

Value addition to commercial shark liver oil

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Abstract

Fish oils have recently become a subject of extensive research following reports of their health promoting effects attributable to their high content of omega-3-fatty acids, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Shark is very strong source of oil rich in omega-3-fatty acids. Generally shark liver oil contains 20-25 % omega-3 fatty acids (total), 15-18 % DHA and 2.5-4 % EPA. In Sri Lanka rather small quantities of oil extracted from shark livers are presently being used for the preparation of animal feeds. Large quantities of shark livers are wasted, and no value addition is done for edible purposes. The objective of this study was to develop a blended oil incorporating shark liver oil and evaluate its properties. Overall objective of this study was to add value to shark liver oil for human consumption in Sri Lanka. Specific objectives were: masking of fishy flavour of shark liver oil, development of a blended oil incorporating shark liver oil, sensory evaluation of blended oil and determination of the shelf life of blended oil.

Ten percent charcoal (w/w %) treatment was applied to remove the off flavour and reddish brown colour of crude shark liver oil. Lemon oil of 0.2 % (w/w %) was used as the flavour-masking agent. A blended oil was developed in 1:3 (shark liver oil: vegetable oil) weight ratio, which can supply 35.7 % of omega-3-fatty acids (total), 55.9 % of DHA and 34.1 % of EPA from the average daily requirement by consuming 10 g/day (1 table spoon). Stir-fried leeks and prawns using prepared blended oil were subjected to a sensory evaluation along with a commercially available vegetable oil as the reference. According to the results of the sensory evaluation there was no significant difference ($P>0.05$) between the prepared blended oil and the vegetable oil, used. Prepared blended oil showed greater stability against oxidation at elevated temperatures. Shelf life and hydrolysis qualities of blended oil were also at a satisfactory level. Prepared blended oil could be promoted as a source of omega-3-essential fatty acids in Sri Lanka.

Introduction

Fish oils have recently become a subject of extensive research following reports of their health promoting effects attributable to their high content of omega-3-fatty acids, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Generally shark liver oil contains 20-25% omega-3 fatty acids (total), 15-18% DHA and 2.5-4% EPA. In Sri Lanka large quantities of shark livers are wasted, and no value addition is done for edible purposes. Overall objective of this study was to add value to shark liver oil for human consumption in Sri Lanka. Specific objectives were; to mask the fishy flavour and odour of shark liver oil, to develop a blended oil incorporating shark liver oil, sensory evaluation of prepared blended oil and to determine the shelf life of prepared blended oil.

Methodology

Deodourization and discolouration of commercial shark liver oil

Shark liver oil was treated with 2%, 6% and 10% (w/w %) activated charcoal and the mixture kept over night. Solutions were filtered and checked for odour and colour.

Preparation of blended oil

Considering the oil qualities and ω -3-fatty acid supplementation levels blended oil samples in weight ratios of 1:2 and 1:3 (shark liver oil: vegetable oil) were prepared using 6% and 10% charcoal treated shark liver oil. 0.2% (w/w) of lemon oil flavor was added as the flavor-masking agent. Prepared blended oil samples were checked for odour and colour.

Reuse of activated charcoal

Activated charcoal, which used for the 10% treatment was checked for reuse by using 10% NaOH and 0.1M HCl treatments.

Sensory evaluation of the blended oil

A Triangle test was conducted to determine whether the prepared blended oil was significantly different from the commercially available vegetable oil by using stir-fried leeks and prawns. Results were analyzed using a one-tailed binomial test for significance.

Determination of Accelerated Shelf Life

Accelerated shelf life was determined for the commercial shark liver oil (crude oil), 10% charcoal treated shark liver oil, prepared blended oil and Vegetable oil (commercially available) at 42 °C storage condition. Free fatty acid (FFA) value and peroxide value (PV) were determined at 3-4 days intervals.

Results and discussion

Deodourization and discolouration of commercial shark liver oil

Lightness of oil colour had increased with the increasing of percentage of activated charcoal treated. Off odor strength had decreased with the increasing percentage of activated charcoal. Blended oil sample prepared using 10% charcoal treated shark liver oil in 1:3-weight ratio had the best properties.

Activated charcoal for reuse

Odour and colour qualities of the second oil filtrate were not at satisfactory level.

Analysis of sensory data

6 out of 10 panelists had correctly identified the different stir-fried leeks sample. The identification was not statistically significant ($P=0.007$). Therefore the organoleptic difference between the stir-fried leeks samples was insignificant. Only 2 out of 10 panelists had correctly identified the different stir-fried prawn sample ($P=0.896$). Therefore it could be concluded that there was no significant organoleptic difference between the stir-fried prawn samples.

Determination of the accelerated shelf life

Storage at 35 °C to 40 °C can bring about 4-fold deterioration in oils. With most oils acidity is noticeable to the palate when the FFA value is about 0.5-1.5%. Indian standards reported that the FFA value of shark liver oil must be less than 1.5% (Liyanage, 1999). Fresh oils usually have PV below 10 meq/kg (Egan *et al*, 1981).

The variations of FFA values at storage temperature of 42 °C are given in figure 1.

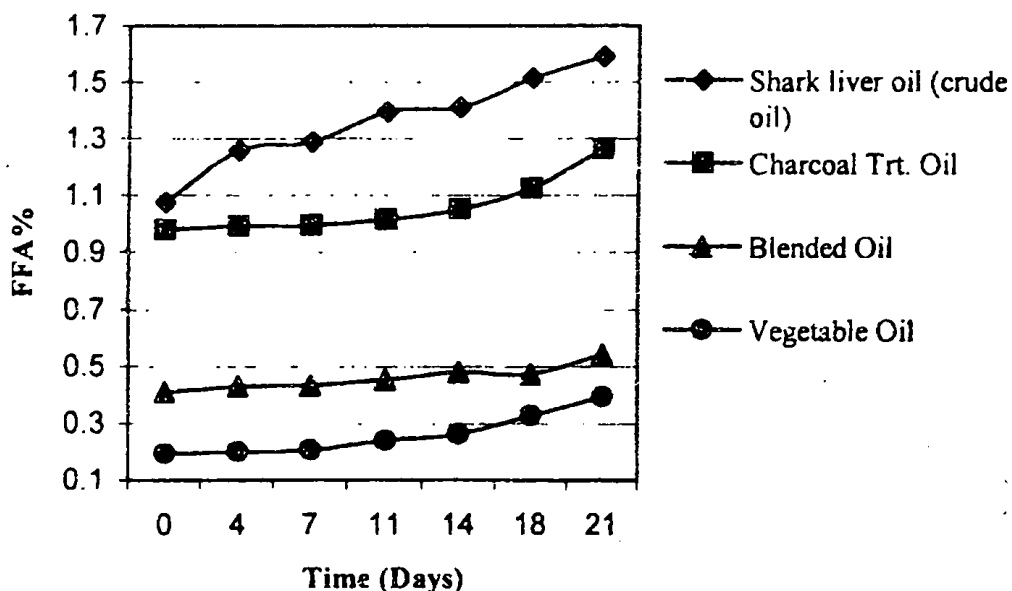


Figure 1. Free fatty acid value variations of different oils with storage time

Hydrolysis rate of commercial shark liver oil is greater than all the other three oils. Vegetable oil has the lowest hydrolysis rate. When comparing the qualities of the commercially available vegetable oil and the blended oil, prepared blended oil qualities (shelf life and hydrolysis rate) are at a satisfactory level.

Initial FFA value of the charcoal treated shark liver oil (0.979%) is lower than the initial FFA value of the commercial shark liver oil (1.075%). Therefore activated charcoal absorbs free fatty acids.

Figure 2, shows the variation in peroxide values with storage time.

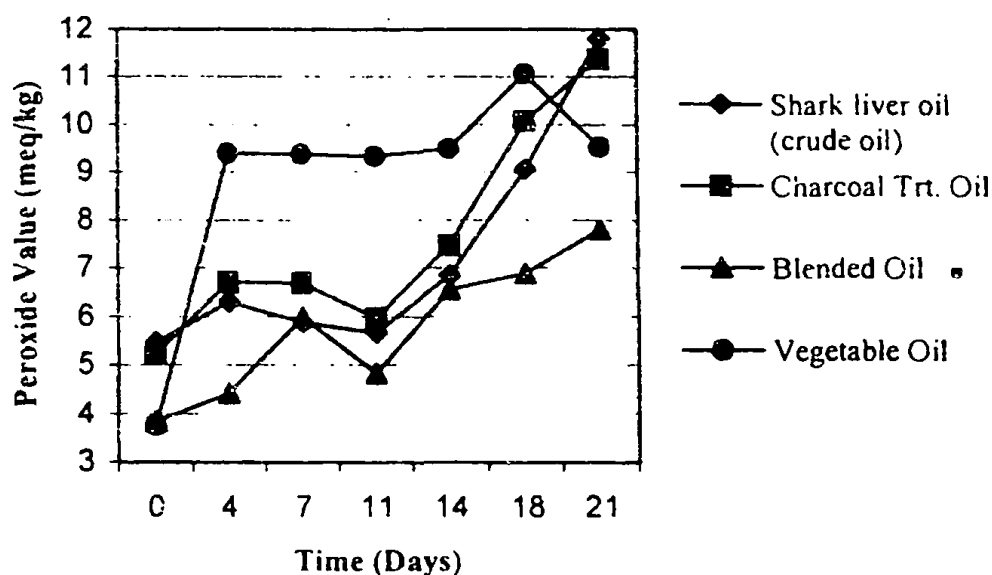


Figure 2. Peroxide value variations in different oils with storage time.

The commercially available vegetable oil shows least stability at higher temperatures. Prepared blended oil shows greatest stability against oxidation at elevated temperatures.

Conclusion

Prepared blended oil could be promoted as a source of ω -3-essential fatty acids in Sri Lanka. It could be used as a cooking oil for stir frying of vegetables, prawns, dried fish, sausages etc. Blended oil can supply 35.7% ω -3-fatty acids (total), 55.9% of DHA and 34.1% of EPA from average daily requirement by consuming 10 g/day (1 table spoon). Prepared blended oil showed greater stability against oxidation at elevated temperatures.