Sampling of Frozen Prawns for Bacteriological Estimation

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[Experiments were conducted to study the significance of difference between samples taken from the surface and interior of a frozen shrimp block, as well as to determine the size of sample necessary to represent the whole block, with respect to bacterial count determination. The results showed that the surface samples and interior samples did not differ significantly at 5% level of significance and that the minimum quantity representative of the block was (21-26) gms. in the case of a block weighing about 1300 gms. The procedure adopted for taking the bacterial count was the normal standard plate count method.]

Introduction

Total bacterial plate count determination or enumeration of the levels of specific organisms in a fish product is necessary to find out the extent of its external contamination. These become more important when judgement of the quality of the product is to be made by an examination of the finished product only, as it happens in preshipment inspections. Samplings for such determinations is fairly easy in the case of individual fish or fillets — either fresh or frozen, where only the variations in the bacterial load between different regions of the fish or fillets need be taken care of. But in products like frozen prawn where large numbers of pieces are frozen into blocks it is natural to expect more variations. The method of drawal of sample and the quantity to be taken for a correct determination of bacterial counts in such cases were investigated and the results are reported here.

Experimental Procedure

Materials used for the study were peeled and deveined prawns quick frozen in a plate freezer at —40°C. Two trials were conducted to study the significance of difference between samples taken from the surface and interior of the frozen block with respect to bacterial count. In both the trials four blocks each weighing about 600 grams, processed under similar conditions, were used for the experiment. Samples were drawn at random from the surface and interior of each of the frozen blocks. The procedure adopted for taking the bacterial count was the usual standard plate count method. To determine the quantity of materials to be taken from each block, two blocks each weighing about 650 grams belonging to the same batch of material and processed under similar conditions were used. Random samples of different quantity groups weighing about (6-11) gm, (11-16) gm, (16-21) gm, (21-26) gm and (26-31) gm. were drawn from the blocks.

The criterion used for testing the significance of the difference between the surface and the interior samples for bacterial count was Students' 't' for the testing of the difference between the means of two samples. Students' 't' statistic is defined as,

$$t_{(n_1+n_2-2)} = \frac{|\bar{x}_1 - \bar{x}_2|}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \quad \ldots\ldots (i)$$

where $S^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{(n_1+n_2-2)}$; $S_1^2 = \frac{\sum_{1}^{n_1}(x_1-\bar{x}_1)^2}{n_1-1}$ and $S_2^2 = \frac{\sum_{1}^{n_2}(x_2-\bar{x}_2)^2}{n_2-1}$.

where $\bar{x}_1$, $\bar{x}_2$, s_1 and s_2 are the means and standard deviations of the two samples of sizes n_1 and n_2 respectively. In order to determine the quantity of material which should be taken from each block, coefficient of variation was taken as a major criterion of comparison.

$$\text{Coefficient of variation (\%)} = 100 . \frac{S}{\bar{x}} \quad \ldots (2)$$

where $S^2 = \frac{\sum_{i}^{n}(x_1-\bar{x})^2}{n-1}$.

Results and Discussion

Arithmetic mean, pooled standard deviation and the calculated value of 't' by the formula (1) are given in Table I. The hypothesis set up for this purpose was that " the surface samples and interior samples were random samples drawn from the same population having the same bacterial load ". The level of significance was chosen to be 5%. The value of 't' was calculated for each block in the two trials.

TABLE I. — Results based on standard plate counts of dilutions of 10^5

Trials	Blocks	Mean of bacterial count per gram of surface samples	Mean of bacterial count per gram of interior samples	Pooled Standard deviation	Calculated value of 't'	Degrees of freedom
I	A	6.5600	5.0150	4.1726	0.6413	10
	B	2.6933	4.2300	4.0297	0.6605	10
	C	2.2817	2.3600	2.0145	0.0673	10
	D	4.2733	3.2383	3.5243	0.5087	10
II	A	19.2933	17.6050	15.6771	0.1865	10
	B	8.9550	3.7517	3.9355	2 2901*	10
	C	19.6867	12.2500	9.2723	1.3892	10
	D	10.3900	13.1900	12.6675	0.3802	10

* Indicates significance at 5% level.

From the table, it is found that in most of the blocks in the two trials the calculated value of 't' does not exceed the Table Value of 't' at 5% level of significance, leading to the acceptance of the hypothesis.

TABLE II.

Quantity of materials taken (gms)	Mean of the bacterial count per gm	Standard deviation	Coefficient of variation (%)
6 – 11	2.4236	1.2755	52.6696
11 – 16	2.2075	0.7102	32.1721
16 – 21	2.8367	0.4339	15.2959
21 – 26	3.4225	0.2687	7.8510
26 – 31	2.9750	0.1960	6.5882

Table II gives the coefficient of variation of different quantity ranges calculated by using formula (2). From the table it follows that as the quantity of material taken from the frozen block increases, coefficient of variation decreases rapidly at the beginning. But with the increase in the amount of material the rate of this decrease also falls off rapidly, so that in the range (21-26) gms. and (26-31) gms the coefficient of variation becomes practically constant, so this indicates that for a correct determination of bacterial count it is necessary to draw a sample minimum of about (21-26) gms. of material from a block weighing about 1300 gms.

Summary

The study relates to the comparison of bacterial load present in the surface and interior of a frozen block of prawns and the quantity of sample to be taken from the block to represent the whole block with respect to bacterial count determination. The results indicate that at 5% level of significance the surface and interior samples do not differ significantly. The minimum quantity representation of a 1300 gm. block was (21-26) gm.

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