QUALITY CONTROL IN YOGURT: ALTERNATIVE PARAMETERS FOR ASSESSMENT

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Abstract

The aim of this paper is to establish the differences in some quality parameters of different trademarks of yogurt-made manufactured products.
Two methods were developed for the purpose of this study. One method consisted in allowing a sample of the product to slide down from the apex of a plastic cone and then trough a glass platform positioned at 30° over the horizontal. The other method was a comparative determination of color between samples.
Duration of study 14 months.
Methodology: The sliding index is based upon the fact that liquid or semisolid materials flow freely by the effect of gravity when placed above a tilted surface or above the apex of a cone, to assess the viscosity of semisolid products. The colorimetric testing shows the extreme differences of color imperceptible.
The results obtained in this work show that the sliding index exhibited variable values from product to product of the same manufacturer and from batch to batch of the same product and manufacturer. The above was confirmed when both methods (cone and wedge) were used to obtain these data. The color variations were observed in a similar way as in the tests described
Conclusion: The use of chromatic characterization could also be employed to study degradation of yogurt products, for it is known that many pigments used in this industry change color with time, due to either degradation, chemical instability or the effect of light.

Keywords: Yogurt, quality, colorimetric testing

Introduction:

Yogurt is the coagulated milk product obtained by lactic fermentation by means of the action of *Streptococcus thermophylus* and *Lactobacillus bulgaricus*. These microorganisms of the lactic fermentation must be viable and to be present in the product finished in the minimum amount of 1 x 10^7 colonies by gram or milliliter. The hard fermentation takes between 6 and 23 hours, to reach the required acidity and organoleptic characteristics.

Then, the homogenized clot is placed in sterile packages. All yogurts must have a pH equal or smaller than 4,6 [1,2]. The aroma, the flavor and the texture of fermented milky foods are often due to the growth of lactic acid-producing bacteria. These form a diverse group of microorganisms, among which one can mention: *Lactobacillus*, *Lactococcus*, *Streptococcus*, *Leuconostoc*.

Like any other nutritional product, yogurt must fulfill certain prescribed requirements of quality according to the corresponding norms. The control of the quality of this type of product is carried out by means of analysis of the product throughout the process, beginning by the raw material and finishing with the finished product packaged. The final consumers trust the quality of the product and the lower-income consumers look for the low price trademarks, assuming than the quality is identical to the one of products of higher price. In fact, the enormous variety of products available to the consumer nowadays makes very difficult, from the layman point of view, to count with technical criteria simple, yet reliable enough, as to make an educated decision. Accordingly, the aim of this present work is to evaluate the quality of a yogurt produced through simple methods, yet capable of assessing the main physicochemical characteristics that could help to propose effective quality norms [2-4].

Material and methods

Quality tests

In Mexico, the elaboration of milky products, as well as in the case of other nutritional products, is ruled by parameters of quality according to the Mexican Official Norms. The particular case of yogurt is NOM 181-SCFI-2010, NMX-F-703-COFOCALEC-2004 official norm and the producers follow the norms corresponding to milky products also, in general. These norms are: NOM-155-SCFI-2003, NOM-184-SSA1-2002, NMX-F-708-COFOCALEC-2004 and they establish the physicochemical and microbiological specifications of milky products. However, they do not specify the viscosity or the difference of color neither establish a procedure to benchmarking one trademark with respect to a standard, making their enforcement very cumbersome, to say the least. Accordingly, in what follows we propose two new parameters to be added the existing norms, namely, the Index of Sliding and the Colorimetric Test.

Index of Sliding

The determination of the sliding index is based on the fact that all liquid or semisolid material flows freely by effect of the gravity when placed onto a wedge. This test was made placing a sample of the product both in a platform tilted 30° and on the apex of a cone. In both cases, the time of sliding of the product is a form to verify the viscosity of the different lots.

Colorimetric test

Colorimetry is the science dedicated to the measurement of the colors and the development of methods for the quantification of the color that is for the obtaining of numerical values of itself. In fact, there exists the need to standardize the color to be able to classify and to reproduce it. The procedure used for the measurement of the color consists basically of adding the answer of *stimuli* by colors and its normalization to the spectral curve of the sensible photoreceptor to color. As a reference, it is customary to employ the so-called spectral curve of the International Commission of Illumination, (known as CIE, after the initial in French). However, it must be noticed that the color is a subjective characteristic that only exists in the eye and the brain of the human observer, being, by no means, an intrinsic characteristic of a material [5].

Colorimetry has had a great expansion due to the cosmetic industry to characterize, for example, shades, inks, dusts and colors for the hair. Using advanced colorimetric techniques make feasible to perform chemical analysis of the surface of many materials, as well as of its response [6]. In the case of food industry, even the slightest change in color can allow to assess the status of the foodstuff or to make decisions from one batch to the next [5].

Experimental

The samples were 3 different trademarks of commercial yogurt (identified as F1, F2 and F3 in this study), readily available in the Mexican market.

A universal support with a lab funnel supported in a ring, was employed (Figure 1a). Underneath the end of the funnel a cone of transparent plastic material, 9 cm in diameter and

18 cm height was placed 1 cm away. The samples of yogurt were stirred for 1 min, at a temperature of 14 °C. Then, 10 ml of each sample were poured and the elapsed time from the vertex to the end of the cone, was recorded (Figure 1b). This procedure was repeated five times with each sample. The measurements were carried out for the 3 different trademarks and several lots of each.

Fig.1. a) Cone system for measuring sliding index. b) Sliding of sample in consecutive stages.

A rectangular flat glass piece (18 x 5 cm) was placed tilted 30º with respect to the horizontal (Figure 2). The samples of yogurt were stirred for 1 min, at a temperature of 14 °C. The sample of yogurt (30 mL) was spilled onto the upper part of the wedge, 1 cm above it and the time to flow through the glass piece was recorded. Again, the procedure was repeated 5 times for the whole set of samples.

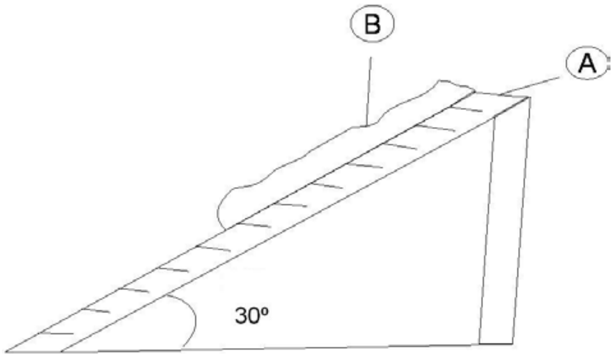

Fig. 2. Platform system for measuring sliding index: A) Glass platform 8 x 5 cm tilted 30° with respect to the horizontal. B) Sample.

A Konika Minolta CIELAB spectrophotometer was employed for the colorimetric characterization. This apparatus provides 3D plots: I, a and b. I is the intensity, ranging between 0 and 100. Coordinate a, defines the deviation of the achromatic point towards red. Coordinate b defines the deviation towards the yellow, as depicted schematically in figure 3.

The 10 mL samples were stirred for 15 s, at 14 °C before measured in the spectrophotometer.

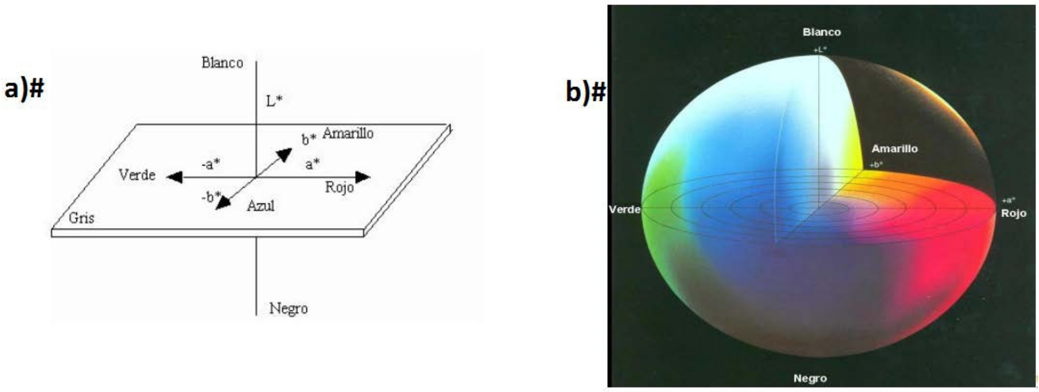

Fig. 3. a) Coordinated Cartesian system. b) Chromaticity space diagram CIELAB.

Results and discussion

Figure 4 summarizes the results of the index of sliding.

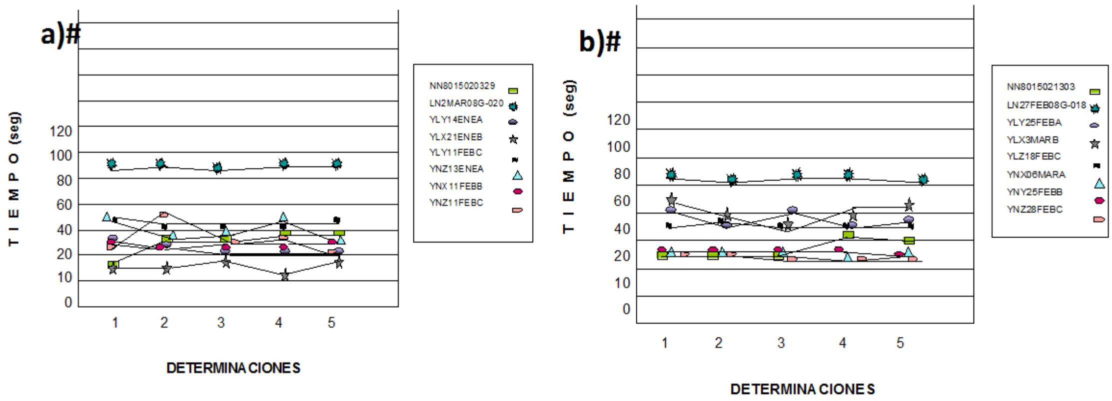

Fig. 4. a) Sliding time of samples from cone system. b) Sliding time of samples from platform at 30°.

As for the colorimetric test, the values obtained for l, a and b, are shown in figure 5. The behavior of the index of sliding in cone of two of the three manufacturers (F2 and F3) is very similar, presenting values that vary between 16.2 and 46.0. One of the manufacturers (F1) presents an index of 89.8.

The variation from one lot to another of a same trademark (F3: L1, L2, L3) indicates values of 27.6, 16.2, 30.4, showing how two lots in similar conditions may vary.

This is also the case of other product (F2: L1, L2, L3), where 2 of the samples have similar values (32.8 and 30.4) and one different to the others (40.0) as shows figure 4.

The distribution of lots of different products from the three studied trademarks analyzed is summarized in Table I. The behavior, in terms of the index of displacement, of two of the three manufacturers (F1 and F3) is similar (36.8 and 33.0) whereas the other trademark (F3) presents a higher value (89.2).

The third manufacturer presents a similar behavior in two lots in (P1, L1 and L2) with values of 57.0 and 58.8, whereas the third lot (L3) shows a decrease (50.6). The index of one trademark (F3, P2, L1, L2, L3) lies within a similar range (27.6, 33.0 and 29.4).

Two trademarks (F1 and F3) have similar index (36.8 and 33.0, respectively) as can be observed in figure 4.

The distribution of lots of the different products from the three studied manufacturers is summarized in Table II.

According to the chromatic values in figure 5, the behavior varied from one manufacturer to the other, from one product to the other and from one lot to another.

For the third manufacturer, two of the three lots (L2 and L3) are similar in terms of the parameter l and the other product (L1) is slightly superior to the previous lots (Figure 5a). Figure 5b shows the variation of color of one trademark, in terms of the deviation of the chromatic point a for the three lots (L1, L2 and L3), showing similar values.

The lots of manufacturers F1 and F2 presented variations of the chromatic point b from product to product, as observed in figure 5c.

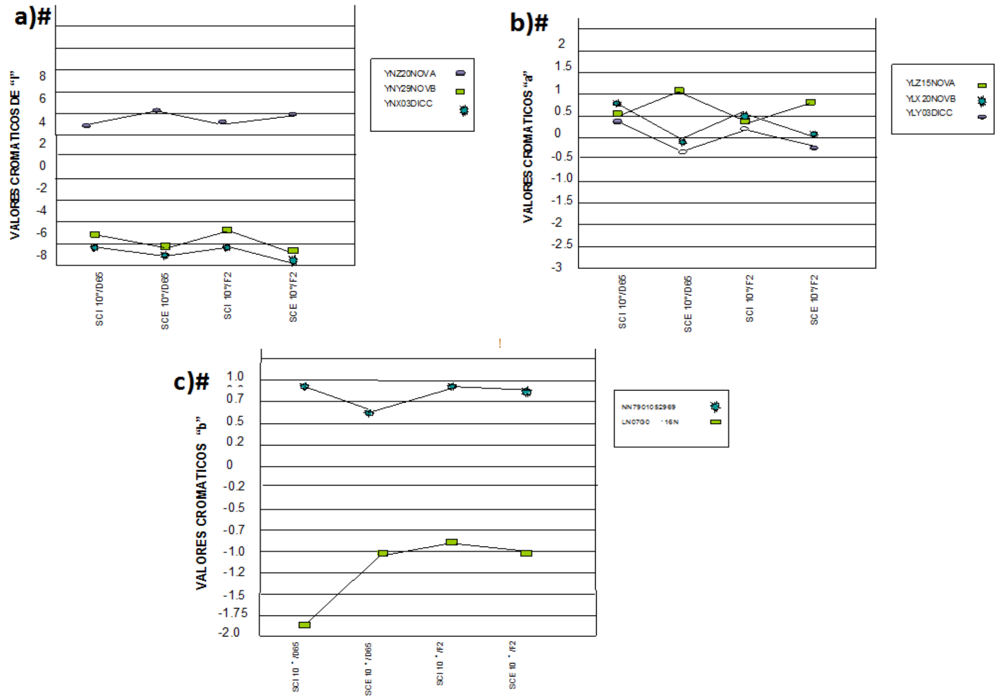

Fig. 5.a) "l" chromatic values for 3 batches of product. b) "a" chromatic values for 3 batches of product. c) "b" chromatic values for 2 batches of product.

Conclusion:

The results obtained in this work, lead to the following conclusions:

The sliding index presented significant variations among manufacturers, among products and even with different lots in a given trademark, as was verified by the wedge and cone methods, which were constant to each other.

The variations of color, practically imperceptible at sight, also showed important differences among lots and from one trademark to the other.

The index of sliding for products has been validated in such important industries as pharmacy and veterinary, and its use in yogurt-based products could add a simple, yet very indicative way to assess quality control.

In addition to the results shown here, the use of chromatic characterization could also be employed to study degradation of yogurt products, for it is known that many pigments used in this industry change color with time, due to degradation, chemical instability or the effect of light.

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