Effect of Incorporation of Vegetable Colour from Red Sandal (*Pterocarpus santalinus*) on Acceptability, Colour Development and Growth of Tilapia (*Tilapia mossambica*)

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Red colour extracted from red sandal wood (*Pterocarpus santalinus*) when incorporated in fish feed is found to increase the acceptability of the feed. It imparted a pink colour to the whole fish as well as to the fish flesh. The fishes fed with coloured feed showed increased feed intake and growth rate.

Fish production by aquaculture has become a major industry in many Asian countries. Aquaculturists have been in intense search for years for materials that could induce growth of the farm fed fish. Colour of the fish muscle is an important aspect in the consumer acceptance of it. Colour extracted from shrimp when incorporated in prawn feed is generally found to increase the acceptability of shrimp (Steel, 1971). Vegetable colours are used by salmon and trout growers for enhancing colour of their fishes. Brinchman (1967) used carotenoids for colouring pond reared fish, especially for salmon. However, there has been no attempt to use vegetable colour as a pigment to impart colour to fish. In the present study the reddish pink coloured pigment extracted from red sandal wood (*Pterocarpus santalinus*) was incorporated in the fish feed and fed to Tilapia. The results on acceptability of feed, growth rate and colour improvement of Tilapia are reported in this paper.

Materials and Methods

Fish meal from oil sardine (*Sardinella longiceps*) ground nut cake and tapioca starch were used for the formulation of feeds. The feeds contained appropriate levels of vitamines and minerals, as recommended by Halver & Coats (1957) and Kanazawa *et al.*, (1970) (Table 1).

Red coloured pigment from red sandal wood (*Pterocarpus santalinus*) was procured from Techno-chemical Industries, Calicut, India.

The extract from red sandal wood was dissolved in a-isopropanol (1%) and scanned in a double beam double wave length spectrophotometer, Hitachi, from 190 to 700 nm.

The raw materials were pulverized to 50-100 microns. It was mixed with tapioca starch and then gelatinized under steam. Feed was made in the form of pellets by using a pelletizer. It was dried to a moisture level below 7%. Experimental feeds were prepared by incorporating required percentage of the colour extract to the above feed (1 and 2% level). Pellets were stored at room temperature. Proximate composition of feeds were determined according to AOAC (1975). Carbohydrate content was estimated by colorimetric method using anthrone reagent (Joe, 1955).

Feeding experiments were conducted on fingerlings of tilapia (*Tilapia mossambica*) of average weight 1.5 ± 0.25 g collected from a private farm in Kochi. These were divided into three parts and weighed fingerlings were released to three plastic tanks containing about 150 l of fresh water. Fish were fed with a ration of 2.5% body weight of

diet per day. Residual feeds remained in the tanks were removed each day, dried and weighed. Periodic cleaning of tank and addition of fresh water were carried out. Aeration was provided to the tank artificially. After a period of six months, fish from the tanks were caught and weighed. Number of fish survived after the feeding (6 months) was recorded. Average body weight of each group of fish was also noted.

Colour of the whole fish and fish muscle in control and experimental groups was measured using a Lovibond tintometer Salisbury, England.

Results and Discussion

Table 1 gives the composition of the feeds and Table 2 the proximate composition of the three feeds. All the feed contained 28-30% protein, 41-42% carbohydrate, 4% fat and 9% crude fibre.

Table 1. *Composition of the feeds*

	Control %	Test, 1 %	Test, 2 %
Ground nut cake	25.00	25.00	25.00
Fish meal	21.00	21.00	21.00
Tapioca starch	50.00	49.00	48.00
Ground-nut oil	1.00	1.00	1.00
Mineral mixture	2.00	2.00	2.00
Vitamine mixture	1.00	1.00	1.00
Vegetable extract colour	0.00	1.00	200.

Table 2. *.Proximate composition of formulated feed*

	Control %	Test, 1 %	Test, 2 %
Moisture	7.80	7.16	6.00
Protein	28.35	30.01	29.60
Fat	4.16	4.20	4.60
Ash	4.98	6.80	6.10
Sand	0.56	0.50	0.58
Crude fibre	9.00	9.25	9.27
Carbohydrate	42.50	41.80	41.10

Health of fish appeared normal in all three groups of fishes. No untoward symptoms were also observed. Weight gain was considerable in the case of fish fed with extract incorporated feed than the control feed (Table 3).

Table 3. *The mortality and growth of Tilapia after feeding for six months*

Feeds	No. of fish	Initial weight	No. of fish survived after 6 months	Final weight of fish after 6 months	Ave rage weight of fish
		g		g	g
Control	12	55	10	680	68
Test, 1	12	52	9	650	72.2
Test, 2	12	52	10	728	72.8

Note : Average of three experiments

Lovibond Tintometer reading was yellow/green in whole fish fed with diet incorporated with sandel wood extract. An improvement in pigmentation to red / orange was noticed in the muscle also. The muscle extract in ■-isopropanol gave the λmax / same as that of original pigment i.e. at 330 and 470 nm (Fig. 1). This indicates

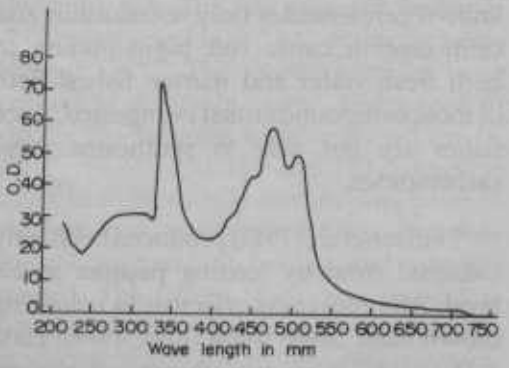

Fig. 1. Absorption spectrum of colour extract from *Pterocarpus santalinus*

that the colour absorbed is retained in the muscle and the red sandel wood colour can improve the colour of the farm fed Tilapia.

Table 4 gives the total quantities of fish feed supplied to each group of experimental Tilapia and the residual feed. It is seen that the group fed with extract incorporated feed consumed more diet than the control group. The same trend was reflected in the growth rate also.

Table 4. *Quantity of feed supplied to each group of Tilapia and residual feed*

Group	Quantity of feed, g	Residual feed, g
Control	1600	420
Test, 1	1600	340
Test, 2	1600	340

Many vegetable colours have been found imparting attractive colours to fish muscle. Ground paprika is effective in colouring brown trout (*Salmo trutta*), because of its high content of red carotenoids, capxanthin and capsorubin (Ellis, 1979). Xanthophylls, pterins and carotenoids are the main pigments in plants, animals and fishes (Brinchmann, 1967). Of the 300 known carotenoides only astaxanthin and canthxanthin cause red pigmentation in both fresh water and marine fishes. Both of these compounds must be ingested, since fishes are not able to synthesize these carotenoides.

Tunison *et al.*, (1942) produced brilliantly coloured trout by feeding paprika at 2% level. Alfa meal was effective in colouring brown trout *Salmo trutta* (Ellis, 1979). Hata & Hata (1972) suggested that in some fishes, zeaxanthin was easily oxidised to astaxanthin. Most shell fish such as cray fish, crabs, lobsters, shrimp, krill, copepods, isopods and mussel contain astaxanthin either free or as ester (Brinchmann, 1967).

The present study shows that feeding Tilapia with diets incorporated with red coloured pigment extracted from sandel wood increases the feed intake and weight. It also imparts an attractive red/orange colour to the fish muscle.

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