toc) and cholesterol (CHO) with Ax, respectively. Six experimental diets containing 2 levels of Ax (0 and 0.6 g $kg^{-1}$ diet) and 3 levels of CHO (0, 6, and 20 g $kg^{-1}$ diet) were formulated in 2 × 3 factorial design. The results showed that interactive effects by dietary CHO and Ax existed on growth parameters, lipase activity, pigmentation, and total Ax content in different parts of shrimp body. The addition of CHO can enhance the positive effects of dietary Ax. Then, a 2 × 3 factorial experiment was conducted with six experimental diets containing two levels of Ax (0 and 0.6 g $kg^{-1}$ diet) and three levels of α-Toc (0, 0.2, and 1 g $kg^{-1}$ diet). The results showed that dietary Ax and α-Toc functioned interactively on growth performance and Ax content in kuruma shrimp.

Overall, carefully dosed Ax supplementation is a beneficial nutritional strategy for kuruma shrimp. Dietary Ax with α-Toc and cholesterol functioned interactively. Our study fills a data gap regarding the interactive effects of these two supplements with Ax and provides practical information to improve pigmentation and performance of kuruma shrimp, thus enhancing their commercial value. It is very important to consider about the proper Ax rations in aqua-feed. Further studies need to be contributed to reveal the mechanisms of related additives interactions in kuruma shrimp.