RESEARCH PAPER

Study of Physicochemical and Microbial Quality of Spiced Fish Sauce made from *Catla Catla* Fish During Storage

A.C. Dagadkhair¹*, K.N. Pakhare², R.R. Andhale¹ and H.M. Syed³

¹MIT CFT, MIT Art Design and Technology University, Pune, Maharashtra, India
²Department of Technology, Food Technology Division, Shivaji University, Kolhapur, Maharashtra, India
³Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapith, Parbhani, Maharashtra, India

*Corresponding author: amoldagadkhair007@gmail.com

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ABSTRACT

The present investigation was undertaken with the objective of finding out the physico-chemical and microbial quality of spiced fish sauce made from the fresh water *Catla catla* fish for a period of 60 days storage. The spiced fish sauce was prepared by anaerobic fermentation for about 2 months and evaluated different physico-chemical for characteristics such as moisture, fat, protein carbohydrate, salt, total ash, pH and TSS were examined at an interval of 15 days. The microbial study of fish sauce during study showed that the TPC (Total Plate Count) and yeast and mold count were gradually decreased from that the fresh of \(5.4 \times 10^4\) cfu/ml to \(4.3 \times 10^3\) cfu/ml and from fresh (\(3.1 \times 10^3\) cfu/ml) (\(2.0 \times 10^2\) cfu/ml), respectively during 60 days. The lactic acid bacteria count was progressively increased during storage (fresh day (\(2.9 \times 10^3\) cfu/ml) (\(4.1 \times 10^3\) cfu/ml)) during 60 days. Further, objectionable colony of *Coliform* and *Salmonella* was detected during the whole storage. The microbial counts were within the specified standards for the consumption of the fishy food products. However, the organoleptic evaluation of the fish sauce during storage showed that the highest score for overall acceptability was recorded for 60 days (8.6) and followed by 45 days (8.5) and 30 days (8.3). It can be concluded that the prepared fish sauce can be stored for 60 days with good physiochemical and sensory quality storage quality and acceptability.

Keywords: Fish, spice, fish sauce, microbial, TPC and LAB's

Fish and fishery products represent a valuable source of nutrients of fundamental importance for diversified and healthy diets. Fish provides not only high-value protein, but also a wide range of essential micronutrients, including various vitamins (D, A and B), minerals and polyunsaturated omega-3 fatty acids (docosahexaenoic acid and eicosapentaenoic acid) (FAO, 2012).

In Southeast Asia, fish sauce is made from various types of fish, from both freshwater and marine fish species by various methods. Each has its unique taste and characteristic (Ismail, 1977; Putro, 1993). Fermentation is one of the oldest techniques in food preservation as it not only extends the shelf-life but also enhances the flavour and nutritional quality of the product (Visessanguan et al., 2005). Fish sauce is a translucent amber liquid with a unique aroma and flavour and is rich in amino acids”. It is basically a protein hydrolysate that results from a natural fermentation of fish and salt (Saisithi, 1994). Degradation of fish protein to free amino acids is primarily responsible for the delicious taste of fish sauce. It is a rich source of essential amino acids especially lysine and vitamin B₁₂ (Chayovan et al., 1983).

Spices and herbs have been used for thousands of
centuries by many cultures to enhance the flavor, aroma and antimicrobial functions in foods (Omer, 2006; Reichling et al., 2009). Wheat contains about 26–28% starch. Gelatinization of starch is responsible for the thickening or viscosity of foods (Vickie, 2008). Present study was undertaken with the objectives study of physico-chemical and microbial quality of spiced fish sauce made from *Catla catla* fish during storage.

**Flow sheet for Preparation of plain Fish sauce**

- Fresh Fish
- Sensory evaluation
- Dressing
- Cut it into required size pieces
- Washed
- Mixed with salt (3:1 proportion fish: salt)
- Kept in a glass jar and light the lid was tight (To maintain anaerobic condition)
- Kept for Fermentation (for 2 month)
- Shape the jar occasionally during fermentation
- Amber colored of liquid was drained off
- Transferred to well sterile bottle
- Plain fish sauce
- Spices
- Roasting
- Grinding
- Mix into plain fish sauce
- Pasteurization
- Pouring into required size bottle
- Capping
- Cooling and storage

**MATERIALS AND METHODS**

**Raw materials**

The raw materials such as fresh fish, salt, wheat flour, spices and other material were procured from the local market.

**Preparation of plain and spiced fish sauce**

Spiced fish sauce was prepared as per the methodology given by (Al-Jedah et al., 2000). The flow chart and recipe used for the preparation of the spiced fish sauce is presented in the fig. 1 and table 1, respectively.

**Table 1: Recipe for the preparation of the spiced fish sauce**

<table>
<thead>
<tr>
<th>Name of ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain (Concentrated) fish sauce (kg)</td>
<td>1</td>
</tr>
<tr>
<td>Wheat</td>
<td>1.5</td>
</tr>
<tr>
<td>Coriander</td>
<td>1</td>
</tr>
<tr>
<td>Mustard</td>
<td>1</td>
</tr>
<tr>
<td>Cumin seeds</td>
<td>500</td>
</tr>
<tr>
<td>Fennel seeds</td>
<td>750</td>
</tr>
<tr>
<td>Black pepper</td>
<td>100</td>
</tr>
<tr>
<td>Water (lit)</td>
<td>8</td>
</tr>
</tbody>
</table>

**Physicochemical analysis of spiced fish sauce**

Chemical constituents like moisture, fat, protein, carbohydrate, total ash, salt, TSS, TS Total organic content and pH were determined as per the methodology given by AOAC, (2005).

**Microbial Quality of fish Sauce**

Microbial quality parameter such as Total plate count (TPC), Yeast and Moulds (YM), LAB's, *C. Pasteurization* and *S. salmonella* count, were examined as per the methods given by APHA, (1992). The effects of storage on microbial quality of spiced fish sauce was studied for 60 days at specific interval of 15 days.

**Sensory evaluation**

The sensory evaluation of prepared fish sauce was carried out as per the method given by the Sung and Stone (2004).
The data obtained from various parameters were recorded and statistically analysed as per method of Panse and Sukhatme (1987).

RESULTS AND DISCUSSION

The results pertaining to the present study effect of storage on physicochemical and microbial properties of spiced fish sauce were studied and presented under suitable headings and sub headings.

Effect of storage (ambient temperature) on physicochemical

The effect of storage (ambient temperature) on physicochemical quality of spiced sauce were studied and results obtained are depicted in table 2 for 60 days storage at an interval of 15 days.

It is clear from the result in that the moisture content of spiced sauce was found to be increased linearly from fresh 65.81g/100g to to that 60 days was 66.20g/100g. Whereas, the fat content was slightly decreased during storage period fresh (6.20g/100g) to 60 days (6.08g/100g). The increase in moisture content and decrease in fat content of spiced sauce may be due to degradation and hydrolysis of nutrients by fermentation of lactic acid bacteria. The results obtained are in accordance with the Magdi, (2010) for moisture and fat content of spiced fish sauce. The protein content of the spiced fish sauce increased during the storage, the increase in protein concentration of spiced fish sauce may be due to increase in bulk of microbes in the sauce.

Further, it was noted from the table 2 that carbohydrates content decreased from fresh 16.15g/100g, 15 days 15.87g/100g, 30 days 15.70g/100g, 45 days 15.57g/100g to 60 days 15.10g/100g. Ultimate results showed that the carbohydrate content decreased during storage and it could be due to utilization of carbohydrate by microbes in the sauce. Negligible changes were however observed for the salt and ash content during the period of 60 days storage. The pH of any food product has direct impact on the storage of spiced fish sauce. The pH of spiced sauce however gradually decreased during storage. The pH of spiced sauce however gradually decreased during storage. The pH of spiced sauce during in noted from fresh 5.62 in 15 days 5.45, 30 days 5.32 in 45 days 5.10 and 60 days 4.87. However, slight decrease in the total soluble solids took place during the storage. Results obtained are comparable with the results reported by Nicole et al. (2011).

Effect of storage (ambient temperature) on viscosity of spiced fish sauce

The viscosity of the spiced fish sauce was measured during the 60 days storage at an interval of 15 days by using the Brookfield viscometer and results recorded are summarized in the table 3 and Fig. 1.

### Table 2: Effect of storage (ambient temperature) on chemical composition of spiced fish sauce

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Fresh</th>
<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
<th>SE±</th>
<th>CD at 5 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (g/100g)</td>
<td>65.81</td>
<td>65.85</td>
<td>65.89</td>
<td>65.95</td>
<td>66.20</td>
<td>0.0191</td>
<td>0.0590</td>
</tr>
<tr>
<td>Fat (g/100g)</td>
<td>06.20</td>
<td>06.16</td>
<td>06.15</td>
<td>06.12</td>
<td>06.08</td>
<td>0.0103</td>
<td>0.0318</td>
</tr>
<tr>
<td>Protein (g/100g)</td>
<td>05.72</td>
<td>05.79</td>
<td>05.84</td>
<td>05.97</td>
<td>06.25</td>
<td>0.0129</td>
<td>0.0397</td>
</tr>
<tr>
<td>Carbohydrates (g/100g)</td>
<td>16.15</td>
<td>15.87</td>
<td>15.70</td>
<td>15.57</td>
<td>15.10</td>
<td>0.0214</td>
<td>0.0662</td>
</tr>
<tr>
<td>Salt (g/100g)</td>
<td>03.20</td>
<td>03.20</td>
<td>03.19</td>
<td>03.18</td>
<td>03.18</td>
<td>0.0115</td>
<td>0.0355</td>
</tr>
<tr>
<td>Total Ash (g/100g)</td>
<td>02.90</td>
<td>02.90</td>
<td>02.89</td>
<td>02.88</td>
<td>02.88</td>
<td>0.0096</td>
<td>0.0297</td>
</tr>
<tr>
<td>pH</td>
<td>5.62</td>
<td>5.45</td>
<td>5.32</td>
<td>5.10</td>
<td>4.87</td>
<td>0.0187</td>
<td>0.0579</td>
</tr>
<tr>
<td>Total soluble solids</td>
<td>21</td>
<td>22</td>
<td>22</td>
<td>23</td>
<td>23</td>
<td>1.0645</td>
<td>3.2805</td>
</tr>
</tbody>
</table>

*Each value represents the average of three determinations
Table 3: Effect of storage (ambient temperature) on viscosity of spiced fish sauce

<table>
<thead>
<tr>
<th>Days</th>
<th>Viscosity in Centipoise (cP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>282.0</td>
</tr>
<tr>
<td>15</td>
<td>278.2</td>
</tr>
<tr>
<td>30</td>
<td>275.3</td>
</tr>
<tr>
<td>45</td>
<td>268.6</td>
</tr>
<tr>
<td>60</td>
<td>260.4</td>
</tr>
</tbody>
</table>

*Each value represents the average of three determinations

From the table 3, Fig 1 it could be revealed that the viscosity gradually decreased from the fresh value 282.0 cP to that of 15 days 278.2 cP to 30 days 275.3 cP to 45 days 268.6 cP to 60 days 260.4 cP. Decrease in the viscosity during storage might be due to fermentation activity and hydrolysis of food components. Similar results and concerning viscosity changes during storage were expressed by Beal et al. (1999) and Fengxia et al. (2014).

Microbial quality of spiced fish sauce

In fish sauce production, microorganisms were associated with the fermentation process, the different microbial quality parameters such as TPC, Yeast and Mold, LAB's, coliform and Salmonella were examined during the storage of 60 days at an interval of 15 days. The results recorded are tabulated in the table 3.

The results (table 4) show that the TPC of fish sauce drastically decreased during storage. It was found that the TPC and Yeast and mold count decreased from fresh fish sauce (5.4 × 10⁴ cfu/ml) to 60 days (4.3 × 10³ cfu/ml) and fresh (3.1 × 10⁴ cfu/ml) to 60 days (2.0 × 10² cfu/ml) respectively. The constituents in spices such as sulphur compounds, terpenes and terpene derivatives, phenols, esters, aldehydes, alcohols and glycosides have shown antimicrobial functions and may result in decrease in the TPC. The results of TPC are comparable with the results narrated by Berna et al. (2005) and Syed et al. (2010).

Further, it could be revealed that the LAB count was progressively increased during storage right from the fresh (2.9 × 10³ cfu/ml) to 15 days (3.1 × 10³ cfu/ml), 30 days (3.4 × 10³ cfu/ml), 45 days (3.6 × 10³ cfu/ml) and 60 days (4.1 × 10³ cfu/ml). Addition of spices could act as stimulants for the growth of Lactic acid bacteria (Al Jedah et al., 2000) Results of the LAB are in accordance with the findings of Rollan et al., (2010). However, during the whole study right from the preparation of plain fish sauce to the final microbial

![Effect of storage (ambient temperature) on viscosity of spiced fish sauce](image_url)

**Fig. 1.** Effect of storage (ambient temperature) on viscosity of spiced fish sauce
examination of spiced sauce showed absence of any Coliform and Salmonella count in the sample.

Sensory Evaluation of the of Spiced fish Sauce during the storage

The different organoleptic parameters such as color, taste, flavor and overall acceptability were evaluated from the 10 semi-trained panelist and the sensory score obtained are presented in the table 5 and Fig. 2.

Table 4: Sensory evaluation of the of Spiced fish Sauce during the storage

<table>
<thead>
<tr>
<th>Days</th>
<th>Sensory attributes</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Colour</td>
<td>Taste</td>
</tr>
<tr>
<td>Fresh</td>
<td>8.5</td>
<td>7.5</td>
</tr>
<tr>
<td>15</td>
<td>8.4</td>
<td>8.3</td>
</tr>
<tr>
<td>30</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>45</td>
<td>7.7</td>
<td>8.5</td>
</tr>
<tr>
<td>60</td>
<td>7.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Mean</td>
<td>8.10</td>
<td>8.22</td>
</tr>
<tr>
<td>SE</td>
<td>0.0164</td>
<td>0.0869</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>0.3280</td>
<td>0.2678</td>
</tr>
</tbody>
</table>

*Each value represents the average of ten determinations

sensory score for colour of fish sauce was found to be linearly decreased from the fresh (8.5) to 60 days (7.5) with a mean value of 8.10. The decrease in the color sensory score during storage may be due to changes in the chemical composition of sauce by action of LAB. The taste of product was progressively increased during storage, the best taste was observed on 45 days (8.5) and 60 days (8.5) storage and which was at par with 15 days (8.3) and 30 days (8.3) followed by fresh day (7.5).

Further, it could be noted that the flavour character was successively increased during storage of sauce, the highest score for the flavour was noted on 60 days (8.5) followed by 45 days (8.3). It was seen from the results that variation do exists in overall acceptability score. The overall acceptability was found to be highest on 60 days storage (8.6). The overall acceptability of spiced sauce on storage of 45 days (8.5) and 30 days (8.3) was also good as compared to 15 days (8.2) and fresh (8.0). The overall acceptability of sauce was attributed to the different characters of colour, taste and flavour of the product. It was revealed from the scores of the overall acceptability that the overall acceptability of sauce was gradually increased on storage. This effect on sensorial quality of spiced fish may be due to changes in the chemical composition of sauce and increase in the acidity results into increasing the palatability of the product.
CONCLUSION

Form the present investigation, it could be concluded that the *Catla* fish sauce can be stored for 60 days at room temperature. During the storage physicochemical and microbial changes were observed. The microbial count during the storage was found to be within the given limit and hence prepared sauce was fit for consumption and commercial exploitation.

REFERENCES


