

# Formulation And Physicochemical Characterization Of Fish Skin (*Labeo rohita*) Oil Incorporated Mayonnaise

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**Abstract.** The present work is involved in preparing mayonnaise from fish skin oil (FSO) extracted from the skin of *Labeo rohita*. Mayonnaise was prepared using lemon juice, egg yolk, FSO, salt and sugar. The prepared mayonnaise was subjected to physicochemical characterization via acid value, peroxide value, and free fatty acid content determination. Its proximate composition was determined and the results revealed that it has crude protein content of  $1.27 \pm 0.02\%$ , total lipid of  $75.62 \pm 0.01\%$ , total carbohydrate of  $9.12 \pm 0.03\%$ , moisture content of  $13.69 \pm 0.03$ , ash content of  $0.30 \pm 0.01\%$  and pH of  $4.15 \pm 0.01$ . It was also subjected to FT-IR analysis and the results was compared with that of a market product. Sensory evaluation for taste, odour, flavour, colour, appearance was conducted and the results are also satisfactory. Prepared mayonnaise was checked for storage stability for 30 days at room temperature of  $30^\circ\text{C}$  and results revealed that the mayonnaise deteriorated after 12<sup>th</sup> day of room temperature storage.

## 1 Introduction

Mayonnaise is an oil-in-water emulsion, made by using an emulsifying agent to stabilize the emulsion. Mayonnaise is consumed as condiments. It is used both as an individual and as an ingredient in different preparations. Mayonnaise, traditionally, is an emulsion prepared by mixing egg yolk, vinegar, oil, and spices [1]. Conventional mayonnaise contains high fat (70-80%) and cholesterol content [2]. Commercial mayonnaise is prepared using egg yolks, salt, vinegar, thickening agents, and flavoring agents [3]. Now a day interest has been moved on the production of nutritionally superior quality mayonnaise so that it can be used in various ways in the diet. Replacing conventional oils with fish oil will be beneficial as long-chain omega 3 fatty acids into fish oils have cholesterol-lowering properties.

In this paper, an attempt was made to formulate a nutritionally enhanced mayonnaise with fish skin oil, which also contains omega 3 fatty acids, determined by gas chromatography. Here the oil used is extracted from the waste skin of *Labeo rohita*. This oil has noticeable antioxidative properties and also has thermal and oxidative stability as investigated earlier. Egg yolk used in mayonnaise production acts as an emulsifier and color enhancer. Lemon juice and salt are added as flavoring agents, which also produce physical stability. The objective of the work is to formulate a nutritionally superior quality mayonnaise and to characterize its physicochemical and functional properties along with a comparison with a market available one.

## 2 Methods and Materials

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### 2.1 Sample collection

Fish skins were collected from the local market and washed thoroughly to remove dust particles and any sort of scales with distilled water. It was cut into smaller pieces and kept at  $-20^\circ\text{C}$  until further use.

### 2.2 Sample preparation

Before oil extraction, the skin was thawed to room temperature. To extract oil from fish skin, first, the skins were dried in a hot air oven under constant temperature of  $55^\circ\text{C}$  and then grinded to obtain fish skin powder. Later it was dissolved in n-hexane with a 1:10 (w/v) ratio and kept for 24 hours. After 24 hours it was filtered using a whattman (no.4) filter paper. The filtrate was then subjected to distillation to separate the oil from the solvent at atmospheric pressure and under vacuum. Total oil yield was 23.2%.

### 2.3 Mayonnaise preparation

The nutritionally enriched mayonnaise was prepared according to a combined method [4,5,6] with slight modifications. The amount of each ingredient of the mayonnaise is represented in Table 1. The dry ingredient salt is mixed with lemon juice in a magnetic stirrer for 5 minutes, followed by mixing with egg yolk for 5 minutes. Oil was mixed slowly to the mixture under continuous mixing to form the emulsion, and stirrer until a smooth paste-like structure formed. A pictorial view of the prepared mayonnaise is mentioned in Figure 1.

## 2.4 Physicochemical analysis

The prepared mayonnaise (FSM) was subjected to physicochemical analysis with Acid value and Peroxide value determination according to the AOCS official method.

## 2.5 Proximate Composition of the Mayonnaise

The FSM was subjected to proximate composition analysis to reveal its major constituents such as Carbohydrates, Proteins, Fat, Moisture, Ash Content and pH. The result is reported in Table 3.

## 2.6 FT-IR analysis

FT-IR analysis of the lyophilized Mayonnaise was carried out to identify the functional group present in the sample and to compare the same with a market available formulation one. The result is shown in Figure 2.

## 2.7 Sensory property and Storage stability analysis

The FSM was analyzed for taste, odor, texture, flavor, and appearance and compared with a market one. The storage stability was determined by keeping the mayonnaise at 30°C for 30 days.

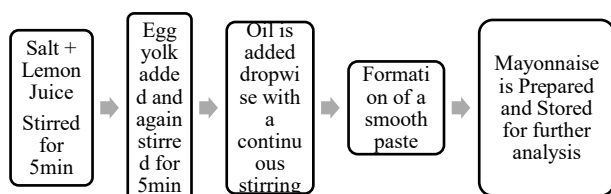
## 3 Results

### 3.1 Preparation of Mayonnaise

The amount of ingredients taken for the production of FSM is listed in Table 1 and the flow presentation of mayonnaise preparation is mentioned in Figure 1.

**Table 1.** Composition of FSM

Ingredients	Amount
Fresh egg yolk	15%
Lemon Juice	13%
Fish skin oil (FSO)	70%
Salt	2%



**Figure 1.** Flow of the FSM Preparation

### 3.2 Physicochemical property analysis

To determine the quality of FSM, Acid value and Peroxide value were conducted. The acid value indicating the hydrolysis of triglycerides present and the Peroxide value indicating the degree of oxidative stability due to unsaturation of the fatty acids present. The FSO is already established as edible by the authors

previous work. [6]. The values for FSM are represented in Table 2.

**Table 2 :** Physicochemical Properties of FSM

Parameter	Amount
Acid Value	3.01 ± 0.01 mg KOH/gm of oil
Peroxide Value	5.16 ± 0.01 meqO <sub>2</sub> /kg oil

All the tests are performed thrice. Data is expressed as Mean±SD.

All the parameters are within the range of edibility. The acid value of FSM is higher than previous works but the peroxide value matches with the same [7]. During storage both the acid value and peroxide value are increased, indicating lipid oxidation.

### 3.3 Proximate compositions

Proximate composition indicates the major nutrient constituent. The proximate composition of FSM was analyzed according to the standard method and the values are noted in Table 3. The pH is measured using a pH meter and the value is 4.15.

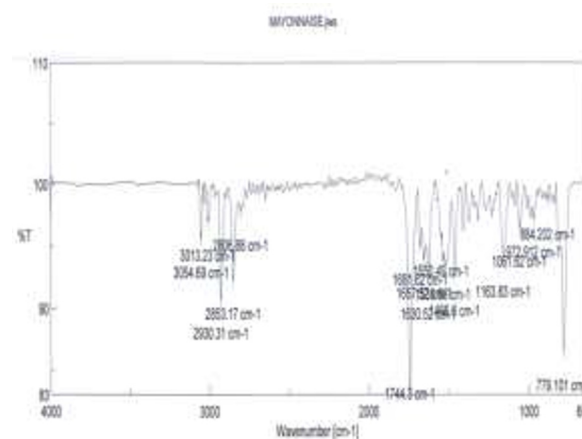
**Table 3.** Proximate Composition of FSM

Parameter	Amount (%)
Carbohydrate	9.12 ± 0.03
Protein	1.27 ± 0.02
Fat	75.62 ± 0.01
Moisture	13.69 ± 0.03
Ash	0.30 ± 0.01

All the tests are performed thrice. Data are expressed as Mean±SD

From the proximate composition, it can be easily stated that the protein content of FSM is too low, whereas the fat content is too high. The FSM contains FSO which has omega 3 fatty acids in it, and egg yolk so that the high-fat content could be beneficial.

### 3.4 FT-IR analysis:



**Figure 2.** FT-IR spectrum of the FSM preparation

FT-IR spectrum of FSM is depicted in Figure 2. The FT-IR spectra show the relation between fat % and water %

within the absorbance at  $1744\text{ cm}^{-1}$  and  $1657\text{ cm}^{-1}$  respectively and it matches with previously conducted works [8]. This spectrum has been compared with a market available one and the spectrum is also shown in Figure 3.

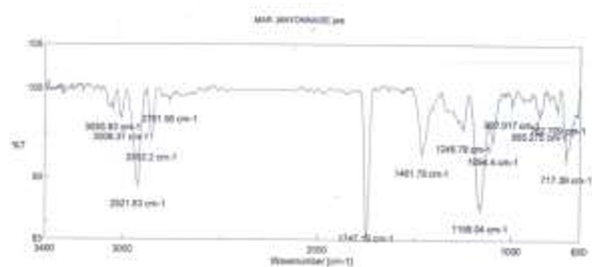


Figure 3. FT-IR spectrum of the market available one

From the comparison of both spectrum, it can be concluded that the FSM has similar chemical properties with the market one.

### 3.5 Sensory and Storage Properties

FSM was analyzed for texture, flavor, color, and odor. Due to the incorporation of the fish skin oil, the FSM has a characteristic fishy smell due to the presence of trimethylamine (TMA) which can make it unacceptable. The fishy smell also merges with other ingredients of FSM and makes it off-flavor. The mayonnaise was stored at  $30^{\circ}\text{C}$  for 30days and deterioration started on the 12<sup>th</sup> day of storage probably due to the antioxidative properties of FSO. The pictorial view of FSM is represented in Figure 4.



Figure 5. Prepared mayonnaise (FSM)

### 4 Conclusion

The work describes the beneficial food application of FSO. The prepared mayonnaise prepared can be a good alternative to conventional mayonnaise. Due to its strong fishy smell, it may not be acceptable to the consumers but the addition of some flavor enhancers can overcome the smell, and then it could be a good choice. All the other Physicochemical and Organoleptic parameters fall within the edibility range. The prepared mayonnaise is omega 3 fatty acid-rich and has good antioxidative properties.

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