Significance of Pigmentation and Use in Aquaculture

İbrahim Diler[1,*] , Kamil Dilek[2]
[1] Kepez Aquaculture Center, P.O.Box: 190, 07001 Antalya, Turkey.
[2] Kocaeli University, College of Karamürsel, Kocaeli, Turkey.

*Corresponding Author: Tel.: + 90. 242. 251 05 85; Fax: + 90. 242. 251 05 84;
E-mail: idiler@yahoo.com

Abstract

Aquaculture is a rapidly growing global industry, comprising cultivation of various freshwater and marine species of finfish, prawn, and ornamental fish. By the year 2000, as much as 20% of the world 3% of the Turkey production of fish will be based on aquaculture. Properly formulated feeds and pigmentation are a significant part of successful aquaculture. Carotenoids play a major role in culture of some species i.e. salmon and rainbow trout, gold fish, red and gilthead sea bream. Various biological and nutritional roles for carotenoids in some species are documented along with the effect of biotic and abiotic factors on astaxanthin and final flesh or skin pigmentation. In this review role of carotenoids related technical knowledge in aquaculture besides practical knowledge to farmers.

Key Words: astaxanthin, pigmentation, aquaculture, feed additive.

Introduction

It is important to use carotenoids in fish feeds. These give yellow, red and pink to the skin, flesh and eggs of fish. Some 600 species of plant and water organisms naturally contains the substances (Latscha, 1990; 1991). Astaxanthin, which is the most effective on pigmentation exists densely in water organisms such as gammarus, copepods etc. and starfish (Diler, 1997; Torrisen, 1989a; 1989b).

It is desired that fish products have same physical characters to effect of choosing and into meet of demand of the customer in the market of such characteristics as colour. Fish in nature have the characteristics colour due to their preys (e.g. Freshwater shrimp, Gammarus, *Artemia*). Because fish from aquaculture are pale due to the feeds used, this case reduces the attractiveness of the products. The negativenesses among the fish cultured are coped with by supplementing the feeds with natural or synthetic pigments, which are commercially available. One of the most important of the pigments is astaxanthin. It is not harmful to the human and anticancerogeous and antioxidant. Thus, European Union and Organisation of Health in U.S.A. have given permission to used in feeds (FFI, 1995; Schiedt, 1988).

The flesh of trout and salmon smoked and filleted should contain 7-8 mg/kg of carotenoid. The value is only above 2-4 mg/kg in fish fed the diets without pigment (Meyers, 1994; No and Storebakken, 1991). The gap can be eliminated easily by using astaxanthin. Adding pigment substances (especially astaxanthin) to the feeds minimizes colour loosing during the processing and provides colour stability for six months (No and Storebakken, 1991; Skrede *et al*., 1990).

The fact that the colour of the skin of red sea bream (*Pagrus spp*.), gold fish (*Carassius spp*.) is identical to the colour of their counterparts, the colour of the check of gilthead sea bream is pink and flesh's colour of shrimp and crawfish is red-pink are important pewliarities in the market (Tanaka, 1978). The characters mentioned above are provided through the pigmentation. In this way consumer demand increases for the products in question. Thus, economic gain from the products is relatively more (Meyers, 1994; Skrede *et al*., 1990).

Function of Carotenoids

The fact that carotenoids are selectively deposited and stored in the tissue emphasises their physiological importance. Several observations regarding this phenomen have been brought forward, such as (Latscha, 1990; 1991; Meyers, 1994; Torrisen, 1989a; 1989b; Torrisen *et al*., 1989);

- Attractant for the sperm.
- Colour attractant in the skin of males at breeding.
- Fertilization improving agent, resulting in a higher proportion of fertilized eggs.
- Protection against to environmental effects (harmful light, high temperature, low oxygen tension ammonia etc., thus reducing mortality during embryonic development.
- Reproductive role through deposition in the flesh and skin of the growing fish,

presumably to make it sexually attractive.
- Subsequent mobilisation from the flesh to the reproductive organs and the eggs.
- Vitamin A_1 and A_2 precursors in vitamin A deficient diets.
- Providing protect against to stress.
- Increasing survival and growth rate addition larval feed.
- Effects of anticancer and antioxidant.

Applied of Species on Pigmentation

1- Marine fish and salmonids

- Salmonids, Rainbow trout, Red sea bream, Gilthead sea bream.

2- Freshwater fish

- Common carps, chichlids and *Tilapia* spp., gold fish.

3- Crustaceae

- Shrimps, marine and freshwater crawfish.

Use of Ratio Pigmentation in Aquaculture

In salmon; From harvest for portion size;
- before 6-12 months 80-100 ppm
- before 12-18 months 40-80 ppm

In trout; From harvest for portion size;
- before 4 weeks 100 ppm
- before 8 weeks 75 ppm
- before 12 weeks 50 ppm

From spawning for broodstocks;
- before 4-6 months 50-75 ppm

In red sea breams; From harvest for portion size;
- before 3 months 25-35 ppm

From spawning for broodstocks;
- before 4-5 months 40-50 ppm

In gilthead sea breams; From harvest for portion size;
- before 3 months 20-30ppm

From spawning for broodstocks;
- before 4-5 months 20-30 ppm

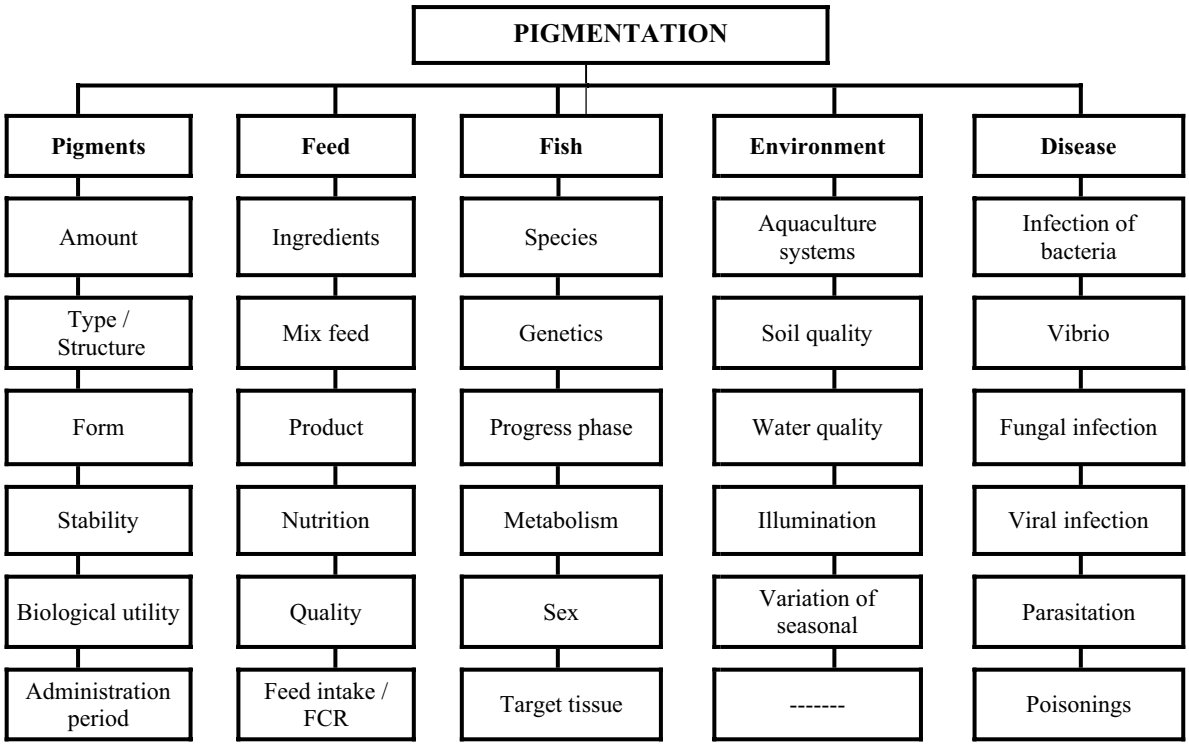

Figure 1. Relation of pigmentation and other factors.

In gold fish; From harvest;

- before one month 100 ppm
- before 2 months 75 ppm
- before 3 months 50 ppm

In shrimps; From harvest;

- before 3 months 75-100 ppm
- before 6 months 40-50 ppm

Results and Conclusion

Carotenoids are widespread and important pigment classes in the organisms as well as contributing characteristic quality criterion for marketing and consumer demands of aquacultural products. Appearance of an animal product, especially colour plays an important role on the marketing. Colour, nutritional value, healthy appearance, freshness and sensory test components are the subconscious elements to choose the product. Choosing a product is effected by the educational condition, environment and customs as well (Diler, 1997; Meyers, 1994; No and Storebakken, 1991).

Traditional aquaculture is being replaced with the modern manner. This situation needs to harvest more amount of product in higher quality from a smaller area. This has, however, been accompanied by some problems regarding the product. Fish in the nature have special skin and flesh colour.

On the other hand, those from aquaculture are pale and greyish, which bring about reduction in the domestic consumption and exportation. In the diets of fish for which pigmentation is important, synthetic and natural carotenoid sources are included in order to eliminate the problem. Asthaxanthin, one of the synthetic sources, is fairly effective on making fish colourful (No and Storebakken, 1991; Haard, 1992; Torrisen *et al*., 1989).

A study on rainbow trout showed that quality products obtained through the pigmentation gave good results in the smoking technology. In this way, marketing of these products is easier (Diler, 1997; Skrede *et al*., 1990).

Consequently, it is recommended for farmers to use pigment substances in their feeds. In view of the economical and consuming high quality products, pigmentation studies need to be conducted on red sea bream, gilthead sea bream, gold fish along with rainbow trout (Tanaka, 1978).

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