
Oxidation Stability of Breadsticks

Reference: **EURACHEM GUIDELINES**

Tested with **VELP Scientifica OXITEST Oxidation Stability Reactor** (Code F30900248)



Introduction

Grissini, or Traditional Italian Bread Sticks, originated in Turin in Piedmont, are crunchy bread substitutes nowadays served in restaurants and cafes all over the world.

In general a food product's shelf life is influenced by several factors related to its nutritional formula and features, packaging or storage environment. Nevertheless, mostly in fatty foods, in the definition of the shelf life, it is important to discriminate their resistance against oxidation during storage, since the lipid auto-oxidation causes the development of compounds responsible for the loss of sensorial quality of foods.

Oxidation Stability in Food

One of the most important quality alteration of food is due to oxygen absorption by the unsaturated fatty acids, free or esterified. The auto-oxidation of fats is a chemical reaction promoted by oxygen, light, high temperatures, metal traces and, sometimes, enzymes.

OXITEST can determine the oxidation stability of various sample types, without the need for preliminary fat separation.

OXITEST Principle

OXITEST speeds up the oxidation process because of the two accelerating factors, temperature and oxygen pressure, according to the most common applications.

The instrument measures the absolute pressure change inside the two chambers, monitoring the oxygen uptake by reactive components in the sample and automatically generates an IP value.

IP Definition: IP stands for Induction Period and it is the time required to reach the starting point of oxidation, corresponding to either a level of detectable rancidity or a sudden change in the rate of oxidation. The longer the Induction Period, the higher the stability against oxidation over time.

Sample

Italian breadsticks

Fat labeled value: 13.3 %

Equipment and Chemicals

- Analytical balance, 3 decimals
- Grinder
- Silicone grease
- Oxygen, purity grade 5.0

Sample Preparation

Store the samples at room temperature.

Grind the breadsticks to a suitable finesse and pour 10 grams of homogeneous sample directly on the surface of the titanium sample holder, by using a spatula.

In each reaction chamber (A and B), place 3 sample holders containing the sample, grinded breadsticks, for a total of 30g.

Analysis Procedure

Grease the O-rings with silicon grease and set them in their position. Close the chambers with the titanium covers and turn the discharge valves in open position. Set the following conditions on the OXISoft™ software:

Temperatures: 80 – 90 – 100 °C

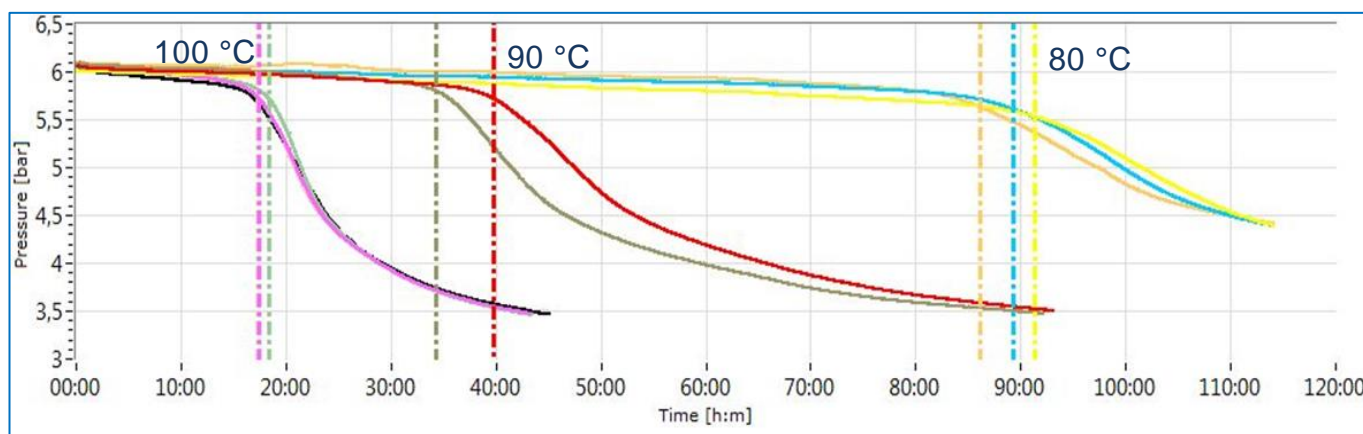
Oxygen Pressure: 6 bars

When the temperature set is reached inside the chambers, close the discharge valves and start loading oxygen.

Data acquisition is automatically started by the software.

Typical Results on Breadsticks

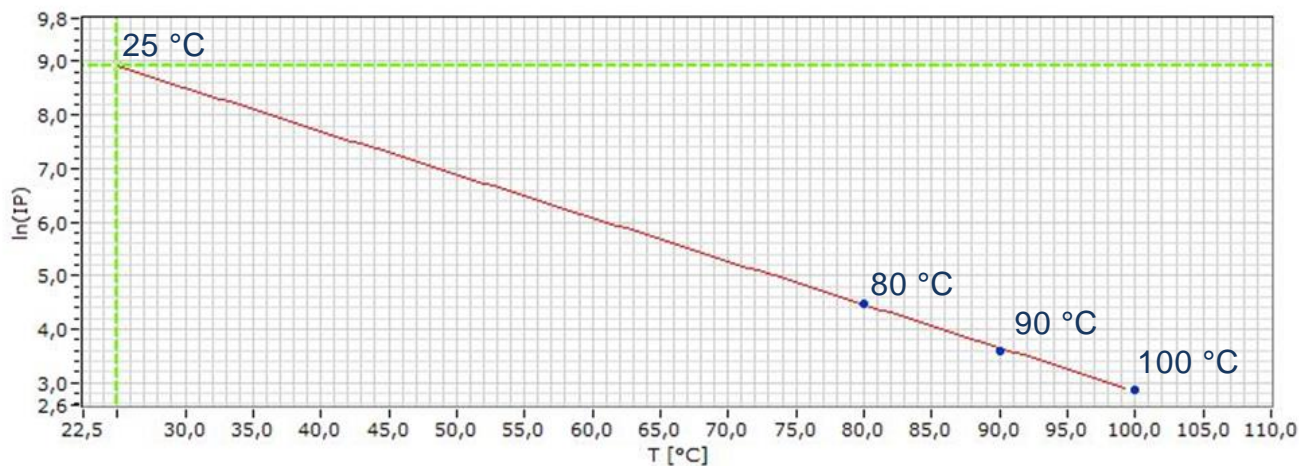
Breadsticks sample has been tested at 80, 90 and 100 °C. At the end of the oxidation tests, the IP of every run is automatically calculated by the software OXISoft™.



Estimated Shelf Life

The graph below shows the correlation between IP and temperature.

Using IP results obtained at different temperatures, in the case of a linear equation between results, it's possible to have a prediction of the shelf life of the product at the storage temperature (e.g. 25 °C), easily extrapolated by the dedicated OXISoft™ procedure "Estimated shelf life".



$$\text{Equation curve: } \ln(\text{IP}) = -0,080886 \cdot T + 10,935969$$

$$R^2 = 0,997699$$

$$\text{IP estimated at } 25,0 \text{ [}^\circ\text{C]} = \mathbf{309:17:59} \text{ [d:h:m]}$$

Conclusion

The correlation between In(IP) results obtained at different temperatures is linear ($R^2 = 0,997699$). The OXISoft™ results estimate the resistance to oxidation of the breadsticks at the storage temperature of 25 °C.

The shelf life of the breadsticks is strictly correlated to their oxidation stability and calculated by traditional techniques, it results around 1 year. The Oxitest allows the estimation of the shelf life of breadsticks in a considerably reduced time, obtaining the same result.

Benefits of OXITEST are:

- Test is made directly on the whole sample
- No need for preliminary fat separation of the sample
- Resistant titanium chamber
- Time saving analysis, if compared to the traditional methods
- Especially designed for R&D, Product Development and Quality Control labs
- Many investigations available through the software OXISoft™:
 1. Repeatability test: a series of tests run on the same sample or standard to verify its IP period, to calculate accuracy and repeatability of the data
 2. Freshness test: to verify the quality of different lots, for example of the same raw material, and compare them
 3. Formula comparison: to identify the most stable formula of a finished product, under the same conditions
 4. Packaging comparison: for testing which packaging maintains the product in the freshest condition
 5. IP during ageing: to obtain a graph of the decrease of the product IP during the shelf-life period
 6. Estimated shelf life: to have a prediction of oxidation stability during the shelf life.