Printable TTI Labels
for Food Products
Technical Features

OnVu™

Dr. Leonhard Feiler, Ciba Specialty Chemicals
Storage life of perishable Foods

Influencing Factors

- Atmosphere (Gases)
- Temperature
- Humidity
- Light
- Packaging
- Radiation

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Dr. Leonhard Feiler
The Chill Chain, one Example

Method used to date (thermometer)

Status: non-standardized, non-continuous controls

Producer ↓ Transport ↓ Sales ↓ Customer

TTI Innovation:
Application of the time-temperature indicator straight on the packaging

The goal: continuous temperature control through intelligent packaging

Typical food chain for fresh meat
The Time-Temperature-Problem

Shortening of shelf-life caused by too high storage temperature

Source: Vitsab
**Definition**

**Time Temperature Indicator (TTI)**

A TTI

- visualises the accumulated time and temperature history of a product
- signals the end of shelf-life as defined by the producer and acts as a “freshness“ indicator
- is no irreversible temperature indicator for a certain temperature (single temperature abuse indicator)
Colour change of the TTI

How does a TTI work

① Not activated (initial state)
② Activation with UV light (packing of the product)
③ Fading of the activated TTI in dependence of storage conditions (time and temperature)
Important Parameters of a TTI

Properties

- reproducible, accurate, reliable
- cost effective
- easy to apply
- easy to activate
- storable at room temperature
- safe for indirect food contact
- versatile in application (printable, incorporated in packaging or existing label)
behaviour of the TTI is independent of time and location
Correlation of a TTI with Ageing of Food

Dr. J. Kreyenschmidt, Bonn Univ.

Accurately reports the freshness
TTI Label: Cross Section

Production using normal printing techniques, e.g. Flexo
Photochromic Pigment as the Active Material

A Pigment is

- not soluble in the matrix
- no migration
- inherently safe
- composed of discrete particles
- the colour effect is obtained by absorption of light
- and through scattering (depending on particle size)
- strong optical effect
- better in light fastness compared to a dye
Pigment Properties in General

- Higher:
  - Tinctorial strength
- Lower:
  - Viscosity
  - Opacity
  - Photochemical stability

Migration vs. Particle Size

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Comparison Pigment versus dissolved TTI

- **Pigmentary TTI**
  - Discrete particles in the binder
  - Molecules perfectly aligned with a constant surrounding
  - Properties e.g. the bleaching reaction remain constant
  - Reliable system

- **TTI in Solution**
  - Dissolved in the binder
  - Molecules irregularly distributed
  - Neighbourhood depending on matrix, solvents, gases etc.
  - Properties can change
  - System not easily controllable
Filter System

- Application on top of the TTI after its activation by UV irradiation
- UV-absorbers prevent the deliberate re-activation of the TTI
- Other absorbers (yellow) protect from the influence of light (e.g. day light)
- Transparent, ensures the visibility of the TTI
TTI the Application Principle

Calibration

Selection of the right compound

Production, Printing of the TTI Label

Production line: Packaging

TTI-Activation, apply filter

Adhesive bonding to the package

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TTI target markets

• **First-generation TTIs (A-labels)**
  - Chilled and fresh food
  - Focus on meat, fish and dairy products
  - Currently suitable for 5-7 days storage at 5°C
  - Can be supplied as labels or printed directly onto a package

• **Additional TTI generations under development**
  - Chilled and fresh food with longer storage times
  - Focus on meat, fish and pharmaceutical applications
Conclusion

- reliable TTI due to pigmentary active material, proved to be accurate and reproducible
- safe for indirect food contact due to intrinsic low solubility of the active substance
- easy to activate and apply, system can be incorporated in existing label dispensers (UV activation, applying filter and adhesive bonding to the articles)
- can be included also in existing labels or printed directly on the package
- storable at room temperature due to in situ activation
- cost effective, no complicated machinery needed
TTI-Consortium

- Idea / Concept
- R & D
- Correlation TTI – ageing of food

Ciba
- R & D, process development
- Production of the active TTI materials and printing inks
- Development of the filter system
- Legal and patent support
- Registration
- Sales and distribution

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