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Research Note

Simple Methods for Evaluating *Attiéké* Spoilage

ABSTRACT

Optical density, viable count and pH changes during attiéké *storage suggested that* attiéké *spoilage was highly related with microbial growth. These simple tests, which were associated with flavour alterations, could be evaluated by sensory analysis of* attiéké *and might serve as prime criteria of* attiéké *spoilage.*

INTRODUCTION

Attiéké is a major processed cassava product developed by Ivory Coast women in extremely ancient times. It is a fermented and granulated steam-cooked food. Its processing includes peeling roots, washing and grinding them to a mash. A leaven (a cooked and fermented cassava pulp) is added before the grinding step. This product is fermented for three days and as much water as possible squeezed out. The dewatered mash is granulated, then sun-dried and steam-cooked until the moisture content is about 30–40% (Leloussey, 1968). *Attiéké* is widely consumed in the Ivory Coast and other African countries and exported in Europe in the form of dehydrated *attiéké*. It differs in its texture, colour and taste from *gari* which is well known in several countries. *Gari* is a sieved and roasted granular product. Its moisture content is around 8·2% (Onyekwere & Koleoso, 1983). *Attiéké* also differs in its physico-chemical properties from *farinha demandioca* which is a roasted and dewatered mash. The moisture content of this coarse granular flour is around 10–15% (Dougan *et al.*, 1983). *Attiéké* is

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very perishable with a shelf life of about 3–4 days. Its spoilage is characterized by a sour taste as well as an acidic odour. The objective of this research is to determine the criteria of spoilage in fresh *attiéké*.

MATERIALS AND METHODS

Attiéké storage

Fresh *attiéké* was sealed in small plastic bags of 400 g for some minutes after its preparation. It was stored at 22°C (ambient temperature), which is the same as that used by Ivory Coast producers for fresh *attiéké*. Initially, and at intervals of 1, 2, 3 and 4 days, some bags were removed from storage and their contents tested.

Objective measurements

A 2 g *attiéké* sample (from 3 samples × 10 batches) was mixed with 20 ml distilled water, stirred well and let stand for 30 min so that *attiéké* liquid was obtained. Optical densities were measured at 600 nm with a spectrophotometer (UV-120 01). Viable counts were made by plating the *attiéké* liquid in PCA medium according to the French standard and American Public Heath Association methods and counting the colonies present after aerobic incubation for 2 days at 37°C. Samples for each storage time were tested in triplicate every day. pH was measured with a glass-electrode pH meter (Crison).

Sensory analysis

A certain quantity of *attiéké* was served in coded cups to 10 experienced panelists seated in individual booths. The panel judged *attiéké* for flavour using a scale ranging from 9 = fresh *attiéké* flavour ('excellent') to 1 = extreme off-flavour ('completely unacceptable'). Fresh *attiéké* was presented as an identified standard. The flavours of test samples were compared with that of fresh *attiéké* obtained the same day and stored at 5°C. The panelists received the standard and two samples of each storage time. Average flavour scores of the taste panel represent mean values from four replications of each storage time.

Statistical analysis

Analysis of variance was used to study the sensory evaluation data. Correlation coefficients were calculated to determine the relationship

between flavour scores and changes measured by each of the three simple methods.

RESULTS AND DISCUSSION

Sensory evaluation

In the samples, the average flavour declined slightly during the first day of storage but no statistically significant ($p = 0{\cdot}05$) off-flavour was detected by the panel. By the second day the average flavour score became pronounced and varied from 8·75 to 7·60 (note: a score of 7·0 = off-flavour).

After the third day, a large flavour score decrease was observed (score 4·50). The average flavour score had dropped to 2·24 during the fourth day (2·24 = unacceptable = off-flavour). Microbial analysis showed that lactic acid bacteria were present in *attiéké* when spoilage was detectable.

Objective measurements

Table 1 shows that the pH had increased 0·05 unit by the first day of storage and by 1·05 units after the second day of storage. This was associated with the greatest increases of microbial growth, viable count and optical density

TABLE 1

Effect of Storage on *Attiéké* Flavour and Simple Criteria for Measuring Spoilage

Days at 22°C	Attiéké *flavour*	*pH*	*OD (600 nm)*	*Viable count/ml*
0	8·75	3·49	0·027	$3{\cdot}2 \times 10^3$
1	8·37	3·54	0·060	7×10^4
2	7·60	4·54	0·137	$4{\cdot}5 \times 10^5$
3	4·50	4·75	0·153	5×10^6
4	2·24	5·96	0·169	$5{\cdot}8 \times 10^6$

during the same time. After the third day, the three changes varied little. The three significant figures in Table 1 are justified by experimental accuracy and are useful (for flavour and pH) in order to determine the lowest flavour and pH changes observed between the days of *attiéké* storage.

Statistical analysis

The average flavour score changes corresponded to objective changes observed in *attiéké* spoilage. There was highest correlation between optical density and pH on the one hand and flavour scores on the other. All correlation coefficients were statistically significant ($p < 0{\cdot}01$).

DISCUSSION

The data of Table 1 suggest the possibility of using measurement changes resulting from the growth of microorganisms as an 'index' of *attiéké* spoilage. These results agree with the Woodburn *et al.* (1966) report on the relationship of microbiological factors and meat flavour. They also agree with Dotsun *et al.* (1977) who had shown that the deterioration of *tofu* flavour appeared to be related to acidification by lactic acid bacteria. *Tofu*, similar to soybean curd products, is common throughout Asia (Wang, 1967) and has been eaten for centuries in China (Altschul, 1965) and Japan (Miller, 1933; Miller *et al.*, 1952). Of the three methods used, the acidity test is found to be the best index of *attiéké* spoilage because it can be determined simply with a pH meter or an indicator-impregnated pH paper. The two other methods are also simple but viable counts require some equipment, the results take a long time and optical density measurements are influenced by *attiéké* particles.

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