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Comparative study of changes in the quality attributes of Indian mackerel (*Rastrelliger kanagurta*) and pink perch (*Nemipterus japonicus*) stored in solar operated refrigerated fish vending Unit

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Abstract
Fish is a highly perishable product due to its high water activity and protein content, neutral pH and presence of autolytic enzymes. Time and temperature are the most critical factors to control and ensure that seafood retains freshness as long as possible. The aim of the study was to use the solar energy as an alternate source of energy. The unit consists of 3 different compartments to keep different sized-variety fishes separately and have the display facility. A study was conducted on quality attributes of fatty and lean fish, fresh Indian mackerel (*Rastrelliger kanagurta*) and pink perch (*Nemipterus japonicus*) were procured from the Mangalore landing centre in very fresh condition. The influences of refrigerated storage on the samples were evaluated by studying the bio-chemical and sensory attributes. During the storage study period, the samples were drawn at every alternate day of interval, upto 8 days for mackerel and 10 days for a perch for analyses. pH, AAN, NPN and the overall acceptability of both mackerel and pink perch decreased significantly ($p<0.05$) with the increase in storage days.

Keywords: Solar, vending unit, refrigerated, *Rastrelliger kanagurta*, *Nemipterus japonicus*

1. Introduction
Fish is considered as the food for less privileged section in developing nations, and is the only sources of high quality protein available at affordable price and in sufficient quantity [1]. Fish is a preferable substitute for livestock meat because of its low cholesterol level and high omega-3 fatty acid content which help in reducing cardiovascular and various other diseases [2]. Indian mackerel and pink perch are commercially important species in India. Pink perch is a suitable raw material for surimi production [3] because it exhibit proper characteristic for processing export quality surimi, on the other hand the fresh Mackerel has high market demand. It is well known fact that a huge amount of fish is lost every year due to quality deterioration because of post-harvest fish handling as well as preservation techniques that might guarantee the high quality of the product. The shelf life of fish is influenced by a number of factors such as initial microbiological load, season, handling and the limited and variable shelf lives of fish are major problems for fish quality and assurance [4]. Temperature control is the most important physical factor in the preservation of seafood, and it is also important for the prediction of the remaining days of the shelf life of a product. It is known that if fresh seafood is properly handled and kept at low temperatures, the bacterial growth is reduced and other spoilage factors are controlled [5]. The shelf life of most marine fishes has been predicted to range between 2 to 24 days in ice, 5 d at 5 °C and 3 d at 10 °C [6]. The shelf life of Algerian farmed tilapia (*Oreochromis niloticus*) was limited to 12 h and 5 d of storage at 30 and 4 °C, respectively [7]. Solar energy could be easily converted to electrical energy by photovoltaic (PV) cells. Many researchers have revealed that the most preferred solar system in the refrigerator is photovoltaic system applications [8, 9]. Solar powered refrigeration has been very attractive during the last twenty years, since the availability of sunshine and the need for refrigeration both reach a maximum level in the same season [10]. The present investigation was undertaken to study the efficiency of solar operated refrigerated fish vending and display unit on the shelf life stored fatty and lean marine fishes.

2. Materials and method

2.1 Sample preparation

Fresh Indian mackerel (*Rastrelliger kanagurta*) and pink perch (*Nemipterus japonicus*), fatty and lean marine fishes were used for this study. The fishes were procured in fresh condition from Mangalore fish landing centre, were washed in chilled water before keeping in the vending unit. The temperature was maintained between 3-6 ºC. The samples were drawn at every alternate day for bio-chemical and sensory analysis and the total period of refrigerated storage was 10 days.

2.2 Chemical analysis

2.2.1 PH

The pH of the fish was measured using a pH meter in the temperature range of 27-29 ºC as the method described by [11], 5 g of sample was macerated with 45 ml of distilled water and pH was measured. Prior to pH measurement of the sample pH meter was calibrated with a standard buffer solution of pH 4.2 and 9.2 prepared using buffer capsules.

2.2.2 Alpha amino nitrogen

The alpha amino nitrogen (AAN) in the samples was estimated by the method described by [12]. 20 ml of TCA extract was taken into a 100ml volumetric flask. Few drops of thymolpthalein indicator were added and the extract was made alkaline by adding normal NaOH, till a distinct blue colour appeared, then 1 part by volume of $CuCl_2$ was mixed with 2 parts by volume of tri-sodium phosphate and 2 parts by volume of borate buffer. The solution was mixed well and 60 ml of this suspension was added to alkaline solution in a standard flask containing the extract, the volume was made upto 100 ml with distilled water and after shaking it was allowed to stand for 30 min and then filtered. 10 ml of the filtrate was pipetted out into a conical flask and 0.5 ml of glacial acetic acid (CH_3COOH) was added followed by addition of 1.0 g of potassium iodide. The librated iodine was titrated against N/100 sodium thiosulphate using starch as an indicator. When a yellow solution of iodine became faint yellow, few drops of saturated starch solution were added and titration was continued till blue colour completely disappears. The AAN was calculated using the following formula and expressed as mg % of the sample.

1 ml of N/100 $Na_2S_2O_3$ = 0.28 mg of AAN

$$\text{AAN (mg \%)} = \frac{28\times N\times V4\times V1\times 100}{V3\times V2\times W}\times 100$$

Where,

V_1 = Total volume of TCA extract

V_2 = Volume of TCA extract taken for estimation

V_3 = Filtered extract taken for titration

V_4 = Volume of $Na_2S_2O_3$

W = Weight of sample

2.2.3 Non-protein nitrogen

The non protein nitrogen (NPN) content of the samples was determined by Kjeldhal method [13]. 10 g of sample was digested with 10 ml of 20% tri-chloro acetic acid (TCA) solution using pestle and mortar. The slurry was filtered through coarse filter paper, the filtrate was made upto 100 ml with distilled water. 10 ml of aliquot was digested with 10 ml of concentrated sulphuric acid and a pinch of digestion mixture [K_2SO_4 (10): $CuSO_4$ (1): SeO_2 (0.25)] in a 250 ml digestion flask. Few glass beads were added to the digestion flask to avoid bumping. The contents in the digestion flask were heated in the digestion chamber. Digestion was continued till a colourless solution was obtained. After cooling the volume was made by adding distilled water in 100 ml volumetric flask. 2 ml of aliquot was taken and distilled in the Kjeldhal distillation unit with 10 ml of 40% sodium hydroxide solution. The librated ammonia was absorbed in 10 ml of 2% boric acid solution containing mixed indicator (0.1% methyl red and 0.1% bromocresol green in 1:5 ratio dissolved in 95% ethyl alcohol) till the colour of boric acid solution turned to green. This was titrated against 0.02 N standard sulphuric acid until the pink colour was developed. Non protein nitrogen content was calculated by multiplying total nitrogen content by 6.25 and expressed as percentage weight of meat.

$$\text{Total nitrogen (\%)} = \frac{14\times N\times X\times 250\times V3\times 100}{1000\times V1\times V2\times W}$$

Where,

N = Normality of H_2SO_4

X = ml of standard H_2SO_4 required for titration of sample

V_1 = Aliquot (ml) of digested extract taken for distillation

V_2 = Aliquot (ml) of TCA extract taken for digestion

V_3 = Total volume of TCA extract

W = Weight (g) of sample

2.3 Sensory analysis

Sensory characteristics and overall acceptability of fish were assessed by a panel of six members on the basis of ten point scale on each sampling [14] with little modification. Sensory characteristics study includes general appearance, odour, texture of fish. The scores were given in the decreasing order scale with 10-9 excellent, 8-7 good, 6-5 fair and acceptable, 4-3 poor, 2-1 very poor. The mean of the score given by panel represented the overall sensory quality of fish.

2.4 Statistical analysis

The data obtained from sensory, biochemical and microbiological analysis was further analyzed by using Statistical Package for Social Science (SPSS, version 21.00). Analysis of variance (One way-ANOVA) was performed in order to compare the mackerel and pink perch during the refrigerated storage study. Significance of difference was defined at $p<0.05$.

3. Results and discussions

3.1 Changes in pH

The changes in the pH value of mackerel and pink perch are presented on the Fig. 1, it showed no significant difference ($p>0.05$) during the refrigerated storage period. The pH on the initial day recorded was 6.21 and 6.85 for mackerel and pink perch respectively. It increased slightly and reached 7.24 on 10 d of storage in pink perch whereas in case of mackerel it reached 6.21 on 8th d, there was not much variation during storage period. The post-mortem pH, [15] is the most significant factor influencing the texture of the meat and the degree of “gaping”.

3.2 Changes in alpha amino nitrogen (AAN)

The alpha amino nitrogen (AAN) content is represented in the Fig. 2, it showed that the AAN value decreased significantly ($p<0.05$) during the storage days. At the initial day the value of AAN recorded was 0.61 mg % and 0.14 mg % for mackerel and pink perch respectively. In mackerel it reached

0.37 mg % on the 8th d whereas in case pink perch, it first increased up to 4th, then it decreased and reached 0.14 mg % on the 10th d of storage. For AAN the Mackerel showed no significant difference (p> 0.05), whereas pink perch exhibited significant difference (p<0.05) during the storage study. A similar observation was reported in chilled murrel and milk fish [16].

3.3 Changes in non-protein nitrogenous (NPN)
The non-protein nitrogenous (NPN) on the initial day of storage was 1.05 mg % and 1.17 mg % for mackerel and pink perch respectively. It shows significant difference (p<0.05) during storage days for both mackerel and pink perch. NPN value decreased with the increase in storage days, it reached 0.35 mg % and 0.35 mg % on the 8th and 10th d in case of mackerel and pink perch respectively represented in Fig. 3. A decrease in NPN contents in ice stored *Penaeus indicus* for 18 days was observed and the decrease was attributed to protein hydrolysis by bacterial enzymes [17]. Similarly, [18] reported a gradual decrease in NPN of iced black tiger shrimp. During ice and chilled storage NPN fraction leached out including a major portion of the water soluble amino acids. The loss of amino acids affects the taste and results in bitterness of meat.

3.4 Changes in overall acceptability
The overall acceptability of stored mackerel and pink perch is represented in Fig. 4. According to the results, the overall acceptability of both mackerel and pink perch decreased significantly (p<0.05) with the increase in storage days. The initial scores recorded were 9.4 and 10.0 for mackerel and pink perch, they decreased progressively upto 3.8 on the 8th d in mackerel and 3.8 on the 10th d in pink perch respectively. Mackerel was found to be acceptable up to 8th d and pink perch up to 10th d of refrigerated storage.

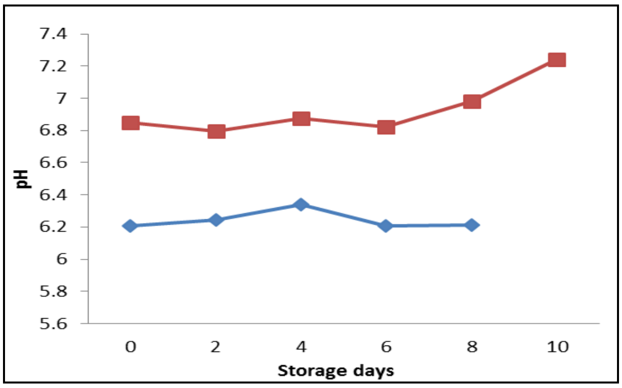

Fig 1: Changes in pH of Mackerel and Pink perch during refrigerated storage

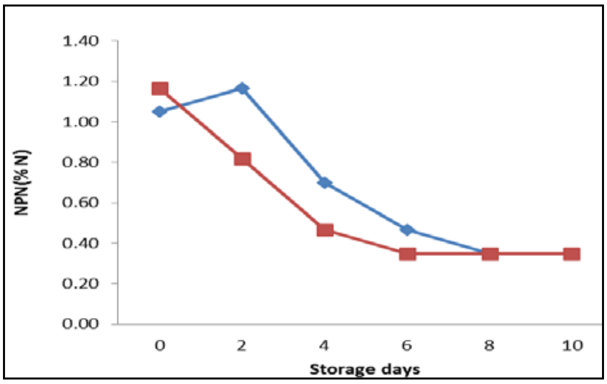

Fig 2: Changes in NPN content of Mackerel and Pink perch during refrigerated storage

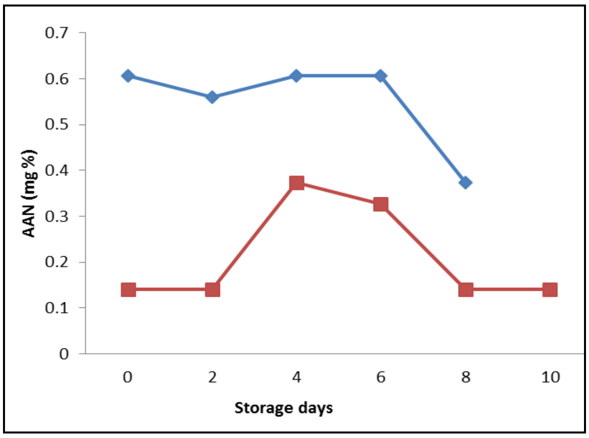

Fig 3: Changes in AAN content of Mackerel and Pink perch during refrigerated storage

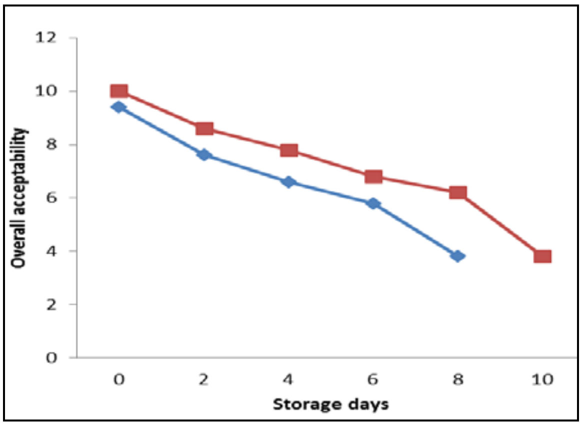

Fig 4: Changes in overall acceptability of Mackerel and Pink perch during refrigerated storage

4. Conclusion
The present study was undertaken to estimate the shelf life of mackerel and pink perch during the chilled condition in the indigenously developed unit, and the results obtained were better than the conventional chilling methods. The stored Mackerel and Pink perch were acceptable upto the 8th and 10th day of storage in contrary to the other chilling methods where the shelf life is for 4-6 days only.

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6. References
1. Lakshmanan PT. Nutrients in fish and their physiological significance. Nutrient profiling and Nutritional labeling of seafoods. 2012, 8-22.
2. Kolanowski W, Laufenberg G. Enrichment of food products with polyunsaturated fatty acids by fish oil addition. Euro. Food Res. and Technol. 2006; 222:472-477.
3. Gopakumar K Surimi. In tropical fishery products. Oxford and IBH Publishing Co. Pvt. Lmt. New delhi, 1997.
4. Konstantinos K. Predictive Modeling of the Shelf life of Fish under non-isothermal conditions. Appl. Environ. Microbiol. 2001; 67(4):1821-1829.
5. Sharifian S, Alizadeh E, Mortazavi MS, Moghadam MS. Effect of refrigerated storage on the microstructure and quality of Grouper (*Epinephelus coioides*) fillets. J Food

Sci and Technol. 2014; 51(5):929-935.

6. Huss HH. Quality and Quality changes in fresh Fish. FAO. Fish. Technol. Pap. UN, Rome. 1995; 348:48.
7. Dergal NB, Abi-ayad SMEA, Deganad G, Douny C, Breose F, Daube G *et al*. Microbial, biochemical and sensorial quality assessment of Algerian farmed tilapia *(Oreochromis niloticus*) stored at 4 ^{o}C and 30 ^{o}C. African Journal of Food Science. 2013; 7(12):498-507.
8. Papadopoulos V, Chouliara I, Badeka A, Savvaidid IN. and Kontominas, MG. Effect of gutting on microbiological, chemical and sensory properties of aquacultured Sea bass (*Dicentrarchus labrax*). Food Microbiol. 2003; 20:411-420.
9. Ewert MK, Agrella M, Frahm J, Bergeron DJ, Berchowitz D. Experimental evaluation of a solar PV-refrigerator with Thermoelectric, Stirling and Vapour Compression Heat Pumps.http://solar.nmsu.edu/publications/pv_direct_refrig.pdf. 1998; Proceedings of Solar'98, ASES.
10. Dhokane NT, Shinde SU, Barve SB. Design and development of intermittent solid adsorption refrigeration system running on solar energy. Int. J Inn. Res. Sci. Eng. & Tech. 2014; 3(4):98-104.
11. Suzuki T. Fish and krill protein: Processing technology. Appl. Sci. pub. London. 1981, 62-112.
12. Pope, CG and Stevens, MF. The determination of amino nitrogen using a copper method. J of Biochem. 1939; 33:1070-1076.
13. AOAC. Official Methods of Analysis; AOAC. Int. Gaithersburg, MD, USA. 2005, 18.
14. Sukumar D, Jeyasekaran G, Shakila RJ, Anandraj R, Ganeshan P. Sensory, microbiological and biochemical quality of black pomfrets (*Pampus niger*) stored in dry ice and ice. Fish Technol. 2007; 44(1):33-42.
15. Huss HH, Fresh Fish. Quality and quality changes. FAO Fish, Rome. 1988; 29:132.
16. Uchoi D, Mandal SC, Barman D, Kumar V, Andrade AJ, Phanna N. Physical, chemical and microbial changes during chilled storage. Aquafind. 2013, 1-4.
17. Joseph J, Perigreen PA, Gopalakrishna-iyer TS. Storage characteristics of cultured *Penaeus indicus* in ice and at ambient temperature. Fish. Technol. 1998; 35(2):84-89.
18. Naik RP, Nayak BB, Chouksey MK, Anupama TK, Moses TLSS, Kumar V. Microbiological and biochemical changes during ice storage of farmed black tiger shrimp (*Peneaus monodon*). Bionano Frontier. 2014; 7(2):249-253.