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Full Length Research Paper

Technical sheet of Process of *attieke* production in Côte d'Ivoire

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Attieke **is the major fermented plant food in Côte d'Ivoire. It is asteamed granular cassava (Manihotesculenta Crantz) meal, couscous-like product, with slightly sour taste and whitish colour. Our study is a technical sheet of process of *attieke* production in côte d'Ivoire. process of *attieke* production in côte d'Ivoire was : Cassava roots, peeling, pulp washing, grinding, fermentation, wrinding, sieving, drying, winniwing and fibre removal, cooking, packaging and *attieke*. *Attieke* not contained coliforms, moulds and an aerobic sulfite reducing bacteria, *Salmonella* and *Echerichia coli*. However, the values obtained fall within the standard specifications set for *attieke* by CODINORM (Côte d'Ivoire standards Board)**

Keywords: *attieke*, process, Côte d'Ivoire

INTRODUCTION

Cassava, the enlarged root of Manihotesculenta Crantz, is an important staple food for about 80% of Cote d'Ivoire's estimated population, especially those living in the southern regions (Aboua et al., 1990). Cassava may be processed by boiling, roasting, drying, or by fermentation, depending on the variety (Kouadio et al., 1991) before eaten. However, the most popular processing method, especially for the varieties which are high in the cyanogenic glucosides, is by fermentation. In Africa, over 90% of the processed cassava are consumed as fermented products (Westby, 2002), and one of the most popular fermented foods derived from cassava in Cote d'Ivoire is *attieke*. *Attieke*, a steamed cassava fermented semolina, is one such fermented cassava product and is of significant importance for an increasing number of people in Cote d'Ivoire (Assanvo et al., 2006) and other countries in the world. Recent data on attieke consumption do not exist, but Aboua et al. (1990) estimated the consumption between 28,000 and 34,000 tons per year, thee quivalent of 40.000 and 50.000 tons of fresh cassava. The popularity of *attieke* to urband wellers is associated with its cheapness, lower bulk (as compared to other cassava product) and its characteristic of ready to eat food. The processing of cassava into *attieke* needs several and hard steps. Our study is a technical sheet of process of *attieke* production in côte d'Ivoire.

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MATERIAL AND METHODS

Material vegetable

The used plant material consisted of 12 months-old freshly harvested cassava roots of the bitter variety, IAC cultivar (Improved African Cassava).

Attieke preparation

Roots are peeled, cut in to pieces and then washed three times with fresh water. The milling takes place in a cooperative mill located in the village. Before milling, 5–10% (w/w) of inoculum, 10% (v/w) water and about 01% (v/w) of palm oil are added and the pieces are ground to a fine paste, which is placed in large bowls. The mash is left to ferment for about 12–15 hours at ambient temperature (30–37°C). After fermentation, the mash is placed in a jute sack and pressed continuously in a hand press for an hour. The press cake is then passed throught wosieves to obtain a fine powder. The grains are formed by shaking and rotating the powder in a large bowl. The grains are sun-dried on black plastic canvas or flat bowls for a time period ranging from a few minutes up to half an hour. After drying, fibres and dirt are removed by sprinkling the grains. The grains are poured onto the sieve
up to a height of 15–20 cm for steaming for about 20–25 hours on a cauldron filled with boiling water. *Attieke* obtained is the filled into plastic bags, sealed air tight and soldon local markets or transported in cars at ambient temperature (30–37°C) in other localities.

Determination of pH and Total Titrable Acidity (TTA)

Thirty grams of cassava traditional inocula samples were blended with 70 ml of steriled is tilled water and filtered through a Whatman filter paper. The pH of 30 ml of the filtered solution was determined using a pH-meter (pH-meter P107, Consort, Bio block Scientific, Illkirch, France). TTA was determined using the standard method described by Amoa-Awua et al.1996. Ten millilitres of filtered solution were titrated with Na OH 01 N, using 1% phenolphthale in as indicator. The volume of aliquot used was recorded to determine the amount of acid in the sample. The titrable acidity was calculated as percentage of lacticacid. The determinations were carried out in triplicates and the mean value recorded.

Enumeration and Identification of Spoilage Microorganisms

Preparation of stock solutions, inoculation of agar plates, cultivation and quantification of micro-organisms were carried out according to (Djeni et al., 2011). For all determinations, 10 g of the traditional cassava inocula samples wash omogenized in a stomacher with 90 ml of sterile buffered peptone water (AES Laboratoire, Combourg, France). Ten fold serial dilutions of stomacher fluid were prepared and spread plated for determination of micro-organism counts. Enumeration of coliforms was carried out using plates of Violet Red Bile Lactose agar (VRBL, Merck 10660, Merck, Darmstadt, Germany). The cultures were incubated for 48 h at 30°C for total coliforms and 44°C for faecal coliforms. Yeasts and moulds were enumerated on plates of Sabouraud–chloramphenicol agar (Fluka, Bochemica 89579, Sigma-Aldrich Chemie GmbH, Bangalore, India), incubatedat 30°C for 4 days. Aerobicmesophiles were enumerated on plates of plate count agar (PCA Oxoid Ltd, Basingstoke, UK) and incubated at 30°C for 2 days.

Isolation and Identification of Food-borne Pathogens

Staphylococcus aureus

Staphylococcus aureus was isolated and enumerated according to the method described by Capita et al., 2001. A volume of 01 ml of each dilution was surface plated on Baird-Parker agar (BPA) contain in geggyolktellurite emulsion (Oxoid) and incubated at 37°C for 24 and 48 h
.The total number of colonies, colonies with different morphology to those of *Staphylococcus aureus* was counted. Five colonies from each sample were randomly selected, purified and tested for cell morphology, arrangement of the cells, Gram reaction, catalase activity, oxidase test, ability to produce acid anaerobically in a glucose-containing growth medium, coagulase activity, thermo-stable nuclease activity, acid production from mannitol and acetoin production. Only, the gram positive cocci were identified using the identification schemes proposed by Schleifer et Kloos, 1975. After the identification, the percentages of *Staphylococcus aureus* and the other strains were calculated. These percentages were later used to correct the results of the counts obtained from each BPA plate.

Bacillus

The quantitative estimation of spores of *B. cereus* was performed by a standard plate-counting method. Isolations were achieved from heat-treated dilutions by plating on mannitol eggyolkpolymyx in B agar (Kouame et al., 2012). Presumptive colonies of *B. cereus* were randomly selected based on characteristic colony feature, purified on the same medium and identified by morphological, cultural and biochemical characteristics according to the documented procedures (Cappucino. and Sherman, 2004)

Salmonella

The research of *Salmonella* in cassava traditional inocula, palm oil and water samples were achieved according to

Photo 1: Cassava roots (photo A.K Kouame)

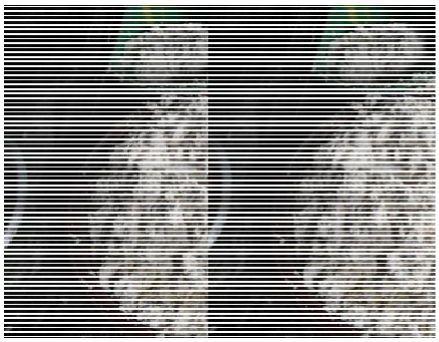

Photo 2: Crushed casssava dough

Photo 3: Pressed cassava paste

Photo 4: Cassava semmoula

Photo 5: Cooking of semoulas

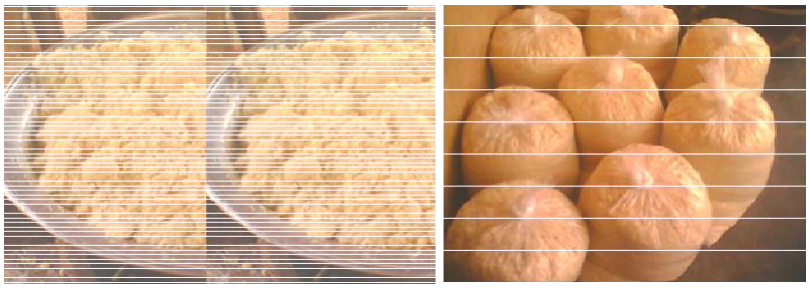

Photo6 : *Attieke*Photoo 7 :*Attieke* packed

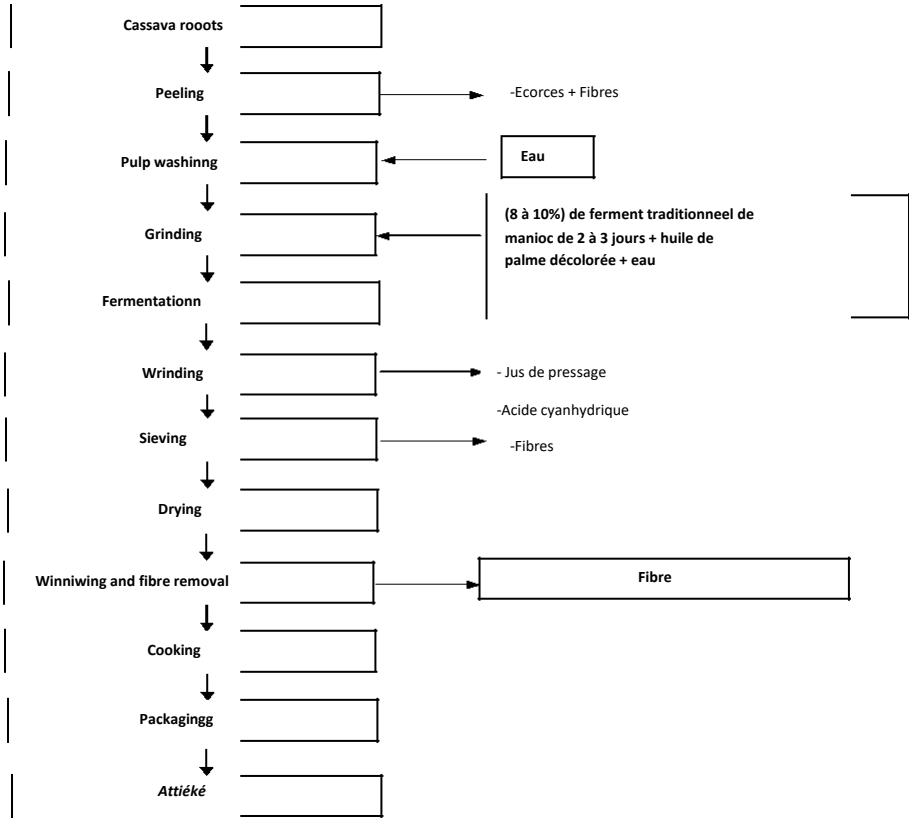

Figure 1: Process of *attieke* production in Côte d'Ivoire

the procedure described in the global *Salmonella* surveillance and laboratory support project of the World Health Organization (Hendriksen, 2003). From each sample, 25g was as eptically weighed and macerated in 225 ml of buffered peptone water (Oxoid) and incubatedat 37°C for 24 h. A selective enrichment in Tetrathionate broth (Mu ¨ller-Kauffmann) and Rappaport Vassiliadissoy peptone both using 1 ml of previously incubated buffered peptone water was achieve dat 37°C for 24 h, followed by a subcultivation on Salmonella Shigella agar incubation at 35°C for 24– 48 hours (Feng et al., 2007). Colourless, transparent and witha black centre colonies were further ide ntified using biochemical tests.

Statistical Analysis

Descriptive statistics for microbioloogical data were calculated with Excel (Microsoft, Redmond,, WA, USA). All statistical analyses were implemented in STTATISTICA for Windows ver. 10 (StatsoftIberica, Lisbon, Portugal). Parametric tests (one-way variance analysis with Duncan's test) at 5% significance level were performed to determmine whether there were significant differences betweeen markets regarding microbiological data collected.

RESULTS AND DISCUSSION

In Côte d'Ivoire*; attieke* plays an important role in the population diet. It is part of the diet of many peoples. It is a typically Ivorian food, whose annnual local consumption is estimated at over 450000 tonns (Djeni, 2011). *Attieke* production in Côte d'Ivoire is ussually prepared by method described above (figure 1). *Attiekke* just after cooking and

Table 1. pH, total titratableacidity and microbial population in cassava traditional inocula used in *attieke*process

Parameters	Values
pH	4.94± 0.8
Titratableacidity (%)	1.67± 0.2
Aerobicmesophiles (CFU.g^{-1})	Ab
Moulds (CFU.g^{-1})	Ab
Staphylococci (CFU.g^{-1})	Ab
Bacilli (CFU.g^{-1})	(1.41± 3.2)10^{3}
Total coliforms (CFU.g^{-1})	Ab
Faecalcoliforms (CFU.g^{-1})	Ab
Escherichia coli	Ab
Salmonella (CFU.g^{-1})	Ab

attieke packed had acidic pH. The production of *attieke* depends on a fermentation step which gives an intermediate product (fermented paste) of acid pH. Other unit operations that result in the finished product do not cause significant pH changes (Kouame 2013). pH values were 4.37 and 4.36, respectively. The titratable acidity values were respectively 2.44 % and 1.78%. However, the values obtained fall within the standard specifications set for *attieke* by CODINORM (Côte d'Ivoire standards Board) (4–5 for pH) and are also similar to the results of Coulin et al. (2006). Just after steaming and packaging in plastic bags, attiékédid not contain coliforms, moulds and anaerobic sulfite reducing bacteria, *Salmonella* and *Echerichia coli* (**Table 1).**

The absence of Salmonella, E. coli and anaerobic sulfite reducing bacteria in attieke samples could be due to the low pH. In fact, the combined effect of organic acids produced during the fermentation period may possibly exert bacteriostatic effect on spoilage organisms and pathogens that might be present (Tomkins et al. 1987; Sengun and Karapinar 2012). They all contained Bacillus sporeat mean loads of (1.41± 3.2)10^{3}.Due to the low level of microbial detection, these *attieke* samples were of satisfying quality in regard to the standards recommended by CODINORM.

CONCLUSION

Attieke is a typically Ivorian food. Its production necessarily involves stages of production that pass from the roots of cassava to the cooking of the semolina. The *attieke* obtained at an acid pH and is of satisfactory microbiological quality.

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