

Consumer's Acceptability Estimation of Cold Preserved Malaysian Freshwater Patin

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Abstract: The study presents an attempt to correlate the consumer acceptability of Malaysian Patin fish with the storage time and temperature. A batch of typical fresh fishes was cut into regular slices (samples), which were wrapped and distributed evenly to four cold stores by 0, 3, 5 and 10°C storage temperature for a period of 28 days. During the course of storage, each three days, samples were taken from the stores to be tested chemically and sincerely by trained panelists. A correlation was developed between the consumer accepted and the storage time and temperatures via the acidity (pH) test. The correlation was plotted graphically to form a simple tool to the fish market retailers by which the quality and the shelf life of the displayed fish could be estimated.

Key words: Freshwater Fish, Consumer's Acceptability

INTRODUCTION

The demand for fish in the world generally^[1] and in Malaysia particularly^[2] has grown considerably in recent years and its perceived benefits to health have made it a more up market food. However, the supply and the prices for marine fish are unstable throughout the year.

The freshwater fish are the viable alternative of marine fish. Karim^[3] reported that the Malaysian Fishery Department is now encouraging and expanding the freshwater fish rearing industry among agriculturists and fishermen to increase their income. The fish farming techniques are improving with the introduction of new techniques in order to have a consistent supply of freshwater fish throughout the year. Fisheries Department reported that the landing of freshwater fish in Malaysia in 1995 and 1996 were 3,9384.94 tones and 3,683.21 tones, respectively^[2]. In a recent development, there are even efforts made by government agencies as well as individuals to introduce freshwater base foods to the markets. One of the successful examples is the introduction of fish balls, breaded fingers and crackers from red tilapia into the market^[2]. It has been known commercially that the unfrozen state of the displayed fish attracts consumers rather than frozen one, accordingly fish are sold unfrozen which will be subjected to spoilage^[4]. It is commonly kept in a point close to the freezing point to extend the shelf life that means gain to the sellers.

To enhance the consumption and utilization of our local freshwater fish, more research should be done in order to study the characteristics of our local freshwater fish from the cold storage and expected shelf life point of view. The need for simple tool which delivers expected shelf life is still valid for the sellers; in the light of above this research work has been justified.

MATERIALS AND METHODS

Pangasius Sutchi which is known locally as Patin species of local freshwater fish is chosen as a sample. *Pangasius sutchi* fishes were bought from a nearby farm. The fish were brought alive to the fisheries laboratory in batches. The fishes were chosen according to their normal market sizes. Their weight and length were recorded before filleting was done. Due to non homogeneity in the fish flesh the sampling area was selected from the upper portion with respect to the lateral line of the fish body as shown in Fig. 1.

Sample Preparations: Prior to filleting, the fishes were killed by stunning the head with a metal for filleting. The fillets were obtained approximately 5 cm below the operculum until approximately 10 cm from the tail ends. This was followed by the de skinning process. The filleting and de skinning were done manually. Fillets were kept in Styrofoam boxes containing crushed ice while waiting for all fish in the batch to be filleted and de skinned. The fillets were then washed under running tap water to remove blood, dirt and slime. The fillets were then weighed and divided into four lots. The first lot was for the storage study at 0°C and the second, third and fourth lots where for 3, 5 and 10°C studies, respectively.

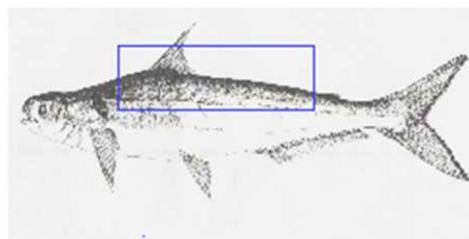


Fig. 1: The Selected Area for Sampling

PH Measurement: Fish muscle was blended in a Waring blender with 1 part of muscle to 5 parts of distilled water. The pH was read directly from a laboratory pH meter (Hanna Instrument, 471). Determination was done in 3 replicates.

Sensory Evaluation: Sensory evaluation was performed by trained panelists which comprised 10 members of the Faculty of Food Science and Biotechnology Universiti Putra Malaysia. Panelists were asked to evaluate on the overall acceptance of the thawed fillets cut in about 4 cm length and 1 cm thick. The evaluation was used based on the hedonic of 7-point.

Where 1 = like very much, 2 = like moderately, 3 = like slightly, 4 = neither like or dislike, 5 = dislike slightly, 6 = dislike moderately and 7 = dislike very much.

RESULTS AND DISCUSSION

Changes in pH Values: The initial pH values of the fresh samples were measured to be 6.03. A significant increase in pH of the four batches during storage course has been noted. All the batches exhibit similar increasing behavior. However, each batch yielded different pH value in the end of the storage period according to the storage temperature of that store. Figure 2 revealed that 6.8, 6.96, 7.12 and 7.6 are the end pH values of the storage temperatures 0, 3, 5 and 10°C, respectively.

In order to estimate the pH value at a prescribed storage (chilling) temperature and storage time, the MMF model has been found to deliver satisfactory fitting model as follows:

$$pH = \frac{ab + cD^d}{b + D^d} \quad (1)$$

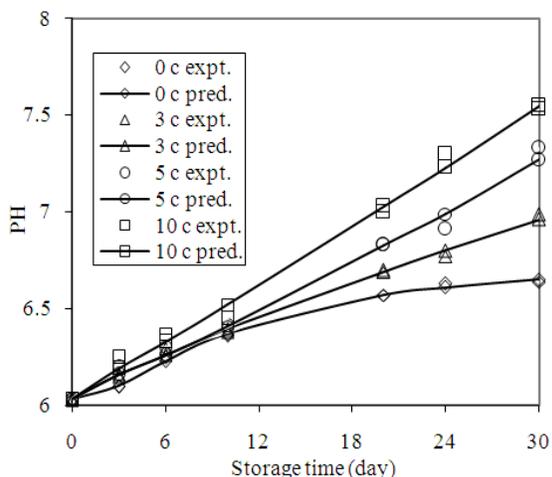


Fig. 2: Evolution of pH Value during Storage Period

The constants a, b, c and d were found to be a function of the storage temperature, therefore for the purpose of precise estimation the following equations may be used along with the storage temperature:

$$a = \frac{1}{0.166 - 0.00031T + 1.89633E - 5T^2} \quad (2)$$

$$b = 1514948.9e^{-\frac{(4.7-T)^2}{0.529}} \quad (3)$$

$$c = \frac{125.44 - 5.67T}{1 - 0.1357T - 0.0127T^2} \quad (4)$$

$$d = \frac{1.645 + 9.45E9T}{1 + 1.011E10 - 1.587E8T^2} \quad (5)$$

Earlier, Gould and Peters^[5] associated the increase in pH during storage of fish muscle with the depletion of the tissues. They also reported that the pH of surface flesh as a rapid test for detection of spoilage at sea. However, they neither mentioned the exact cause of spoilage nor the acceptable range of pH. Jamilah^[6] also reported the increase in pH during her study of bighead carp kept at ambient temperature. Love^[7] and Rhee *et al.*^[8] Reported that enzyme-catalyzed oxidation in fish muscle tissue achieved an optimum rate at pH 6.5. This implies that the enzyme-catalyzed oxidation reaction is at its peak at pH 6.5. However, the activity still goes on thereafter, but at a lower rate.

Sensory Evaluation: Spoilage and quality deterioration can be assessed by chemical and physical methods and sensory evaluation. Not all chemical assessments give good correlation to quality changes and sensory evaluation is a necessity^[9]. Larmond^[10] wrote about the necessity of conducting sensory evaluation. She wrote that sensory testing must play an important in any food quality evaluation since the ultimate criterion for eating quality of food products is a human response. Instrumental methods to determine some physical, chemical or biological properties of the food have been developed and are being used to assess flavor, color and texture. However, sensory evaluation panels must be used to ensure that these instrumental methods are measuring what they think intended for.

In general, sensory evaluations were carried out only for samples that were kept at 0°C. This was due to quality deterioration to the samples after that which prevents them from being further evaluated. The results for each parameter were then evaluated using a hedonic scale. The survey of the sensory evaluation at 0°C has been correlated with the pH ratio variation to yield the following relationship, as shown in Fig. 2. In order to relate the variation of consumer acceptability with pH ratio at 0°C Fig. 3 has been developed and represented mathematically by the following model:

$$\text{acc} = -48.331307 + 50.431848 \frac{\text{pH}}{\text{pHo}} \quad (6)$$

Relative rates of spoilage at different storage temperatures are often useful when estimating the quality of the fish of known temperature history, although, as indicated earlier, this applies only to Fish above 0°C. For ice melts at 0°C under normal conditions, a reference temperature of 0°C is normally used when comparing storage times of fresh fish and shellfish. A development of the Arrhenius reaction rate equation allows the calculation of 'relative spoilage rates' of fish and shellfish for temperatures above 0°C^[11]. The relative spoilage rate (R) is given by:

$$R = (1 + 0.1T_{\text{chilling}})^2 \quad (7)$$

When the temperature history of a fish after catching is known, the quality of fish is estimated by integrating the relative spoilage rates with time, resulting in an equivalent length of time of storage at 0°C. This gives an indication of the quality of the fish by assuming that the fish is in prime condition upon catching and that handling is of a sufficiently high standard to avoid problems such as bruising. Poor handling would result in much more rapid spoilage than the calculated equivalent 'length of time on ice' would indicate. Figure 4 depicts the relationship between the relative rate of spoilage and storage temperatures used in this study. Equation 1 was utilized to calculate pH/pHo for every day during the course of storage and then via equation 6 the acceptability factors were deduced. Since equation 7 has been explained already to predict the relative rate of spoilage for the storage temperature other than 0°C, according to that procedure, it could be inferred that it is possible to predict the acceptability factor for the other storage temperature as shown in Fig. 4. In Fig. 5 curves are included concurrently at the coordinate point (0,1), where 0 stands for the storage time in days and 1 represents the hedonic score which means the acceptability factor is at the highest value. That collection of curves represents the storage temperatures of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 °C. The longest one which appears on the right most of the figure is for 0°C storage temperature and the one at the far left, which is the nearest to the ordinate, represents 10°C. The other curves distributed sequentially.

There was a significant difference for overall acceptability upon storage for all samples kept at all temperatures. There was also a significant difference between storage temperatures. Samples kept at higher temperature exhibit a faster overall acceptance rejection as compared to samples kept at 0°C. Figure 5 has been formed to be used in the fish markets for quality and shelf life estimation. The mentioned figure was verified by comparing its results with many practical observations.

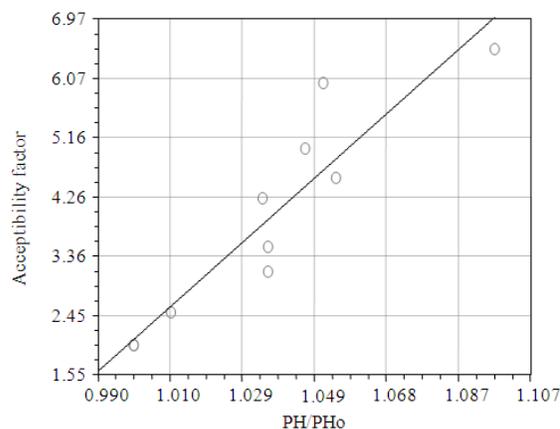


Fig. 3: Relationship between Acceptability and pH Ratio at 0°C

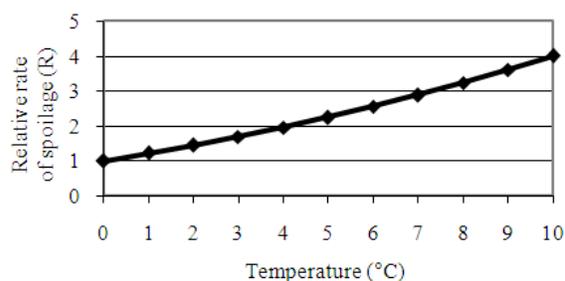


Fig. 4: Effect of Storage Temperature on Spoilage

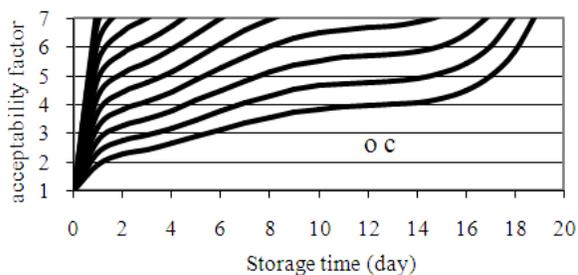


Fig. 5: Predicted Acceptability with Temperature and Time of Storage

CONCLUSION

The ultimate achievement of this study was developing a simple tool to the fish sellers by which the consumer acceptability and the shelf life of the purchased fishes could be estimated. The work was started by preparing of the samples thereafter distributing them into four cold stores of different preservation temperatures for 28 days. Observations of pH and sensory tests were performed periodically during the course of preservation. The PH/PHo observations were regressed verse the time and temperature of storage to yield a new correlation for

Malaysian *Pangasius sutchi* of 70 cm length. Alike regression was developed to yield correlation between the observed consumer acceptability with time at preservation of 0°C. Equation 7 was used to generate the consumer acceptability at the other preservation temperatures not 0°C. Due to good reliability the Fig. 5 could be used for a Malaysian portion of similar age.

Notation:

a, b, c, d	Polynomial coefficients
acc	Hedonic scores
D	the storage time (day)
pH	Acidity index
T	Storage temperature (°C)
Subscript	
O	Fresh

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