

SHORT COMMUNICATION

Quick Test for Evaluating Processed Food Quality

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ABSTRACT

Quick test for quality check of processed food will be handy for Defence Forces. Acidity being one of the most important quality parameters, as per the ASC, BIS, PFA specifications, limits have been laid down as not to exceed 2 per cent in meat and fish products, 0.1 per cent in cereal products, 1.25 per cent in ice cream powder, 1.5 per cent in milk powder, 0.3 per cent in sweetened condensed milk, and 0.15 per cent in butter. In the present study, a simple, quick, semi-quantitative test has been developed for checking acidity in processed foods to ascertain their quality. The test is based on a colour reaction with the sample. The test solution gives blue to green to yellow colour depending on the concentration of acid in the sample. Green colour is the cut-off point for non-acceptance. The large number of samples of meat (155), fish products (48), cereal products (222), ice cream powder (200), butter (200), milk powder (200) and sweetened condensed milk (202) were analysed by the quick test method and the results were compared with those from the standard titrimetric method. Acidity ranged from 0.68 per cent to 2.40 per cent in meat products, 0.70 per cent to 2.50 per cent in fish products, 0.06 per cent to 1.25 per cent in butter, 0.60 per cent to 1.91 per cent in milk powder, 0.05 per cent to 0.54 per cent in ice cream powder, 0.32 per cent to 0.60 per cent in sweetened condensed milk, 0.05 per cent to 1.10 per cent in cereal products. Some samples were found to be unacceptable having acidity more than the specified limits. The data were analysed statistically and the quick test was found to correlate very well with the standard titrimetric method.

Keywords: Acidity, processed foods, quality, test solution, quick test

1. INTRODUCTION

Processed food is being utilised to a larger extent by the Armed Forces. The primary foods to some extent as well as several secondary processed foods are being used specially by troops deployed at high altitudes, remote army units where the road is cut off during winter season. These foods are also used in routine by the civilian population. Generally, processed foods are handy for the jawans on patrolling duty and their quality is of prime importance. Amongst the commodities, a few more common items such as *atta*, *sooji*, *maida*, milk powder, meat and fish

products, butter, refined oils are procured in large quantities. Based on the logistic operations, the procured items are moved through Army Service Corps (ASC) supply depots, Composite Food Laboratory (CFL) for safety clearance, then to the consumer units. In general, the shelf life is 10-12 months for the products supplied to the Army. However, the transit from purchaser to consumer takes a few months. Therefore, the stocking period in the units will be reduced. In this process, expected shelf life is over and then, the samples have to be sent to the CFL for further advice, clearance, checking

the quality. Since, the transit time is the most unpredictable factor, the quick tests for checking the quality of foods will be ideal at the consumer units. The specifications for acidity have been laid down by the statutory bodies, such as PFA, ASC, Bureau of Indian Standards (BIS), etc. The storage deterioration though leads to auto-oxidation reaction resulting in the formation of peroxides, aldehydes and ketones; hydrolytic reactions also occur with the formation of free fatty acids. Thus, acidity can be one of the quality parameters in meat, fish, cereal, and milk-based products. Generally titrimetric methods are used for determination of the acid value. The quick test for quality evaluation of milk powder, atta and refined oil has been reported earlier¹. In the present study, efforts have been made to suitably modify the acidity test for measuring quality of meat, fish, cereal and milk products.

2. MATERIALS AND METHODS

Meat and fish products, cereal products, butter, ice cream powder, milk powder and sweetened condensed milk were procured from the Mysore market. All chemicals used for analysis were of analytical grade.

Preparation of test solution: Polyvinyl alcohol (1 g) was added to 100 ml of 1 per cent sodium hydroxide solution and heated at 100 °C till it dissolved. Triton-X100 (0.2 g) was added to it and heated at 100 °C till a clear solution was obtained. After cooling 0.1 g of bromothymol, blue indicator was added to the solution and shaken. 10 ml of this solution was added to 500 ml of the distilled ethyl alcohol and this was called the test solution.

2.1 Sample Analyses

2.1.1 Meat and Fish Products

The sample (1 g) was taken in a conical flask containing 10 ml chloroform- methanol mixture (1:1). This was allowed to stand for 2 min with intermittent shaking. 1.8 ml of the sample solution was taken in a test tube and 3 ml of test solution added to it, shaken and observed for the stable colour after 1 min.

2.1.2 Cereal Products

To 1g sample in a test tube, 10 ml water was added and mixed well by shaking. One ml of the sample solution was taken in a test tube to which, 2 ml of test solution was added, shaken and was observed for the stable colour after 1 min.

2.1.3 Dairy Products

- To 1 ml of melted butter in a test tube, 4 ml of test solution was added, mixed well by shaking and was observed for the colour after 1 min.
- To 1 g of ice cream powder in a test tube, 10 ml water was added and mixed well. 1 ml of the sample solution was taken in a test tube and to it 4 ml of test solution was added, shaken well and observed the stable colour after 1 min.
- To 1 g of milk powder in a test tube, 10 ml water was added and mixed well. one ml of the sample solution was taken in a test tube, and to it added 4 ml of test solution, shaken and observed for stable colour after 1 min.
- To 1 g of sweetened condensed milk in a test tube, 2 ml water was added and mixed well. one ml of the sample solution was taken in a test tube and to it added 2 ml of test solution, observed for stable colour after 1 min.

The titratable acidity in milk products²⁻⁵ cereal products⁶⁻⁸, and meat and fish products^{9,10} was determined using standard titrimetric procedures. The data obtained from quick test and standard method were statistically analysed for mean, standard deviation and correlation coefficient using MS 2000 software.

3. RESULTS AND DISCUSSION

Simple test with readymade indicator test solution are convenient to quickly assess the quality of the processed foods. These tests can conduct in places where the laboratory facilities are not available. A quick test based on acidity has been developed, optimised, and tested for determination of the quality of stored food products. Using the developed indicator

test solution for acidity, the quick test method was suitably modified for various other processed foods, generally procured by the Armed Forces. Considering the BIS and ASC specifications, for meat and fish products, butter, ice cream powder, milk powder, sweetened condensed milk, and cereals, the standard acids were suitably diluted to get the gradational colour change with the indicator test solution. The results have been given in Table 1. The colour of the test solution changed from dark blue to light blue to green to greenish-yellow to yellow depending on the concentration of acid in the sample.

Large number of samples were evaluated using both the quick test as well as standard method. Green colour was the cut-off point for acceptance of the sample. These samples were given the numerical score of 1 to 5 for analysing the data statistically. The results have been presented in Table 2. Among 155 samples of meat and meat products, 7 samples showed yellow colour by the quick test method

indicating that the acidity was more than the specified limit (> 2 %) and varied between 0.68 to 2.40 per cent among all the samples. Acidity of the fish and fish products ranged from 0.70 to 2.50 per cent as determined by titrimetric method, 25 samples gave blue, 11 green and 12 yellow colour by the quick test method; thus showing that quick test method was well suited for determining acceptance or rejection of the samples. Among 200 butter samples analysed, 84 samples showed yellow or greenish-yellow colour by the quick test method reflecting more than 0.15 per cent acidity, which was more than the specified limit. Acidity ranged from 0.06 to 0.14 per cent in the remaining 116 samples of butter falling in the region of acceptance. Acidity values for most of the milk powder samples were within the specified limit (0.60 to 1.46 %) except 11 samples which gave yellow or greenish-yellow colour by the quick test method, indicating an acidity value of more than 1.5 per cent.

In the case of ice cream powder, the added colour was first eliminated by the adding of a pinch of activated charcoal powder before performing the quick test. All the samples of ice cream powder gave blue or bluish-green colour by the quick test method and acidity varied from 0.05 per cent to 0.54 per cent among all the samples indicating that these were acceptable.

According to BIS specification, acidity limit for sweetened condensed milk is 0.15 per cent, however all the samples had acidity more than 0.3 per cent giving yellow or greenish-yellow colour by the quick test method, indicating non-acceptance of the product. Since 200 samples are quite a large number, these results indicate that the condensed milk process cannot give a product with acidity less than 0.3 per cent. Therefore, it calls for a revision of the specified limit of acidity in case of sweetened condensed milk.

Acidity in *maida*, *sooji* and *atta* ranged from 0.07 to 0.18 per cent, 0.03 to 0.12 per cent, and 0.10 to 0.21 per cent, respectively. 16 samples of *maida*, 21 samples of *sooji*, and 18 samples of *atta* gave light blue or green or yellow colour by the quick test method and acidity values were more than 0.10 per cent, which is more than BIS-

Table 1. Colour of test solution by quick test using standard acid

Samples	Acidity (%)	Colour of test solution
Meat and fish products (Oleic acid)	< 2	Blue
	2	Green
	> 2	Yellow
Butter (Butyric acid)	< 0.13	Blue
	0.131 to 0.15	Light blue
	0.151 to 0.20	Green or yellowish-green
	> 0.2	Yellow
Ice cream powder (Lactic acid)	< 1.1	Blue
	1.1 to 1.25	Light blue
	1.26 to 1.34	Green
	> 1.34	Yellow
Milk powder (Lactic acid)	Up to 1	Dark blue
	1 to 1.5	Light blue / Bluish-green
	1.51 to 2.0	Green / Greenish-yellow
	> 2.0	Yellow
Sweetened condensed milk (Lactic acid)	Up to 0.2	Blue
	0.21 to 0.27	Light blue
	0.28 to 0.30	Bluish green
	0.31 to 0.35	Green / Greenish-yellow
	> 0.35	Yellow
Cereal products [alcoholic (90 % H ₂ SO ₄)	< 0.10	Dark blue
	0.11 to 0.15	Light blue
	0.15 to 0.18	Green
	> 0.18	Yellow

Table 2. Results of quick test for acidity

Samples	No. of samples	Acidity (%) (Std. method)	Colour of test solution by quick test	Remarks
<i>Meat and fish products</i>				
1. Meat and meat products	128	0.80 ± 0.20	Blue (B)	Accepted
	20	1.99 ± 0.21	Green (G)	Accepted
	7	2.20 ± 0.20	Yellow (Y)	Rejected
2. Fish and fish products	25	0.90 ± 0.50	Blue	Accepted
	11	1.99 ± 0.10	Green	Accepted
	12	2.33 ± 0.20	Yellow	Rejected
<i>Milk products</i>				
1. Butter	120	0.081 ± 0.0280	Blue/Bluish-green	Accepted
	6	0.176 ± 0.0089	Greenish-yellow	Rejected
	80	0.415 ± 0.2300	Yellow	Rejected
2. Milk powder	93	0.870 ± 0.0870	Blue	Accepted
	36	1.044 ± 0.0310	Light blue	Accepted
	60	1.227 ± 0.0980	Bluish-green	Accepted
	11	1.802 ± 0.1210	Yellow	Rejected
3. Ice cream powder	200	0.226 ± 0.1172	Blue	Accepted
4. Sweetened condensed milk	38	0.336 ± 0.0134	Greenish-yellow	Rejected
	162	0.405 ± 0.0530	Yellow	Rejected
<i>Cereal products</i>				
1. Maida	61	0.08 ± 0.01	Dark blue	Accepted
	15	0.12 ± 0.01	Light blue	Rejected
	1	0.16 ± 0.02	Green	Rejected
2. Sooji	67	0.05 ± 0.02	Blue	Accepted
	13	0.11 ± 0.01	Light blue	Rejected
	8	0.16 ± 0.03	Green	Rejected
3. Atta	48	0.10 ± 0.03	Blue	Accepted
	10	0.11 ± 0.03	Green	Rejected
	8	0.19 ± 0.02	Yellow	Rejected

specified limit. Some of *atta* samples had very high acidity (more than 1%) and were unacceptable.

The statistical analyses of the data, has been presented in Table 3. The deviation from the mean varied depending on the range of acidity in a large number of samples and was relatively, more in case of meat and fish products. The correlation coefficient ranged from 0.7 to 0.97, indicating a fairly good correlation between the standard and quick test methods.

It is concluded that the semi-quantitative quick test for acidity is comparable with the standard method and this simple test can be adopted for evaluation of quality in various processed foods.

Table 3. Statistical analysis of acidity (%) in various samples

Sample	Mean	Std. Dev. ±	r
Meat and meat products (max 2 %)**	1.062	0.488	0.90
Fish and fish products (max 2 %)**	1.653	0.752	0.825
Butter (max 0.15%)*	0.22	0.21	0.80
Ice cream powder (max 1.25 %)*	0.23	0.11	0.80
Milk powder (max 1.5 %)*	1.06	0.24	0.70
Sweetened condensed milk (max 0.3 %)*	0.39	0.05	0.82
Cereal products (max 0.1 %)*	0.15	0.08	0.61

* = BIS-specified limits for acidity

** = ASC-specified limits for acidity

REFERENCES

1. Premavalli, K.S.; Madhura, C.V. & Arya, S.S. Quick test for quality deterioration in processed foods. *Def. Sci. J.*, 1998, **48**(3), 257-62.
2. Bureau of Indian Standards. Specification for milk powder. IS:1165-1986.
3. Bureau of Indian Standards. Specification for ice cream powder. IS:2802-1964.
4. Bureau of Indian Standards. Specification for sweetened condensed milk. IS:1166-1973.
5. Bureau of Indian Standards. Method of sampling and test for butter. IS:3507-1966.
6. Bureau of Indian Standards. Specification for wheat *atta*. IS:1155-1968.
7. Bureau of Indian Standards. Specification for wheat *maida*. IS:10899-1984.
8. Bureau of Indian Standards. Specification for *sooji* or *rava* (semolina). IS: 1010-1968.
9. Official and tentative methods. American Oil Chemists Society, 1973, Ca-5a-40.
10. A compendium of ASC specifications for food stuffs. DGST, New Delhi, 1991. 140. p.

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