

EVALUATION OF THE EFFECT OF RED CHILI ADDITION TO FOOD PRODUCTS ON THEIR SHELF-LIFE

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Food products containing fats can deteriorate during shelf-life because of oxidation reactions involving oxygen consumption. The instrument OXITEST based on a measure of accelerating oxidation process using high temperatures and pre-determined oxygen pressure, offers a reliable evaluation of the oxidative damage of a food product. The determination of the antioxidant capacity of spices such as red chili in foods could be of great importance for researchers and those involved in the agrofood industry.

In particular, in this work, the effect of the addition of red chili to extra-virgin olive oil has been tested. The powders of red chili belonging to three different cultivars, and characterized by different levels of piquancy, has been added to extra-virgin olive oil samples. The determination of the oxidative stability has been carried out by OXITEST during shelf-life at room temperature. The chili pepper powders have also been submitted to FRAP test in order to monitor the antioxidant effect of the red chili employed.

The results obtained showed that the addition of chili pepper prolonged the stability of all samples compared to that of extra-virgin olive oil alone. The FRAP value showed a good correlation with data registered, and was found not being dependent on the pepper piquancy.



Experimental

Determination of piquancy

Determination of oxidative stability

Three cultivars of chili peppers (*Capsicum annuum*) were selected for this study and obtained from Azienda Agraria Stuard (Parma). Samples of extra virgin oil were purchased from supermarket. After drying (48 h, 60°C) and grinding process, the determination of piquancy of each cultivar was carried out and 1,5 g of powder in 150 mL of oil were added and stored for 3 months (T1= 1 month; T2= 2 months, T3= 3 months).

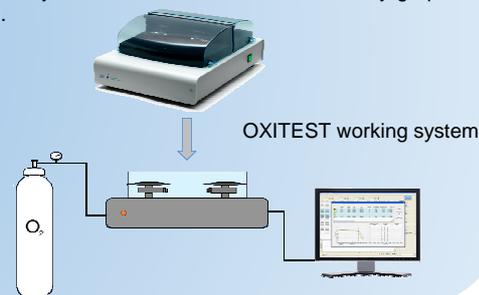


The antioxidant power was measured with FRAP assay according to Benzie & Strain [1].

Sample preparation: After drying process, capsaicinoids extract was prepared from 0.5 g of each grounded chili pepper variety in acetone (20 mL) for 30 min (twice) at 50°C. The obtained solution was centrifugated and the supernatant evaporated under nitrogen stream. The extract was resuspended in HPLC mobile phase and filtrated. The total value of piquancy was expressed as Scoville Units (US): the amount of each capsaicinoid, expressed as µg/g, was multiplied by the following respective coefficient: 16.1 for capsaicin and dihydrocapsaicin, 9.3 for nordihydrocapsaicin, 8.6 for homocapsaicin.

Analytical conditions: LC separation was performed on a column Poroshell Agilent 120 SB-C18 (3.0 x 50 mm, 2.7 µm), 30 °C. The elution of the capsaicinoids was conducted under isocratic conditions with ACN/H₂O 45:55; detection by UV-DAD at 280 nm (Agilent Technologies) [2].

OXITEST is based on a measure of accelerating oxidation process using high temperatures and pre-determined oxygen pressure (T 90 °C, oxygen pressure 6 bar). It has two titanium reactors able to perform the analysis in duplicate. OXITEST response is the Induction Period (IP) expressed as a "stability time" before fat oxidation; it is automatically calculated from oxidation curves by graphical method.



Results

In Table 1 the piquancy (expressed as Scoville Units) of the three chili peppers is reported. According to the different Scoville unit values they were classified as sweet (1), medium (2) and hot (3).

| Sample | Description | Scoville Units |
|--------|----------------|----------------|
| Sweet | Red pepper (1) | 300 |
| Medium | Red pepper (2) | 8600 |
| Hot | Red pepper (3) | 16000 |

Table 1. Piquancy values (Scoville Units) obtained for the three chili peppers.

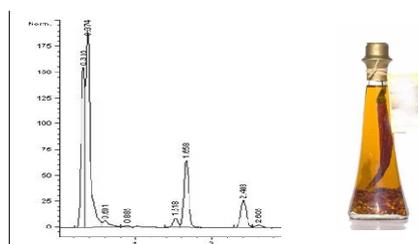


Figure 1. LC-DAD chromatogram of capsaicinoids extract for the determination of piquancy

| Sample | FRAP values (µmol/L Fe ²⁺) | IP Oxitest (minutes) |
|----------|--|----------------------|
| EVO+pep1 | 2763 | 3846 |
| EVO+pep2 | 2481 | 3542 |
| EVO+pep3 | 2269 | 3307 |

Table 2. Comparison between data obtained with FRAP assay and OXITEST.

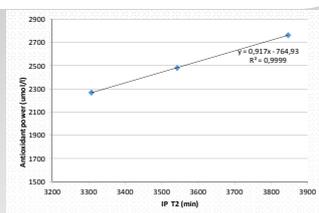


Figure 3. Correlation between results from FRAP assay and OXITEST.

As it can be seen from Figure 2, the addition of chili pepper powder in olive oil increases its stability during storage. Moreover, the antioxidant power is not related with piquancy.

In order to confirm OXITEST results, FRAP assay was performed on the powder of chili peppers (Table 2).

Figure 3 represents the excellent correlation found between the results obtained with the two methods.

More recently, the investigation has also been extended to verify the oxidation process in 'nduja sausage, a typical Calabria's sausage rich in fat and red chilly, usually made without any additives and preservatives. In this case the determination of the oxidative stability has been carried out by OXITEST, and results could be compared with those obtained with 'nduja sausage enriched with carbohydrate-based fiber as a fat replacer.

OXITEST Oxidation Test Reactor - Formulas Comparison at T2

| Reference material: | | | | | | | | | |
|---------------------|-------------------|--|------------------|-------------------|----------|----------|---------|--------------|----------------|
| ID | Date (dd/mm/yyyy) | File Name | Set point T [°C] | Set point P [bar] | IP [min] | SD [min] | RSD [%] | Delta IP [%] | Delta IP [min] |
| F1 | 1/18/13 | Procedure/Repeatability/EVO UNPREVIO T2 AGENT | 90.0 | 6.00 | 46.29 | 1.44 | 3.1 | | |
| Results: | | | | | | | | | |
| ID | Date (dd/mm/yyyy) | File Name | Set point T [°C] | Set point P [bar] | IP [min] | SD [min] | RSD [%] | Delta IP [%] | Delta IP [min] |
| F2 | 25/11/13 | Procedure/Repeatability/EVO UNPREVIO-REP1 T2 AGENT | 90.0 | 6.00 | 64.66 | 2.21 | 3.7 | 17.57 | 35.9 |
| F3 | 07/02/13 | Procedure/Repeatability/EVO UNPREVIO-REP2 T2 AGENT | 90.0 | 6.00 | 59.02 | 1.02 | 1.8 | 12.63 | 27.9 |
| F4 | 07/02/13 | Procedure/Repeatability/EVO UNPREVIO-REP3 T2 AGENT | 90.0 | 6.00 | 55.07 | 2.44 | 5.0 | 08.56 | 19.4 |

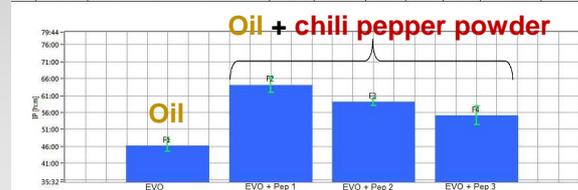


Figure 2. Formula comparison between oil and oil+chili pepper.

[1] Benzie, I.F.F., & Strain J.J. (1996). The ferric reducing ability of plasma (FRAP) as a measure of "antioxidant power": The FRAP Assay. *Analytical biochemistry*, 239, 70–76.

[2] Giuffrida D., Dugo P., Torre G., Bignardi C., Cavazza A., Corradini C., Dugo G. (2013) Characterization of 12 Capsicum varieties by evaluation of their carotenoid profile and pungency determination. *Food Chem.*, 140, 794-802.