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Crab Meal - Waste from Seafood Processing Units: A Good Alternative Protein Source for Fish Meal in Aqua Feed

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SUMMARY

The seafood industry generates huge quantity of wastes during processing of the crustaceans viz., shrimps, crabs and lobsters. After processing of the crustaceans, exoskeleton, carapace and hull are thrown out as a waste product in large quantities by seafood plants. These wastes contain appreciable amount of protein and carotenoids making them suitable as an animal feed. Further, these wastes can be used to replace the high value protein sources such as fish meal, soya bean meal in the aqua feed. Their easy availability in the coastal regions and their low cost would definitely help in reducing the feed cost in the aquaculture.

INTRODUCTION

The crustacean wastes should be utilized by extracting the useful components to make a breakthrough in the formulation of superior diets (Meyers, 1987). Crustacean wastes from the fishing industry contribute around 70% of the total crustacean landings and these wastes cause environmental hazards due to untreated disposals (Van-Ornum, 1992). Though they are rich in protein, chitin and calcium they can be used to produce high value added materials if recycled properly (Perberdy, 1999). The shell wastes of the marine crustacean are one of the primary sources of naturally occurring biopolymer – chitin in many derivatives which will be used in medicine, pharmaceuticals and water treatment (Kumar, 2000). Crab meal is a by-product obtained from the processing of the crabs such as canning and freezing. Based upon the processing method and species about 60-80% of the crab offal are produced (Taufel et al., 1993), which comprises of shells, viscera and un-extracted meat. These wastes have the potential to be used as animal feed particularly for the fishes.

Crab shell wastes

Chemical composition of crab meal:

The proximate composition of crabs varies from species to species. The red crab contains 32% protein, 36% ash, 8% lipid, 11% chitin and highly unsaturated fatty acids accounted for 36 to 48% (Pierce et al., 1969). The chemical composition of the crab meal contains 31.4% crude protein, 10.5% crude fibre, 2% ether extract and 40.8% ash (National academy of science, 1971). The chemical composition of the king crab meal comprises of crude protein 36 to 48%, ether extract 1.4 to 4.2%, ash 31.7 to 41.3% and chitin 17.6 to 17.9% (Husby, 1980). According to Johnson (1988) the chemical composition of the crab meal consists of crude protein 32.2%, crude fat 2.8%, ash 39.4%, crude fibre 10.6% and N-free extract 7.7%. Crab protein concentrate however, contains crude protein 60.5%, crude fat 0.4% and ash 6.1%. Typically, crab meal mainly contains 50% ash, which comprises mostly calcium carbonate with chitin 20%, crude protein 25% and lipid <2% (Nicholson et al., 1996).

Crab meal in colouration:

Rainbow trout fed with a formulated diet containing 20% red crab meal, showed a clear red rainbow steak on the body and has pink flesh, revealing that crab meal can be effectively used as a carotenoid source in its diet (Kuo et al., 1976). Similarly, the carotenoids derived from the red crab (*Pleuroncodes planipes*) at 6 to 9 % in the diet of Coho salmon (*Oncorhynchus kisutch*) revealed fishes having good to excellent coloration and pigmentation after 120 days of culture (Spinelli et al., 1978). A comparative study between oil-extracted astaxanthin from langostilla (*Pleuroncodes planipes*), red yeast (*Phafla rhodozyma*) and synthetic astaxanthin, revealed high flesh pigmentation in rainbow trout (*Oncorhynchus mykiss*) by oil-extracted astaxanthin from langostilla (*Pleuroncodes planipes*). This has been attributed due high esterified astaxanthin content of langostilla carotenoids with better deposition, hue, and pigmentation efficiency compared with other two sources under study (Coral et al., 1998).

Crab meal as a feed for fishes:

The utilization of primary seafood processing wastes as a protein source in the diet of channel catfish was studied by Dean (1992) who reported that crab meal based diet did not show any significant difference against fishmeal based diets. The effect of the fish bone meal and crab by-product meal as a replacement for fish meal at the inclusion rate of 150, 300 and 450 g kg−1 and 54, 115 and 176 g kg−1 respectively was studied by Toppe et al., (2006) in cod fish. Results indicated an increment in the growth by about 10% when the dietary ash level increased from 84 to 180 g kg−1. This study showed that the fishery waste products such as crab meal can also be used as a valuable feed ingredient in cod fish diet. The sensory evaluation viz., proximate analysis, color, fatty acid composition, texture and sensory analyses performed on the fillets of southern flounder (*Paralichthys lethostigma*) fed with crab meal supplemented diet, indicated no significant difference between the fish fillets when comparing fat, protein, fiber content and texture. Hence, crab meal can be supplemented in diet of southern flounder to enhance final product quality (Gonzalez et al., 2006). African giant catfish (*Heterobranchus longifilis)* fingerlings fed with the crab meal as a substitute for the fish meal showed appreciable performance (Keremah, 2013). Study on the effects of marine crab meal and sea urchin meal on the growth performance, skin colouration, final flesh quality and lipid oxidation of red porgy (*Pagrus pagrus*) revealed that both crab meal and sea urchin meal in the diet increased the feed intake and final weight of the fishes. Also the colouration was better in the fishes which were fed with the crab meal (Garcia-Romero et al., 2014).

Montoya-Mejia et al., (2017) evaluated the digestibility, growth performance, blood chemistry, and enzyme activities of Nile tilapia (*Oreochromis niloticus*) juveniles which were fed with different animal (fish silage meal, whey meal, bovine blood meal, and red crab meal) and plant (extruded bean, extruded chickpea meal, coconut paste, *Jatropha curcas* meal, and chickpea meal) dietary by-products for 60 days. Among the various plant and animal by-product meals, the red crab meal and extruded chickpea meal diet showing good growth performance in terms of high final body weight. The protein efficiency ratio was also observed to be higher in the red crab meal based diet compared with others. Valeta (2020) stated that the crab meal can be utilized as a partial replacement for the fish meal in the diet of *Heterobranchus longifilis* for appreciable growth performance when compared with control diet which contains only fish meal.

Crab meal as a feed for crustaceans:

A study conducted by Villarreal et al., (2004) to evaluate the effect of red crab (*Pleuroncodes planipes)* meal as a major protein source in the diet of juvenile brown shrimp *Farfantepenaeus californiensis*, revealed higher final weight, growth rate and better FCR when compared with other ingredients. Hence, they could conclude that it is desirable to use the red crab meal as a replacement for traditional ingredients in shrimp feed.

Goytortua-Bores et al., (2006) evaluated the effect of red crab (*Pleuroncodes planipes*) meal as a replacement for the fish meal at 5%, 10%, 15% inclusion level in the diet of white shrimp *Litopenaeus vannamei*. They observed that 15% dietary inclusion showed higher growth, better digestibility, feed conversion and protein efficiency ratios. A similar study on inclusion of red crab meal in the diet of white shrimp (*Litopenaeus vannamei*) as a replacement for the fish meal showed that growth, survival was not affected in the shrimps which were fed with red crab meal (Ayala-Borboa et al., 2013). Hence, red crab meal could be a desirable substitute for the fish meal.

CONCLUSION

Crab meal is thus seen as one of the promising protein sources which can be used in the diet of animals and fishes. Although the shells of the crabs are discarded as wastes, it can be utilized as a meal or protein concentrate in feed preparation, to minimize the cost of production in aquaculture.

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