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Microbiological quality assessment in a fish processing plant at Mandapam, Ramanathapuram District

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ABSTRACT

Foodborne illness resulting from the consumption of contaminated food and the major causative agents are pathogenic bacteria, fungi, viruses and parasites. Foodborne illness also arises from improper handling, preparation and food storage. The study is planned to evaluate the microbiological quality paramerters to ensure the seafood safty. The concentration and type of microorganism differ from one site of the plant to the other, from fish to fish and from one handler to another. Microbiological analysis reveals that, fish samples of shark (Alopias vulpinus) and tuna (Euthynnus offinis) TPC was maximum in the processing area samples ($65x10^4$ CFU.g^{-1}) and Salmonella sp. were absent in receiving area samples, processing area samples and frozen storage samples. Staphylococcus aureus was present in all the samples (<$1x10^2$ CFU.g^{-1}) and E. coli was present (<10) only in processing area samples and frozen storage samples. The TPC was maximum (93CFU.ml^{-1} at 37°C and 17 CFU.ml^{-1} at 22°C) in the water sample of processing section. The total coliforms and thermo tolerant coliforms counts were observed within the critical limits. Anaerobic sulfate reducing bacteria were totally absent in water and ice samples collected from receiving section and processing section. The swab samples results states that, TPC was maximum in cutting board sample and followed by worker's hand sample collected from processing section. It is concluded from the present study that, the microbiological analysis of fish, water, ice and swab samples showed the safety nature of seafood and it can be consumed without showing any foodborne illness.

Key words: Fish processing plant, Fish microflora, Shark, Tuna

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INTRODUCTION

A major goal for the food processing industry is to provide safe, whole some and acceptable food to the consumer. Control of microorganisms is essential to meet this goal. This control is partly exerted through processing and preservation techniques that eliminate microorganisms or prevent

their growth. It is also required that the basic hygiene level during processing is high and that efficient cleaning and disinfection procedures that eliminate spoilage and pathogenic bacteria. Many food pathogenic and spoilage bacteria are able to attach food contact surfaces and remain viable even after cleaning and disinfection [1, 2]. Microbial contamination on environmental surfaces may be transferred to the food products directly through surface contact or by vectors such as personnel, pests, air movements or cleaning regimes [3-5]. Bacteria may also infect the fish from out side during care less handling of landed fish, its stowing and cutting. Among major external sources of bacterial contamination are ice and salt. Example crushed ice is known to carry heavy bacterial loads. The present study to identify the microbial flora present in a fish processing plant and understand the sources of contamination on the processing equipments, fish, fish handlers, ice and water.

MATERIALS AND METHODS

Tuna (*Euthynnus affinsis*) and gutted shark (*Alopias vulpinus*) samples were taken from the receiving section, processing section and frozen storage of a seafood plant at Mandapam, Ramanathapuram District, Tamilnadu, India. Water and ice samples were also collected from receiving and processing section. Swab sample were taken from work's hand, fish handling box, gutting board and processing section floor. All samples were labeled and immediately transferred to laboratory in insulated ice box at a temperature of below 4°C.

Serial dilutions were performed for all the samples and Total plate count (Nutrient agar medium), *Salmonella sp.* (Bismuth sulfite agar), Staphylococcus *aureus* (Baird Parkar agar medium), *E. coli* (Tergitol-7 agar medium), coliforms (Endo agar medium) and anaerobic sulfate reducing bacteria (Sulphate reducing bacteria medium) counts were observed. After incubation, the colonies were counted by using colony counter (Subra Scientific Co., India).

RESULT AND DISCUSSION

The enumerated counts for the *Euthynnus affinsis* and *Alopias vulpinus* samples were represented in Table 1. The total plate count showed that, the count was maximum in the processing area samples in both fish samples ($65x10^4$ CFU.g^{-1}) and *Salmonella sp.* were absent in receiving area samples, processing area samples and frozen storage samples. *Staphylococcus aureus* was found in all the samples (<$1x10^2$ CFU.g^{-1}) and *E. coli* was found (<10) only in processing area samples and frozen storage samples. The receiving area sample for *E. affinsis* and *A. vulpinus* samples were free from *E. coli* (Table 1). However the higher TPC result in the processing section may be due to improper icing of the processed materials or from cutting board. Venugopal [6] reported that, the contamination of fish particularly by pathogens such as *Salmonella sp.*, *Staphylococcus aureus*, *Campylobacter jejuni*, *Escherichia coli* 0157:H7, *Vibrio parahaemolyticus*, *Yersinia enterocolitica* and *Listeria monocytogenes*, may occur prior to harvest, during capture, processing, distribution and storage. Earlier studies reported that, the some pathogenic bacteria are naturally present in the aquatic (*Clostridium botulinum* type E, pathogenic *Vibrio* sp., *Aeromonas*) and the general environment (*C. botulinum*, type A and B, *Listeria monocytogenes*) and may therefore be found on live or raw fish [7].

Table 1. Counts of bacteria from Tuna and Shark fish samples of different area of the fish processing industry

Name of the fish		Counts of bacteria in samples (CFU.g^{-1})		
		Receiving section	**Processing section**	**Frozen storage**
Tuna (*Euthynnus affinsis*)	Total plate count	$2.5x10^4$	$65x10^4$	$41x10^4$
	Staphylococcus aureus	$<1x10^2$	$<1x10^2$	$<1x10^2$
	Salmonella sp.	Nil	Nil	Nil
	Escherichia coli	Nil	<10	<10
Shark (*Alopias vulpinus*)	Total plate count	$1.9x10^4$	$65x10^4$	$2.5x10^4$
	Staphylococcus aureus	$<1x10^2$	$<1x10^2$	$<1x10^2$
	Salmonella sp.	Nil	Nil	Nil
	Escherichia coli	Nil	<10	<10

Microbiological analysis of water and ice samples collected from receiving section and processing section were represented in Table 2. The analysis revels that, the total plate count was maximum (93CFU.ml^{-1} at 37°C and 17 CFU.ml^{-1} at 22°C) in the water sample of processing section. In ice samples, the total plate count was similar in receiving and processing section (19CFU.ml^{-1} at 37°C and 20CFU.ml^{-1} at 22°C). The total coliforms and thermo tolerant coliforms counts were less than 1 in both sections water and ice samples. Anaerobic sulfate reducing bacteria were absent in both sections water and ice samples.

Table 2. Microbiological analysis of water and ice samples in fish processing plant.

Parameter	Counts of bacteria in samples (CFU.ml^{-1})			
	Water collected from receiving section	**Water collected from processing section**	**Ice collected from receiving section**	**Ice collected from processing section**
Total plate count (22^oC)	<1	17	20	20
Total plate count (37^oC)	<1	93	19	19
Parameter	**Counts of bacteria in samples (CFU.100ml^{-1})**			
	Water collected from receiving section	**Water collected from processing section**	**Ice collected from receiving section**	**Ice collected from processing section**
Total coliforms	<1	<1	<1	<1
Thermo tolerant coliforms	<1	<1	<1	<1
Anaerobic sulfate reducing bacteria	Nil	Nil	Nil	Nil

The counts of swabbed samples were represented in table 3. The total plate count was maximum in cutting board sample ($59x10^2$CFU/25cm^2) and followed by worker's hand sample ($37x10^2$CFU/25cm^2) collected from processing section. The minimum total count was observed in ($5.9x10^2$CFU/25cm^2) fish handling box No.1 from the receiving section. However, a sudden increase of TPC in the water and ice samples of processing section was observed. This could be mainly because of the probability of cross contaminations from both the fish handlers and other

fish contact surfaces. The maximum count of TPC in cutting board is due to the removal of intestine from the fish leads to the release of gut flora in the cutting board and cross contamination by work's hand.

Table 3. Total plate count from swabbing in fish processing plant.

Place of sampling	Swabbing objects	TPC (CFU/25cm^2)
Receiving section	Worker's hand-1	$22x10^2$
	Worker's hand-2	$22x10^2$
	Fish handling box-1	$5.9x10^2$
	Fish handling box-2	$13x10^2$
Processing section	Worker's hand	$37x10^2$
	Fish handling box	$39x10^2$
	Cutting board	$59x10^2$
	Processing section floor	$26x10^2$

The present observed that the cross contamination occurred during processing and similar report was stated by Vogel *et al*. [8]. However, the raw fish or material is not an important initial source for contaminating processing equipment and environment. Several authors worked in the microbiological quality aspects of seafood [9-12]. It is concluded from the present study, the microbiological quality parameters are in safer side and dose not exceeds the permissible limit.

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