ISSN: 0976-3376

Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 08, Issue, 11, pp.6656-6659, November, 2017

RESEARCH ARTICLE

PROCESSING &PRESERVATION OF MACKEREL BY DIFFERENT ANTIMICROBIAL COATING AND PHYSICO-CHEMICAL ATTRIBUTES OF PRESERVED MACKEREL

***Patel Monika and Mishra Sunita**

Department of Food and Nutrition, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A Central University) Vidya Vihar, Rae Bareli Road Lucknow- 226025(U.P.), India Lucknow

ARTICLE INFO

Article History:
Received 27th August, 2017
Received in revised form
08th September, 2017
Accepted 12th October, 2017
Published online 30th November, 2017

Key words:
Mackerel Fish,
Antimicrobial coating,
Physico-chemical,
pH, TSS.

ABSTRACT

Mackerel as food: is an important food fish that is consumed worldwide. As an oily fish, it is a rich source of omega-3 fatty acids. This study was carried out to investigate the potential of various antimicrobial coating including coating of lemon peel oil, olive oil, mustard oil on Physico-chemical attributes of Mackerel. The effectiveness of antimicrobial coating were tested with two parameters such as, pH value, total suspended solid (TSS), at the interval of 0 days, 5 days, 15 days, 25 days. Two type of antimicrobial coating were used with two type of packaging material to compare the effect of using antimicrobial coating. An antimicrobial coating contains an antimicrobial agent that inhibits the ability of microorganisms to grow. Antimicrobial coating added with natural antimicrobials is a promising preservation technology for raw and processed Mackerel because they provide good barrier against spoilage and pathogenic microorganisms. Results of antimicrobial on Physico-chemicals showed that pH was reduced on 25th day and TSS was also reduced on 25th days. Thus it is believe that antimicrobial coating has the potential in reducing the Physico-chemical parameters and increase the shelf life of mackerel.

INTRODUCTION

Indian Mackerel is a major pelagic fishery along the south west coast of India. The abundance is restricted to Kutch, Karnataka and Goa coast. The Indian mackerel (Rastrelliger kanagurta) is a species of Mackerel in the scombroid family (family Scombridae) of order Perciformes. It is commonly found in the Indian and West Pacific oceans, and their surrounding seas. It is an important food fish and is commonly used in South and South-East Asian cuisine. Mackerel as food: is an important food fish that is consumed worldwide. As an oily fish, it is a rich source of omega-3 fatty acids. The flesh of mackerel spoils quickly, especially in the tropics, and can cause scombroid food poisoning. Accordingly, it should be eaten on the day of capture, unless properly refrigerated or cured. Mackerel as a fatty fish has all necessary protein, vitamins and minerals in the desired proportions. It is rich in essential oils, vitamins and minerals. Omega-3 and Omega-6 fatty acids occur in high quantities in this fish. It contains vitamins A, B6, B12, C, D, E and various minerals also occur richly in the fish.

Antimicrobial Coating: The term antimicrobial coating encompasses any kind of coating used to control microbial growth in a Mackerel.

Corresponding author: **Patel Monika,**
Department of Food and Nutrition, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A Central University) Vidya Vihar, Rae Bareli Road Lucknow- 226025(U.P.), India Lucknow

These include packaging materials and edible films and coatings that contain antimicrobial agents and also techniques that modify the atmosphere within the package. Edible Coatings (EC) added with natural antimicrobials are a promising preservation technology for raw and processed fish because they provide good barrier against spoilage and pathogenic microorganisms. In recent years, antimicrobial coating has attracted much attention from the fish industry because of the increase in consumer demand for minimally processed, preservative-free products. Reflecting this demand, the preservative agents must be applied to packaging in such a way that only low levels of preservatives come into contact with the food. The film or coating technique is considered to be more effective, although more complicated to apply. Current trends suggest that, in due course, packaging will generally incorporate antimicrobial agents, and the sealing systems will continue to improve. The focus of packaging in the past has been on the appearance, size, and integrity of the package. A greater emphasis on safety features associated with the addition of antimicrobial agents is perhaps the next area for development in packaging technology. Different oil used for antimicrobial coating:

Lemon Oil: Lemon oil is an essential oil extracted from lemon peels. It is usually yellowish or light green in color, and smells like freshly sliced lemon. Lemon is an important medicinal plant of the family Rutaceae. It is cultivated mainly for its

alkaloids, which are having anticancer activities and the antibacterial potential in crude extracts of different parts (viz., leaves, stem, root and flower) of Lemon against clinically significant bacterial strains has been reported (Kawaii *et al*., 2000). Citrus flavonoids have a large spectrum of biological activity including antibacterial, antifungal, antidiabetic, anticancer and antiviral activities (Burt, 2004; Ortuno *et al*., 2006). Flavonoids can function as direct antioxidants and free radical scavengers, and have the capacity to modulate enzymatic activities and inhibit cell proliferation (Duthie and Crozier, 2000). Antimicrobial activity of the peel extract is directly concerned with the components that they contain. Olive oil is a liquid fat obtained from olives (the fruit of *Olea europaea*; family Oleaceae), a traditional tree crop of the Mediterranean Basin. Olive oil is produced from olive trees, each olive tree yielding between 15 and 40 kg of olives per year. It is commonly used in cooking, whether for frying or as a salad dressing. . The composition of olive oil varies with the cultivar, altitude, time of harvest and extraction process. In many of the countries around the Mediterranean, one of the most natural ways to preserve food was, and still is, with olive oil. Olive oil can be used to preserve vegetables, meats, fish, cheese and herbs. Olive oil is a natural preservative that prevents spoilage by isolating the food from air, providing a seal that can delay oxidation, deterioration and moulding. Olive oil in addition to other uses, is an excellent preservative for storing and preserving fresh products.

Mustard oil and their constituents are known to possess antibacterial, antifungal, antiparasitic and insecticidal properties. It is supposed that foodstuffs with high protein and fat content can protect bacteria from the antibacterial effect of mustard oil and other natural antimicrobials. Mustard oils are aromatic, concentrated, hydrophobic liquids containing more than 50 different components. It has been suggested that mustard oil containing phenolic compounds possess the strongest antimicrobial activities. The alcohol terpenoids can act as protein denaturing or dehydrating agents, but they are more active when the cell membrane has increased permeability, suggesting that their main target may be within the cell. Hydrophobic mustard oil compounds can increase the permeability of the membrane, leading to leakage of the cell contents, because the cell membrane is considered to be their main target both in bacterial and in fungal cells. The present study on "Packaging and Processing of Mackerel Fish by Applying Antimicrobial Coating" i.e. Lemon oil, Herbs & Spices is quite interesting & relevant to the present day society. The structure of the today's society is that most of the people are working and that leaves little time and energy for buying and cooking fresh fish. From this topic the preservation and processing of Mackerel fish by using different method of Processing will be study. The shelf life of fresh Mackerel fish will be carried by adopting proper processing techniques. The privilege of fresh fish preservation at commercial level was found with keeping quality of 5-6 month in deep freezer temperature.

MATERIALS AND METHODS

Extraction of lemon peel oil:

Preparation of raw material: select fresh lemon (6kg) and remove the peel from lemon.

The peel was dried in order to reduce the initial moisture content in dehydrator. After drying the peel was grinded in order to increase the content surface reducing the resistance to oil extraction and dried lemon peel sample (180g) were obtained.

Soxhlet extraction method: weighed 50g sample of dried lemon peel powder. Placed a sample inside a thimble made from a thick filter paper and loaded in main chamber of Soxhlet extractor. 250ml n-hexane was filled in a round bottom flask. The Soxhlet was then equipped with a condenser and the solvent was heated to reflux. The reaction mixture was stirred and heated for 4hours under strong reflux. The extract oil was diluted in n-hexane and filtered after separation. The solution was separated by rotary evaporator. 10 ml lemon peel oil was obtained.

Processing and Packaging of Mackerel by Antimicrobial Coating

Material used in processing of Mackerel: Fresh Mackerel of good variety, mustard oil, olive oil, chilli powder, salt, turmeric powder, Lemon peel oil.

Processing of Mackerel: For preserving the Mackerel, 30 Mackerel were selected from the market which was further divided in to 15-15 for processing. 15 were coated with mustard oil (250 ml) and remaining 15 were coated with mixture of olive oil (250ml)and lemon oil (10ml). Take mustard oil and solution of lemon peel oil + olive oil in separate bowl. Add turmeric powder, salt, chilli powder in both bowl and mix it properly. Dip 15 mackerel in mustard oil solution and dip 15 Mackerel in lemon peel oil + olive oil solution.

Material used in packaging of Mackerel: polythene, aluminium foil, glass jar.

Packaging of Mackerel: firstly pack 8 mackerel which was dipped in mustard oil solution in a pair in transparent polythene then covered with aluminium wrapper and sealed it with the help of sealing machine. Same procedure was followed for the 8 mackerel which was dipped in lemon peel oil and olive oil solution. Remaining 14 fish further divided in to 7-7 which was dipped separately in both solutions packed in to glass jar.

Physiochemical Testing: physiochemical testing includes changes in pH and TSS (Total Suspended Solid) at the interval of 0 days, 5 days, 15 days and 25 days. pH was checked by using pH meter and TSS was checked by using hand refractometer.

RESULTS AND DISCUSSION

The potential of antimicrobial coating to be used in fish preservation was assessed by the measurement of pH, total suspended solid (TSS). Below are details of each sample

Table 1. Distribution of sample

Treatments	Sample preparations
T1	Mackerel preserved in glass jar by mustard oil
T2	Mackerel preserved in polythene by mustard oil
T3	Mackerel preserved in glass jar by olive + lemon oil
T4	Mackerel preserved in polythene by olive + lemon oil

Table 2. Effect of preservation by mustard oil in glass jar (T1) on physicochemical properties of mackerel:

Before preservation		After preservation		
		5 days	15 days	25 days
pH	6.9	6.1	5.82	5.25
TSS(mg/l)	71	68	65	62.1

The pH of the mackerel before processing and preservation was 6.9 and after preservation of mackerel by T1 treatment the highest pH was 6.1 on 5th day of preservation whereas the lowest pH was 5.25 on 25th day. The TSS of the mackerel before processing and preservation was 71 and after preservation of mackerel by T1 treatment the highest TSS 68 was on 5th day of preservation whereas the lowest TSS was 62.1 on 25th day

Table 3. Effect of preservation by mustard oil in polythene (T2) on physicochemical properties of mackerel

Before preservation		After preservation		
		5 days	15 days	25 days
pH	6.9	5.82	4.62	4.51
TSS	71	67	64.6	62

The pH of the mackerel before processing and preservation was and after preservation of mackerel by T2 treatment the highest pH 5.82 was on 5th day of preservation whereas the lowest pH was 4.51 on 25th day. The TSS of the mackerel before processing and preservation was 71 and after preservation of mackerel by T2 treatment the highest TSS was 62 on 5th day of preservation whereas the lowest TSS was 62 on 25th day

Table4: Effect of preservation by olive oil+ lemon oil in glass jar(T3) on physicochemical properties of mackerel:

Before preservation		After preservation		
		5 days	15 days	25 days
Ph	6.43	5.31	5.21	4.66
TSS	73	69	65	61.1

The pH of the mackerel before processing and preservation was 6.43 and after preservation of mackerel by T3 treatment the highest pH was 5.31 on 5th day of preservation whereas the lowest pH was 4.66 on 25th day. The TSS of the mackerel before processing and preservation was 73 and after preservation of mackerel by T3 treatment the highest TSS was 69 on 5th day of preservation whereas the lowest TSS was 61.1 on 25th day

Table 5. Effect of preservation by olive oil+ lemon oil in polythene (T4) on physicochemical properties of mackerel

Before preservation		After preservation		
		5 days	15 days	25 days
pH	6.43	4.77	4.52	4.41
TSS	73	69.2	66.5	62.6

The pH of the mackerel before processing and preservation was 6.43 and after preservation of mackerel by T4 treatment the highest pH was 4.77 on 5th day of preservation whereas the lowest pH was 4.41 on 25th day. The TSS of the mackerel before processing and preservation was 73 and after preservation of mackerel by T4 treatment the highest TSS was 69.2 on 5th day of preservation whereas the lowest TSS was 62.6 on 25th day.

Physico chemical analysis

Physic chemical parameters involve in present study was-

- pH
- TSS

The Physico chemical attributes include pH, TSS of processed and preserved mackerel were checked at the gap of 5, 15, 25 days by pH meter, hand refractometer respectively.

Table 6. Variation in pH of mackerel after preservation by different treatment (T1, T2, T3, T4)

DAYS	T1	T2	T3	T4
0 days	6.9	6.9	6.43	6.43
5 days	6.1	5.82	5.31	4.77
15 days	5.82	4.62	5.21	4.52
25 days	5.25	4.51	4.66	4.41
Standard deviation	0.68	1.21	0.74	0.94

- The pH value of the mackerel after preservation lying in the acidic range. The value for the fresh mackerel for T1 and T2 found to be 6.9 and for T3 and T4 found to be 6.43 on day of first.
- The changes in pH were occurred. After Day first the maximum pH was 6.1 by treatment 1(T1) on 5th day and the minimum pH was 4.41 by treatment 4 (T4) on 25th day.

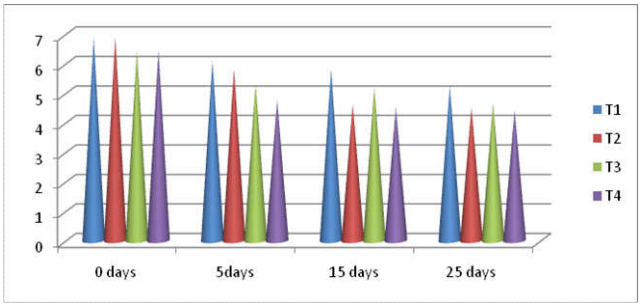

Fig. 1.Variation in pH of mackerel after preservation

Table 7. variation in TSS of mackerel after preservation by different treatment (T1, T2, T3, T4)

DAYS	T1	T2	T3	T4
0 days	71	71	73	73
5 days	68	67	69	69.2
15 days	65	64.6	65	66.5
25 days	62.1	62	61.1	62.6
Standard deviation	3.84	3.82	5.12	4.38

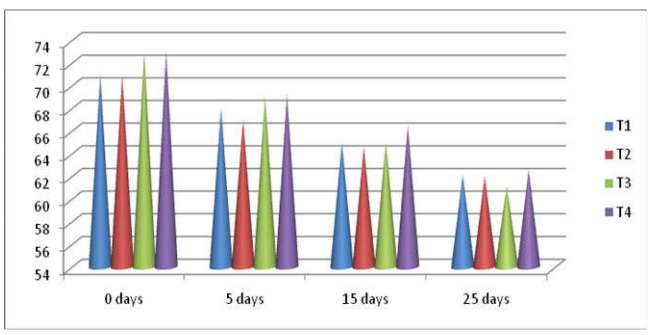

Fig. 2. TSS of mackerel after preservation by different treatment

- The TSS value of the mackerel after preservation lying in the solid range. The value for the fresh mackerel for T1 and T2 found to be 71 and for T3 and T4 found to be 73 on day of first.
- The changes in TSS were occurred. After Day first the maximum TSS was 69.2 by treatment 4(T4) on 5th day and the minimum TSS was 61.1 by treatment 3 (T3) on 25th day.

Conclusion

The study shows that the peel of lemon is not only an astringent but also is a good antimicrobial agent. It delays or inhibits the growth of microbes and increase the shelf life of Mackerel. Antimicrobial coating by using different treatment decrease the pH and TSS of mackerel which maintain the acceptability of Mackerel for long time. The results show that antimicrobial coating has the potential in decreasing the oxygen level in sealed packet and jar than that of the conventional system and also economic as it can be found easily. Antimicrobial coating is a potentially to reduce the pH, reduce the total suspended solid and thus increase the shelf life and acceptability of mackerel.

REFERENCES

Abbas, K.A., A.M. Saleh, A., Mohamed and O. Lasekan, 2009. The relationship between water activity and fish spoilage during cold storage: *A review. J. Food, Agric. Environ*., 7: 86-90.

Adebowale, B.A., L.N. Dongo, C.O. Jayeola and S.B. Orisajo, 2008. Comparative quality assessment of fish (Clarias gariepnius) smoked with cocoa pod husk and three other different smoking materials. J. *Food Technol*., 6: 5-8. DOI: 10.3923/jftech.2008.5.8

Akinola O.A., A.A. Akinyemi and B.O. Bolaji, 2006. Evaluation of traditional and solar drying systems towards enhancing fish storage and preservation in Nigeria Abeokuta local government as a case study. *J. Fisheries Int.,* 1: 44-49. DOI: 10.3923/jfish.2006.44.49

Bagamboula, C.F., M. Uyttendaele and J. Debevere, 2004. Inhibitory effect of thyme and basil essential oils, carvacrol, thymol, estragol, linalool and pcymene towards Shigella sonnei and S. flexneri. *Food Microbiol*., 21: 33-42.

Banerjee S. 2006. Inhibition of mackerel (Scomber scombrus) muscle lipoxygenase by green tea polyphenols. Food Research International, 39: 486–491.

Benjakul S., Visessanguan W., Phongkanpai V., Tanaka M. 2005. Antioxidative activity of caramelisation products and their preventive effect on lipid oxidation in fish mince. *Food Chemistry*, 90: 231–239.

Chidanandaiah Keshri, R.C., Sanyal, M.K. 2009. Effect of sodium alginate coating with preservatives on the quality of meat patties during refrigerated (4ºC) storage. *Journal of Muscle Foods*, 20: 275-292.

Datta, S., Janes, M.E., Xue, Q.G., La Peyre, J.F. 2008. Control of Listeria monocytogenes and Salmonella annatum on the surface of smoked salmon coated with calcium alginate coating containing oyster lysozyme and nisin. *Journal of Food Science*, 73: 6771.

Del Nobile, M.A., Corbo, M.R., Speranza, B., Sinigaglia, M., Conte, A., Caroprese, M. 2009. Combined effect of MAP and active compounds on fresh blue fish burger. *International Journal of Food Microbiology*, 135(3): 281-287.

Erkan, N., Bilen, G. 2010. Effect of essential oils treatment on the frozen storage stability of chub mackerel fillets. Journal für Verbraucherschutz und *Lebensmittelsicherheit*, 5: 101-110

Falguera, V., Quintero, J.P., Jiménez, A., Munoz, J.A., Ibarz, A. 2011. Edible films and coatings: Structures, active functions and trends in their use. *Trends in Food Science & Technology*, 22: 292303.

Fan, W., Chi, Y. Zhang, S. 2008. The use of a tea polyphenol dip to extend the shelf life of silver carp (Hypophthalmicthys molitrix) during storage in ice. Food Chemistry, 108: 148-153.

Giatrakou, V., Kykkidou, S., Papavergou, A., Kontominas, M.G., Savvaidis, I.N. 2008. Potential of oregano essential oil and MAP to extend the shelf life of fresh swordfish: A comparative study with ice storage. *Journal of Food Science*, 73(4): 167-173.

Gimenez, B., Roncales, P., Beltran, J.A. 2004. The effects of natural antioxidants and lighting conditions on the quality characteristics of gilt-head sea bream fillets (Sparus aurata) packaged in a modified atmosphere. *Journal of the Science of Food and Agriculture*, 84: 1053-1060.

Jeon Y-J, Kamil J, Shahidi F. 2002.Chitosan as an edible invisible film for quality preservation of herring and Atlantic Cod. J. Agric. Food Chem 50: 5167-5178. Krochta, JM, De M-J. 1997. Edible and biodegradable polymer films: challenges and opportunities. *Food Technol*. 51 (2):61-72.

Lee CM,Toledo RT. 1977.Degradation of fish muscle during mechanical deboning and storage with emphasis on lipid oxidation. *J Food Science* 42 (6): 1646-1649.

Muzzarelli RAA, Jeuniaux C, Gooday GW. 1973. Natural chelating polymers, Pergamon Press, New York. Muzzarelli RAA. 1996. Chitosan-based dietary foods. Carbohydr. *Polym*. 29:309-316.

National Fisheries Insitute (NFI), Inc. News releases. Shellfish safety is adequate, industry says.http://www.nfi.org/Index.php?a=news&b=NwesReleases&x=564 10/8/2004.

Shahidi F, Kamil J, Jeon Y-J, Kim S-K.Antioxidant role of chitosan in a cooked Cod (Gadus morhua) model system. 2002. *J Food Lipids* 9: 57-64.

Tsai GJ, Su WH, Chen HC, Pan CL. 2002 Antimicrobial activity of shrimp chitin and chitosan from different treatments and applications of fish preservation. *Fisheries* Science 68: 170-177.

****