# Oxidation Stability of Chia seeds flour

Reference: **International Standard Procedure AOCS Cd 12c-16**

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

## Introduction

Many studies have demonstrated that an increased intake of saturated lipids and trans-fatty acids is closely related to the incidence of cardiovascular disease, whereas the consumption of lipids rich in ω-3 fatty acids reduces the risk of this pathology. Chia (*Salvia hispanica* L.) seed is among the richest natural source of α-linolenic acid (C18:3) which nutritionally represents the most important source of ω-3. Chia is a food crop originating from central America, important in the diet of pre-Columbian civilizations and the use of Chia seeds as a novel food ingredient has been approved by the European Parliament and the European Council.

## 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

Chia seeds flour
Fat labeled value: 30 %

## Equipment and Chemicals

- Analytical balance, 3 decimals
- Grinder

- Silicone grease
- Oxygen, purity grade 5.0

## Sample Preparation

Store the samples at room temperature. Chia seeds flour is already milled and doesn't require any homogenization.
Pour 10 grams of sample directly on the surface of the titanium sample holder, by using a spatula.
In each reaction chamber (A and B), place 2 spacers and one sample holder containing the sample.

## 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 Chia seeds flour

Chia seeds flour 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[TM].

| Date [dd/mm/yy] | File Name | Set point T [°C] | Set point P [bar] | IP [h:m] | SD [h:m] | RSD [%] |
|---|---|---|---|---|---|---|
| 25/04/16 | Chia Seeds Flour 80°C | 80.0 | 6.00 | 62:55 | 0:16 | 0.4 |
| 27/04/16 | Chia Seeds Flour 90°C | 90.0 | 6.00 | 20:56 | 0:02 | 0.2 |
| 26/04/16 | Chia Seeds Flour 100°C | 100.0 | 6.00 | 7:11 | 0:29 | 6.9 |

## 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[TM] procedure "Estimated shelf life".
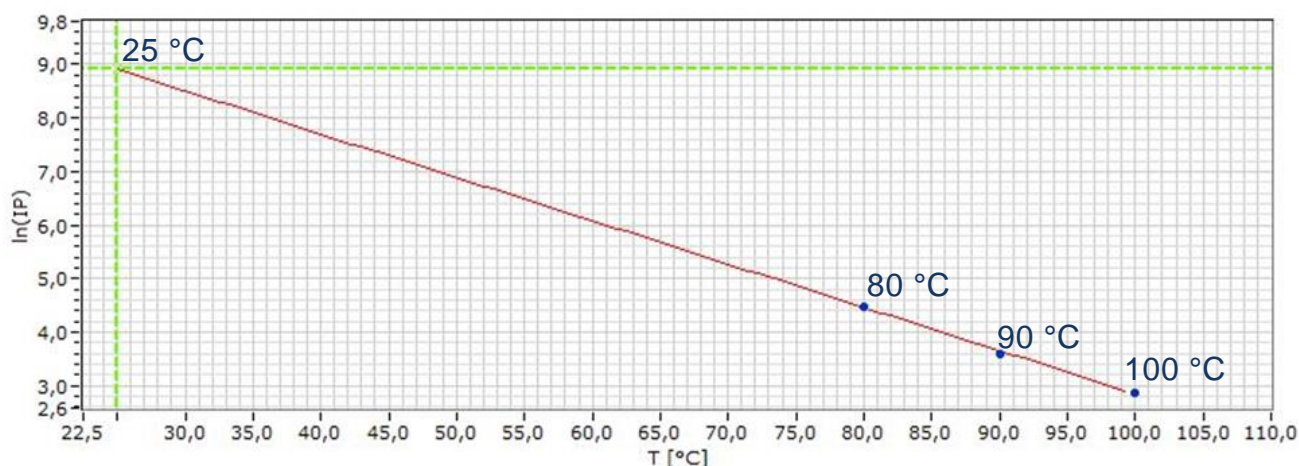


Equation curve: ln(IP)= -0,108502*T + 12,816853          $R^2$ = 0,999932

IP estimated at 25,0 [°C] = **1018:15:45** [d:h:m]

## Conclusion

The correlation between ln(IP) results obtained at different temperatures is linear ($R^2$ = 0,999932). The OXISoft[TM] results estimate the resistance to oxidation of the chia seeds flour at the storage temperature of 25 °C.
The Oxitest allows the estimation of the shelf life of chia seeds flour 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.