Natural pigments add consumer appeal of fishery products

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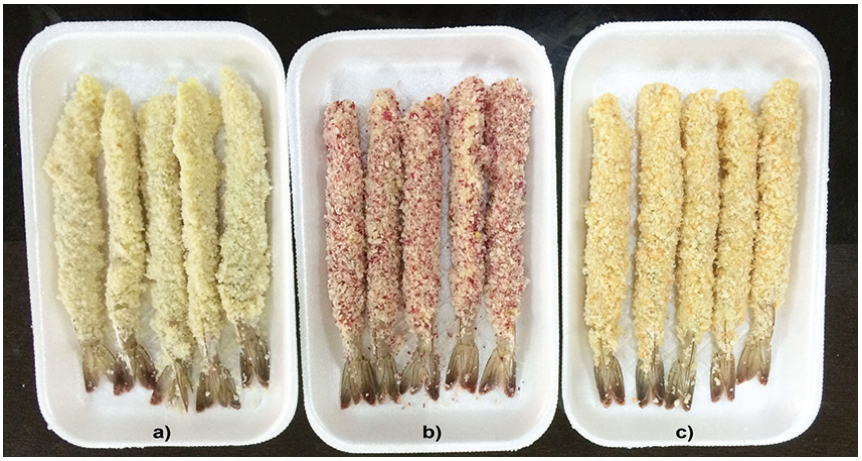
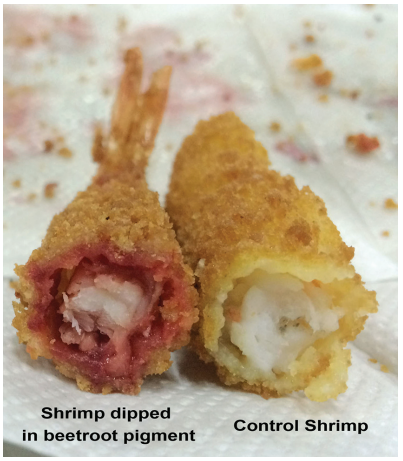
The demand for natural colours in food is set to increase due to consumer awareness on the deleterious effects of synthetic colours. Fortifying fishery products with natural colours from fruits and vegetables not only improves the aesthetic value of food, but also provide health benefits. Carrot and beetroot are rich source of pigments which are known for their antioxidant, anticancer, anti-atherogenic, anti-inflammatory and antimicrobial properties (Stintzing and Carle, 2004; Koley *et al.*, 2014). In the present study, fishery products namely battered and breaded stretched shrimp and fish wafers were fortified with beetroot and carrot pigments to enhance consumer appeal for the products.

Extraction of natural pigments: Natural pigments were extracted from beetroot (*Beta vulgaris*) and carrot (*Daucus carota;* orange cultivar) using a screw presser. The yields of pigment-laden liquid from beetroot and carrot were 73% (v/w) and 62% (v/w), respectively.

Battered and breaded shrimp fortified with natural pigments: *Litopenaeus vannamei* shrimp (mean weight 14.5g) were stretched using the CIFT-shrimp stretching mould. The extension in length ranged between 2 and 2.5 cm. Battered and breaded stretched *L. vannamei* was prepared by pre-dusting the stretched shrimp with dry batter and later coating the pre-dusted shrimp



a) Stretched shrimp b) Beetroot pigment coated c) Carrot pigment coated



Cross section of stretched shrimp

Fig 1. Stretched shrimp coated with vegetable pigments and stretched shrimp dipped directly in undiluted beetroot pigment-laden liquid

with an adhesive type quick setting batter (finely ground wheat flour maida 2000g, corn flour 200g, Bengal gram 200g, salt 30g, guar gum 5g, turmeric powder 5g and sodium tri polyphosphate 10g) formulated at ICAR-CIFT, Cochin. Control shrimp were breaded using commercially available bread crumbs. Beetroot and carrot pigment-laden liquids were sprayed on commercial bread crumbs at different concentrations (1, 2, 4 and 8% v/w) to impart colour to the stretched shrimp (Fig 1). In another batch, stretched *L. vannamei* shrimp were directly dipped in the undiluted colour-laden liquid (separately in beetroot and carrot pigment-laden liquids) and later breaded with commercially available bread crumbs (Fig. 1).

The L* (lightness), a* (positive value-red-; negative value-green), b* (positive value-yellow, negative value-blue) values of control and pigment-fortified breaded shrimp was measured using Hunter's colorimeter (ColorFlex EZ, Hunter Lab) immediately after preparation. Beetroot pigment-fortified breaded shrimp had higher a* value (10.7) whereas carrot pigment-fortified breaded shrimp had higher b* (20.7) value (Fig 2). Stretched shrimp dipped directly in beetroot pigment laden liquid (undiluted) imparted a deep pink colour to the shrimps and after frying the outer layer of the shrimp had distinct pink colour (Fig 1b). However, based on taste, the bread crumbs coated with beetroot were preferred to direct dipping of the shrimp in beetroot-laden liquid and the results based on organoleptic

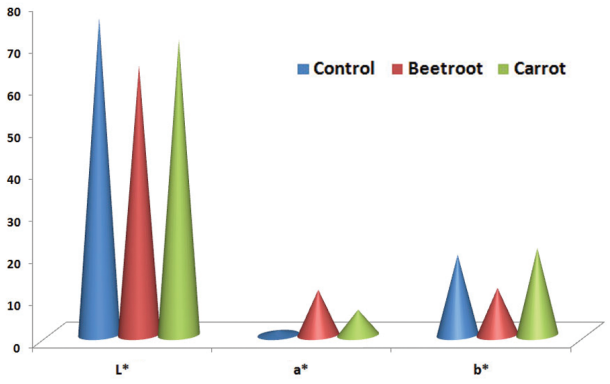


Fig. 2. Colour and lightness value of vegetable pigment fortified *L .vannamei* shrimp

evaluation (colour and taste) showed that beetroot pigment at 4% v/w and carrot pigment at 8% v/w had better acceptability.

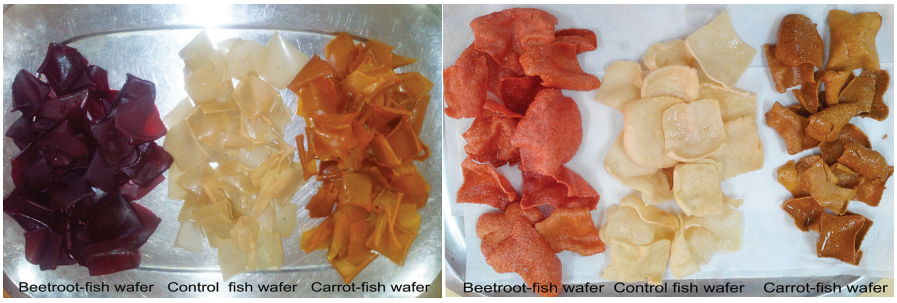
Fish wafers fortified with natural pigments: Fish wafers were prepared using croaker (*Nibea maculata*) fish meat. Coloured wafers were prepared by mixing the ingredients in natural pigment-laden liquid extracted from beetroot and carrot. The ingredients for the preparation of wafers are given in Table 1. Wafers were prepared as per ICAR-CIFT standardized process. However, beetroot-fish wafers and carrot-fish wafers were prepared by substituting water with the pigment-laden liquid. The fish wafers were stored in sealed polythene pouches and stored at ambient temperature in a dry place.

The control wafers appeared off white, beetroot-fish wafer as dark pink and carrot-fish

Table 1. Ingredients for the preparation of control and coloured fish wafers

Ingredients	Control-fish wafer (%)	Beetroot-fish wafer (%)	Carrot-fish wafer (%)
Fish mince	23.0	23.0	23.0
Starch	23.0	23.0	23.0
Corn flour	11.5	11.5	11.5
Salt	0.5	0.5	0.5
Water	42.0	0	0
Pigment-laden liquid extracted from beetroot	0	42.0	0
Pigment-laden liquid extracted from carrot	0	0	42.0

wafers as bright orange in raw form/before frying, to the naked eye (Fig. 3a). However, on frying there was a distinct change in the colour of the fish wafers. Control fish wafers appeared light yellowish brown; beetroot-fish wafers as light pink and carrot-fish wafers as dark brown colour (Fig. 3b).



a) Raw fish wafers b) Fried fish wafers

Fig. 3. Appearance of raw and fried fish wafers

The L* value of raw wafers was distinctly higher for control fish wafer (51.55±2.3) compared to carrot-fish wafer (35.95±1.9) and beetroot-fish wafer (20.7±1 whereas a* value and b* value were higher for raw carrot-fish wafer (19.4±1.8) (Fig. 4). Frying increased the L*, a*, b* values of control fish wafers and beetroot-fish wafers but the increase in these values was relatively higher for beetroot-fish wafers. L* value of beetroot-fish wafers increased from 20.7 to 37.8; a* increased from 6.9 to 16.6 and b* value increased from 4.3 to 25.2. During storage at ambient temperature, there was a slight change in the L*, a* and b* values of all the different fish wafers but the trend remained similar to that of raw fish wafers. The texture of the fried control fish wafers and beetroot-fish wafer was puffy but carrot-fish wafer was crispy.

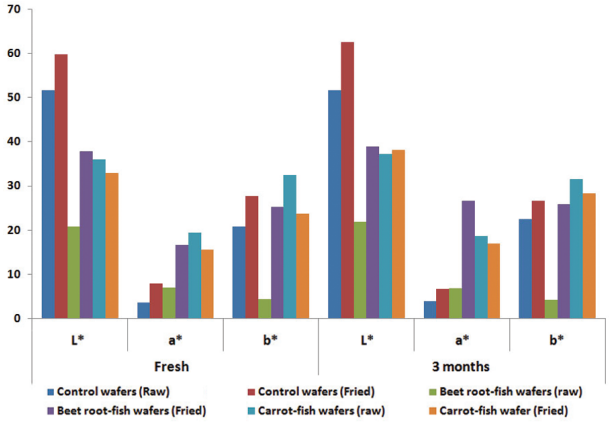


Fig. 4. L*, a* and b* values of raw and fried fish wafers (Fresh and after three months storage at ambient temperature)

Battered and breaded shrimp and fish wafers fortified with beetroot and carrot pigments were simple to prepare, increased the sensory appeal and have the potential to enhance consumer appeal. The results indicate that beetroot was relatively better compared to carrot as a colour imparting natural agent.

References

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Koley, T.K., Singh, S., Khemariya, P., Sarkar, A, Kaur, C., Chandra, S.N.S. and Naik, P.S. (2014) - Evaluation of bioactive properties of Indian carrot (*Daucus carota* L.): A chemometric approach. *Food Res. Intl*, **60:** 76-85.