

Faecal Indicator Bacteria in Fish

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The bacterial quality of a processed food material depends, to a great extent, on the sanitary conditions of the processing unit. The necessity for a bacterium that will indicate the extent of sanitation had long been felt. *E. coli* and faecal streptococci were the organisms of choice for this purpose. These organisms are present in the intestinal tract of man and animals and, therefore, if these bacteria are present in any food product it clearly indicates faecal contamination and a general breakdown in hygiene and sanitation. *E. coli* and faecal streptococci are generally known as faecal indicator bacteria.

E. coli

Morphology : It is a Gram negative, rod shaped non-spore forming bacterium.

Primary habitat : The primary habitat of *E. coli* is the intestinal tract of many warm blooded animals. Therefore, its presence in fish is generally considered as an indication of faecal contamination.

Chances of contamination : Natural water gets contaminated with *E. coli* either by direct contact or by mixing up with terrestrial sewage. When this water is used for fish processing, these organisms get entry into the product. Similar possibilities arise when the ice used for preservation or the utensils used for processing are contaminated with *E. coli*. Possibility of a direct contamination of fish with faecal material is remote and, if it occurs, it does not often exceed 25 mg. of faecal matter per 10 kg. fish which will, in turn, give rise to 100 Enterobacteriaceae, 10 group D streptococci and a few clostridia per gram. But, whatever may be the type of contamination, when the organisms have entered into fish in considerable numbers, it is very difficult to get rid of them completely.

Even if *E. coli* is completely removed by some chemical treatment, the wholesomeness of the food cannot be guaranteed as many of the viruses

and intestinal parasites which are comparatively resistant to such treatments may be present in the product in viable form. Hence, it is better to process the material hygienically than to remove the contaminated bacteria in the final stage of processing.

Off-shore water does not contain *E. coli* whereas incidence of this organism is usually noted in near-shore waters. In India, *E. coli* has been isolated from beach sea water throughout the year. Fishing in these waters and washing the boat deck and fish containers using near-shore waters are known to contaminate the catch with *E. coli*. Inadequately cleaned and disinfected boat deck and other containers used on-board trawlers act as sources of contamination. Contamination is also known to occur from ice and from unclean workers. It goes without saying that when the temperature is also favourable, the contaminated organisms multiply rapidly and further aggravate the situation.

Incidence : The incidence of *E. coli* on utensils, palms of workers and in water, ice and various fishery products is indicated in the Table given below:

Sample	Number of samples analysed	% Incidence of <i>E. coli</i>
Utensils	300	16
Palm of workers	300	10
Water	800	25
Ice	800	18
Frozen HL shrimps	400	13
" PD shrimps	600	26
" PUD shrimps	250	30
" Cooked shrimps	350	6
" Cooked lobsters	30	10
" Cuttle fish	50	12
" Squids	30	0
" Cat fish	8	13
" Seer fish	40	20

Viability during freezing and frozen storage : *E. coli* is very sensitive to sub-zero temperature. About 95% reduction in the count of *E. coli* takes place during freezing at -40°C while complete destruction takes place during frozen storage at -20°C in a period of about 4 to 5 months.

Faecal Streptococci

Morphology : They are Gram positive, non-spore forming non-motile cocci.

Primary habitat : The primary habitat of faecal streptococci is the intestinal tract of man, animals and birds. Their presence in fish material has been accepted as an indication of faecal contamination just like *E. coli*. These organisms are not present in off-shore waters and in fish collected from such waters.

Source of contamination

- 1) Near-shore waters
- 2) Contaminated boat deck, fish boxes and other contact surfaces
- 3) Polluted process water
- 4) Unclean workers
- 5) Poor sanitary condition in the processing units

Incidence : The incidence of faecal streptococci in fishery products and factory environments is given in the following table:

Sample	No. of samples analysed	% Incidence of faecal streptococci
Utensils	300	43
Palm of workers	300	50
Water	800	34
Ice	800	55
Frozen HL shrimps	400	92
" PD shrimps	600	94
" PUD shrimps	250	96
" Cooked shrimps	350	56
" Cooked lobsters	30	50
" Cuttle fish	50	96
" Squids	30	80
" Cat fish	8	50
" Seer fish	40	55

Viability during freezing and frozen storage : Experiments have given clear indication that faecal streptococci are comparatively resistant to many adverse conditions. They undergo least fluctuations during processing. About 30% reduction of faecal streptococci takes place during freezing at -40°C while during subsequent storage at -20°C not much reduction takes place in count even after two years.

As faecal streptococci are more resistant to freezing and frozen storage compared to *E. coli* they are considered to be better indicators of the sanitary conditions under which the material is processed.

Comparison of *E. coli* and Faecal streptococci as indicators of food sanitary quality :

No.	Characteristic	<i>E. coli</i>	Faecal streptococci
1.	Morphology	Rods	Cocci
2.	Gram reaction	Negative	Positive
3.	Incidence in intestinal tract	10^7 to 10^9 /g of faeces	10^5 to 10^8 /g of faeces
4.	Incidence in faecal matter of various animal species	Absent in most	Present in most
5.	Specificity to intestinal tract	Generally specific	Generally less specific
6.	Occurrence outside intestinal tract	Common in low numbers	Common in higher numbers
7.	Ease of isolation and identification	Relatively easy	Comparatively difficult
8.	Response to adverse environmental conditions	Less resistant	More resistant
9.	Relative survival in frozen foods	Generally less	High
10.	Destruction during freezing (-40°C)	95%	30%
11.	Destruction during frozen storage	Complete destruction in 4-5 months	Practically no destruction even after 2 years
12.	Relative survival in dried foods	Low	High