STABILIZERS FOR CANDLES
Overview

- Objectives
- Electromagnetic waves
- UV-Absorber and HALS
- Light / UV-test
- Thermal stability
- Antioxidants
Objectives

To protect candles from

- store light
- UV light / sunlight
- chemical reactions
  - with fragrances
  - with wax
- heat during production
What is Light?

Light is composed of electromagnetic waves with different lengths.

The shorter the wave length the higher its energy!
Electromagnetic waves

- UV - B 280 - 320 nm
- UV - A 320 – 380 nm
- purple 380 - 450 nm
- blue 450 - 490 nm
- green 490 - 560 nm
- yellow 560 - 590 nm
- orange 590 - 630 nm
- red 630 - 780 nm
- infrared 780
The energy of electromagnetic waves can destroy color, fragrance and wax molecules.
Fading of dye

<table>
<thead>
<tr>
<th>Original Color</th>
<th>Store Light</th>
<th>UV - Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 3500 0.2 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Stabilizer</td>
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</tbody>
</table>

If light breaks the bonds of dye
- color gets lighter and less saturated
- hue changes
Yellowing of fragrance

A higher dosage of stabilizer is required.
Yellowing of wax

UV light easily breaks double bonds and wax yellows.

store light
+ stabilizer
original

UV light
+ stabilizer
No stabilizer
UV absorber absorb high-energy UV radiation and transform it into heat energy.

In doing this, an atom in the absorber molecule is rearranged.

This process is known as "keto-enol tautomerism".
UV absorber

A minimum dosage of stabilizer is required to ensure an acceptable protection.

Higher doses increase UV absorption and improve results.

Stabilizer should not be incorporated into candle dyes.
Effective UV absorbers should cover the whole UV spectrum.
Stabilizers can change the shade slightly.
Optical brighteners absorb UV light and emit it as visible light, creating a radiant white appearance.
Do not use UV absorbers together with optical brighteners!
They are radical scavengers which are not used up.

Better protection from visible light than antioxidants.

Slow down chemical reactions between fragrance and dyes.

Hindered A mine Light S tabilizer
Only use suitable HALS! They may react with fragrance in an undesired way, turning candles brown.
Chemical Reactions

The right stabilizer system can slow down chemical reactions.

Chemical reactions between dye and fragrance take place during and after production.
Test equipment

UV-light test chamber
Test equipment

Lux-meter
UV-light meter
Store light test

Test conditions

- Light source: Osram L 85W/954
- Temperature 20 °C – 25 °C
- Light energy: 22,000 lux
- Time of exposure: 1 or 2 weeks

Temperature has a huge impact on intensity of visible light.
UV-stability test

Test conditions

- Light source: Osram Everson L8079R
- Light intensity (600 µW/cm²)
- Temperature 20 – 25 °C
- Time of exposure: 1 or 2 weeks
UV-tests and light tests often show different results.

A dye may fade more under store light.
Wax is heated
- during transport
- and storage before production
- in production
- when it is remelted

Fully refined paraffins have a good heat resistance. Acids do not!
Antioxidants protect wax, fragrance and dyes during production from thermal degradation.

Suitable antioxidants can increase light fastness in combination with UV absorbers.
Antioxidants

Radicals can be formed by heat and radiation of light.

Antioxidants react with radicals or peroxides to yield chemically inactive substances.
Summary

Stabilizers protect candles from
- Store Light
- UV Light
- Heat
Summary

Stabilizers slow down reactions
- with fragrances, wax and dyes
- in production due to heat
- during storage