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The Effects of Potassium Sorbate on the Spoilage of Anchovy (*Engraulis encrasicolus*) Under Retail Conditions

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ABSTRACT

The objective of this research was to evaluate the spoilage characteristics of fresh anchovy (*Engraulis encrasicolus*) treated with potassium sorbate dips during retail storage. In this study, 4 different sorbate application (control, 30 and 60 sec immersion into 3% sorbate solution (w/v) and ice of this solution) with 4 different storage periods were evaluated. The results of this research showed that all of the potassium sorbate application systems (solutions or ice) had significant (P>0.05) effect on some microbiological and chemical spoilage parameters. Application of the potassium sorbate was able to delay the proliferation of some microorganisms and impede totally the molds found on the fish during storage. Also, TVN and TMA-N values were significantly (P>0.05) increased during storage but this was to a lesser extend for the sorbate treated samples compared to the control group. This research, also, showed that the sorbate used in the 3% ice form was more effective against the chemical and microbiological alterations than that of the 3% immersion counterparts. In conclusion, this research indicated that Anchovies could be retailed in better conditions and with better sensory properties with potassium sorbate treatment which improved the shelf-life when compared to the control group. It also suggested that sorbates could be used not only by the fishermen but also the other affiliated people in Anchovy marketing channel of Turkey to offer better fish to the consumers.

INTRODUCTION

Fresh fish is usually preferred by the seafood consumers but unfortunately it is highly perishable or has very limited shelf life (Shewan, 1977; Huss, 1988). The perishable nature and limited storage time of the seafoods is primarily due to the alterations induced by intrinsical enzymes and microbial activity. Disregarding the enzymes, most of the investigations undertaken were to retard microbial deterioration's (Sofos and Busta, 1981; Thakur and Patel, 1994). Many researchers have tried to apply may types of antimicrobial agents to control microorganisms for extending shelf life of fresh seafoods. Finally, potassium sorbate as a potential preservative has received a great deal of attention for application for many kinds of fish (Yetim, 1997). This agent with good solubility in water and absence of taste, odor or color is particularly suitable in producing a variety of safe food items (Gram, 1991; Thakur and Patel, 1994). It has been claimed that a wide range of fish bacteria which play an important role in fish spoilage are inhibited by sorbate treatment including TMA poducers. Nevertheless. to date there has been no study on the influence of sorbates on fish preservation which is a needed in Turkey (Yetim, 1997). The objective of this research was to investigate the effects of potassium sorbate dip or ice on the spoilage characteristics of fresh anchovy during retail storage and marketing.

MATERIALS and METHODS

In this experiment, strictly fresh anchovies (*Engraulis encrasicolus*) were directly obtained from a fishing vessel and this was used as fish materials. The fish samples were immediately transferred to the laboratory in a ice box and divided into 4 lots; 1 group for control which was only dipped in distilled water, 2 groups for 30 s and 60 s immersion into 3.0 % (w/v) freshly prepared potassium sorbate solution and 1 group for the treatment with ice of the sorbate solution. After the dipping process, the fish samples were drained and stored in retailing conditions (approximately 5±1°C) for 6 days. Four fish from each treatment lot were removed from storage and subjected to chemical and microbiological analysis. Trimethylamine nitrogen (TMA-N) and Total volatile nitrogen (TVN) values of the fish were determined by utilizing the method described by Boland and Paige (1971), and reported as mg/100 g sample. American Public Health Association (APHA, 1992) procedures were used for the microbiological analysis on aseptically removed and homogenized samples. The experiment consisted of a (4x4) factorial design with two replications, and the statistical analysis were conducted by using SAS (SAS, 1985).

RESULTS and DISCUSSION

Least square means (LSM) and standard deviations (SD) for the results of this experiment were summarized in Table 1. As seen in the table, application of sorbate and storage time had significant (P>0.05) effect on the chemical and microbiological quality characteristics of the anchovy. For example, the production of TVN and TMA-N values showed a significant (P>0.05) decrease with the application of potassium sorbate irrespective of the treatment type. For example, at the 6th day of storage, TVN values started at 7.10 mg/100 g and arose to 37.35 and 22.05 mg/100 g fish for the control and 60 s sorbate dipped samples respectively. The same results were also true for TMA-N, so this might be due to the interference of the TMA-N producing organisms and other chemical changes. Similar results in cod fillets were reported by Thakur and Patel (1994) in which the TVN and TMA-N values were delayed in sorbated samples.

In general, the application of sorbate reduced the colony forming units (CFU) of all microorganisms with the exception of molds/yeast which was totally inhibited. The APC and psychrophile counts for sorbate treated samples (30 s, 60 s or ice form) were significantly (P>0.05) lower than those for the control group. For example, the differences between the treatments is not totally consistent, the application of potassium sorbate was able to delay the proliferation of total aerobic plate counts (APC) which was 3.99 log CFU/g for the control but 3.41 log CFU/g for sorbate ice treated samples at the end of storage. However, coliform bacteria did not show a consistent difference between the control and the sorbate treated samples. Again, a comparable results for the normal

flora in cod were reported by Lynch and Potter (1982) in which psychrophilic bacteria was inhibited to a greater extend by potassium sorbate.

Storage time also had a significant (P>0.05) effect on the chemical and microbiological quality parameters measured in this study. As could be followed from Table 1, an increase was observed for the TVN and TMA-N values with the advance of storage time, and the same trend is also true for psychrophiles as would be expected. The results of TVN and TMA-N analysis showed that the control anchovies suffered from rapid accumulation of these parameters while the fish dipped or iced with sorbate showed negligible TVN and TMA-N production. For example, the control group had 8.70 TMA-N and 37.35 TVN mg/100 g fish at the end of the storage but the sorbate treated samples had much lower TMA-N and TVN values (1.495 and 17.150 mg/100 g fish) in the same time period. This means that almost 3 more days of shelf life extention is possible for anchovy sold in the market. Similar results were also reported by the other researchers worked on sorbates and shelf life of the fish (Shaw et al., 1983).

CONCLUSION

In conclusion, potassium sorbate resulted in a markedly slower rate of spoilage bacteria and no growth in mold/yeast, and also substantial delayed production of amines on the anchovies when compared to control samples. Therefore, either sorbate dip or its ice would be useful for extending the shelf life of the anchovies since additional days of freshness is considered unequivocally valuable in the marketing channel of fresh fish.

LITERATURE

APHA, 1992. "Compendium of Methods for the Microbiological Examination of Foods." 3rd Ed. by Vanderzant, C. and Splittstoesser, D.F., American Public Health Association, Washington, DC.

Boland, F.E. and Paige, D.D. 1971. Collaborative study of a method for the determination of trimethylamine nitrogen in fish. J.AOAC. 54: 725.

Gram, L. 1991. Inhibition of mesophilic spoilage Aeromonas ssp. on fish by salt, potassium sorbate, smoke and chilling. J. Food Prot. 54: 436.

Huss, H.H. 1988. Fresh fish-quality and quality changes. FAO Fisheries Ser. No: 29, Rome.

Lynch, D.J. and Potter, N.N. 1982. Effects of potassium sorbate on normal flora and on S. aureus added to minced cod. J. Food Prot. 45: 824.

SAS, (1985) "SAS User's Guide: Statistics," 5th Ed. SAS Institute, Inc. Raleigh, NC.

Shewan, J.M. 1977. The bacteriology of fresh and spoiling fish and the biochemical changes induced by bacterial action. Proc. of the Conf. on Handling, Proc. and Mark. of Tropical Fish. p 51-66, Tropical Prod. Inst., London.

Shaw, S.J. Bligh, E.G. and Woyewoda, A.D. 1983. Effects of potassium sorbate application on shelf life of Atlantic cod. Can. Inst. Food Sci. and Technol. J. 16: 237.

Sofos, J.N. and Busta, F.F. 1981. Antimicrobial activity of sorbates. J. Food Prot. 44: 614.

Thakur, B.R. and Patel, T.R. 1994. Sorbates in fish and fish products. Food Rev. Int. 10: 93.

Table 1. LSM and SD values for the effects of 3.0% potassium sorbate dip or ice and storage time on some chemical and microbiological quality parameters of Anchovies

	Parameters					
Sorbates	TVN	TMA-N	APC	*Psychrophiles*	*Coliform*	Mold/Yeast
Control	22.525^{a}(0.27)	3.775^{a}(0.07)	3.986^{a}(0.01)	5.242^{a}(0.01)	2.580^{a}(0.01)	2.684^{a} (0.003)
30 s KSD	17.387^{b}(0.27)	1.181^{bc}(0.07)	3.805^{b}(0.01)	4.723^{b}(0.01)	2.385^{bc} (0.01)	0.651^{b} (0.003)
60 s KSD	14.212^{c} (0.27)	1.085^{c} (0.07)	3.528^{d} (0.01)	4.490^{d} (0.01)	2.316^{c} (0.01)	0.651^{b} (0.003)
KS-Ice	13.162^{d} (0.27)	1.332^{b} (0.07)	3.639^{c} (0.01)	4.565^{c} (0.01)	2.414^{b} (0.01)	0.651^{b} (0.003)
Storage Time						
1st Day	7.100^{d} (0.27)	0.575^{d} (0.07)	4.039^{a} (0.01)	4.616^{c} (0.01)	3.145^{a} (0.01)	2.607^{a} (0.003)
2nd Day	14.600^{c} (0.27)	1.377^{c} (0.07)	3.765^{b} (0.01)	4.559^{d} (0.01)	2.745^{b} (0.01)	0.657^{d} (0.003)
4th Day	19.800^{b} (0.27)	2.027^{ba} (0.07)	3.697^{c} (0.01)	4.837^{b} (0.01)	2.167^{c} (0.01)	0.676^{c} (0.003)
6th Day	25.787^{a} (0.27)	3.393^{a} (0.07)	3.456^{d} (0.01)	5.008^{a} (0.01)	1.599^{d} (0.01)	0.698^{b} (0.003)

TVN: Total Volatile Nitrogen (mg/100 g),
TMA-N: Trimetil Amine Nitrogen (mg/100 g),
APC: Total Aerobic Plate Count (log CFU/g),
KSD: Potassium Sorbate Dip,
^{a,b,c,d} Means with the same superscript letters in a column are not significantly different (P>0.05).