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Canned Tomato Quality and Stability Preservation a Comparative Study †

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Abstract: As the Algerian food market is booming and opens up to international trade, industrials have a great interest in the quality of local products and want to raise it to the standards of import products, so to achieve this study, accelerated aging of a large consumer product: canned dual concentrate of tomato was conducted on two local and imported brands, to check its stability over time and therefore the validity of the date of consumption but also its hygienic quality in order to verify the effectiveness of the pasteurization process. Results reported that no deformation of the packaging was noticed, a preservation of organoleptic characteristics (odor, color, appearance and texture of the product), a difference in pH (<0.5) pH unit compared to control, dry extract for both brands show superior values compared to those reported on the package. For the stability variation of flora is quantitatively and qualitatively analyzed), in addition to pathogenic germs (*Clostridium* Sulfito-reducers, *Staphylococcus aureus*, *Coliforms* and *Salmonella*) and the presence of total mesophil aerobic flora (FTAM). Studied parameters gave good statistics and norms on local market products.

Keywords: local tomato market; quality control; stability study; canned tomatoes

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1. Introduction

Tomato is one of the most popular and important horticultural crops in the world [1]. Its worldwide production was about 188 million tons in 2018 [2,3]. Processed tomatoes are mainly (75%) concentrated into a paste [4,5] which is the main constituent in tomato value-added products [5–7], as the canned, concentrate, sauce, and ketchup [8], the minimum quality requirements and ingredients that can be used in tomato processing are defined in local and international legislations and standards to protect consumer health and ensure fair food trade [9].

The favorable organoleptic properties of tomato is complemented by its very valuable composition [10] Within the European Union, the additives that may be included in concentrates are strictly regulated. These include the maximum amount of acidity regulators and salt that the end-product can contain. In addition to the prohibition of colorants [11], all ingredients used in the manufacture of the product must be indicated on the label of the product package [12]. Despite these regulations, issues of food fraud continue to be on the rise typically, to reduce production costs or to produce products more appealing to consumers for increased profit [13].

Thus, monitoring and retaining the quality traits during the production process is very important [7,14]. The solid content in tomato paste is mainly affected by the degree of concentration, and to some extent, by the cultivar [15]. Fresh tomatoes with a higher NTSS content require less tomato fruit and less water removal to reach the desired end-product quality [16,17]. Sugars and organic acids in tomatoes and their interactions with

the volatile compounds are responsible for the typical sweet-sour flavor of tomatoes or tomato products [18,19]. Two other important quality parameters in tomato paste are pH and titratable acidity (TA), which play a key role in food safety and the tomato flavor. Tomato paste's pH and the acidity are affected by the cultivar, the ripening stage at the time of harvesting, the tomato processing conditions (hot vs. cold break processing), growing location, and seasonal variations [4,16,20,21]. Consideration of the role played by solids, viscosity, pH, sugars, and acids in tomato quality, several analytical methods have been developed and are currently used in the tomato industry [1,22,23].

For the objective qualification of local and imported double canned tomato product, soluble solid content (SSC), ph, sensory analysis, stability and microbial quality are standard methods generally applied in final product quality control based on national and international standards.

2. Experiments

Routine quality control practices involve hourly testing of freshly manufactured tomato paste samples from each production line. These tests include soluble solids, viscosity, consistency, pH, acidity, and color [7,24], which are the pre-eminent quality parameters of tomato paste in determining consumer's acceptability and are an essential part of the quality grade standards. For example, natural tomato soluble solids (NTSS) in fresh tomatoes is mainly contributed by the reducing sugars, which significantly affects the overall quality of the final product, as well as its yield and consistency [16,20], pH and titratable acidity (TA), play a key role in food safety and the tomato flavor, tomatoes are low acidic foods (pH < 4.6), and they do not require extreme thermal treatment to ensure microbiological food safety; furthermore, the low pH helps to inhibit the spore-forming bacteria. A pH < 4.4 is considered the highest desirable value for food safety and to prevent thermophilic spoilage and ensure a margin safety [4,15,25–27].

2.1. Experimental Design

This experiment was carried out in an independent quality controle laboratory "Tanit Lab", standard descriptive methods and regulation (JORADP N°39 2017, ISO, AFNOR, CODEX…)were used, it consisted briefly of 2 levels: twins witnesses tin cans at room temperature and incubated ones at 30 °C (in Memmert incubators) during 21 days. the same procedure was followed for local and imported products. Physical and chemical measurements, qualitative and quantitative Flora and microbial analysis; were performed after incubation period for all tested samples except ph measurements which was assessed before and after incubation.

2.2. PH Measurement

pH was measured using a pH meter Precisa, which placed in the stirred tomato paste. Prior use, pH meter was calibrated and cleaned when measuring pH value between different samples to avoid cross contamination and error value.

2.3. Total Solid Measurements

Tomato paste was centrifuged then float liquid was dripped on a portable refractometer prism, and then observed. Read the numbers on the scale to obtain Brix° value.

2.4. Sensorial Analysis

Physical appearance of tin cans by means of absence of fuitage, flochage, deformation…; sensory color, flavor and texture of tomato pasta measurements was done before and after incubation period, and then compared.

2.5. Qualitative and Quantitative Flora Analysis

Qualitative analysis of opened tin cans after incubation period were performed by observing a tomato pasta smear under Paralux microscope (magnification X30) into 10 fields to determine homogeneous flora then count it and make an average in order to assess a stabity factor namely R which is calculated using the following formula:

R = Nb incubated tin cans flora/Nb witnesses tin cans flora

For a good stability parameter R should be <100.

2.6. Microbial Analysis

Microbial analysis were performed according to national and international standards and regulation (JORADP N°39 2017, ISO, AFNOR…), to evaluate samples potent contamination after incubation period by germs as: *Clostridium* Sulfito-reducers (NA ISO 7937), *Staphylococcus aureus* (NA ISO 688861), *Coliforms* (NA ISO 4831), *Salmonella* (NA ISO 6579) and the presence of total mesophil aerobic flora (FTAM) (NA ISO 4833), and assess by the way hygienic safety, efficiency of pasteurization process and food security of local and imported tested products.

2.7. Statistical Analysis

Data are presented as mean ± standard deviation (S.D.). Statistical analysis was performed using Microsoft Office Excel 2008 ($p < 0.05$).

3. Results and Discussion

3.1. Sensorial Analysis

Color is very important parameter in food products. In tomato derived products, color is crucial because the tomato red color pigment (lycopene) can be degraded by a heat-induced process or by non-enzymatic changes [8,9]. Sensorial analysis of witnesses and incubated local and imported tin canned tomato after incubation period exhibit no physical deformations, on the other hand a remarkable darkness and an increasing thickness was observed in incubated imported tin cans when comparing with it witness and local ones.

3.2. Physico-Chemical Analysis (Total Solids (Brix°, pH)

The total solid values for tomato paste resulted in this study were in the range of 30 ± 0.1% to 32 ± 0.0% Brix°. These values were still higher than standard value for double tomato paste > 28%. In terms of pH values, results were in the range of 4, 24 ± 0.01–4, 09 ± 0.05 for witnesses and incubated imported tin cans respectively, and 4, 18 ± 0.0–4, 25 ± 0.01 for witnesses and incubated local tin cans respectively, which is in agreement with standard value that indicates a difference less than 0, 5 between witnesses and incubated tin cans ph values.

3.3. Qualitative and Quantitative Flora Analysis

Present Flora was hogenious when analyzed by microscope and germ colonies counting leads to a stability factor R in the range of 3, 13 ± 0.0–2, 75 ± 0.0 for witnesses and incubated imported tin cans respectively, and 3, 65 ± 0.03–3, 53 ± 0.02 for witnesses and incubated local tin cans respectively, which is in agreement with stability factor R standard value that indicates a difference less than 100 between witnesses and incubated tin cans R values.

3.4. Microbial Analysis

After culture on specific mediums and incubation times, results of microbial analysis of total mesophil aerobic flora (FTAM) exhibit 300 ± 5.0–180 ± 2.5 germs/g for witnesses

and incubated local tin cans respectively and 450 ± 7.5–130 ± 9.8 germs/g for witnesses and incubated imported tin cans respectively ($<3 \times 10^5$), in addition to a total absence of pathogens in all tested samples, obtained results are in agreement with local and international standards, which indicates a good hygienic quality and efficiency of pasteurization process of the products.

4. Conclusions

In the present study, a large consumed local and imported product namely canned tomato was assessed for its conservation stability according to national and international standards and obtained results were compared and exhibit a very good physico-chemical and hygienic quality which gave a global overview on local market products safety and consumption behavior.

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