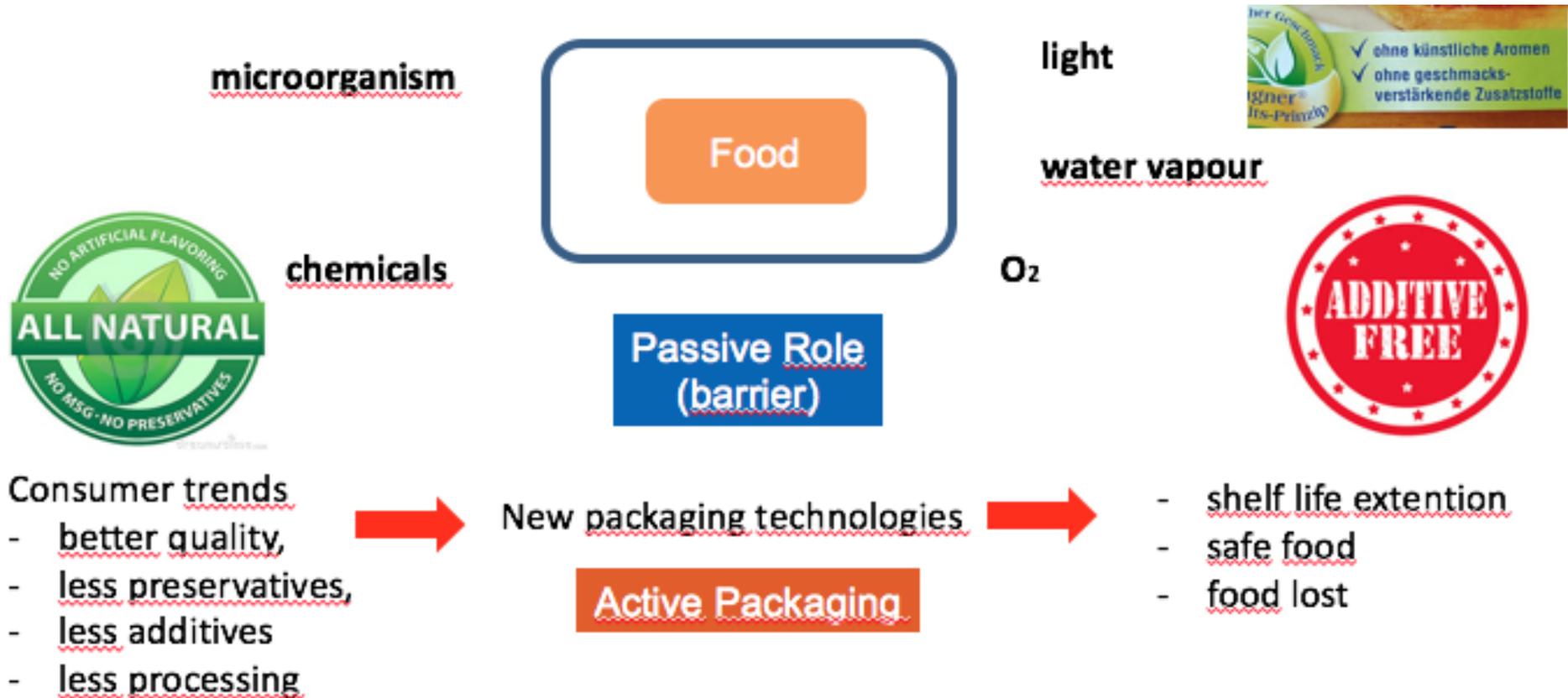


# AKTIVNA IN INTELIGENTNA PAPIRNA IN KARTONSKA EMBALAŽA

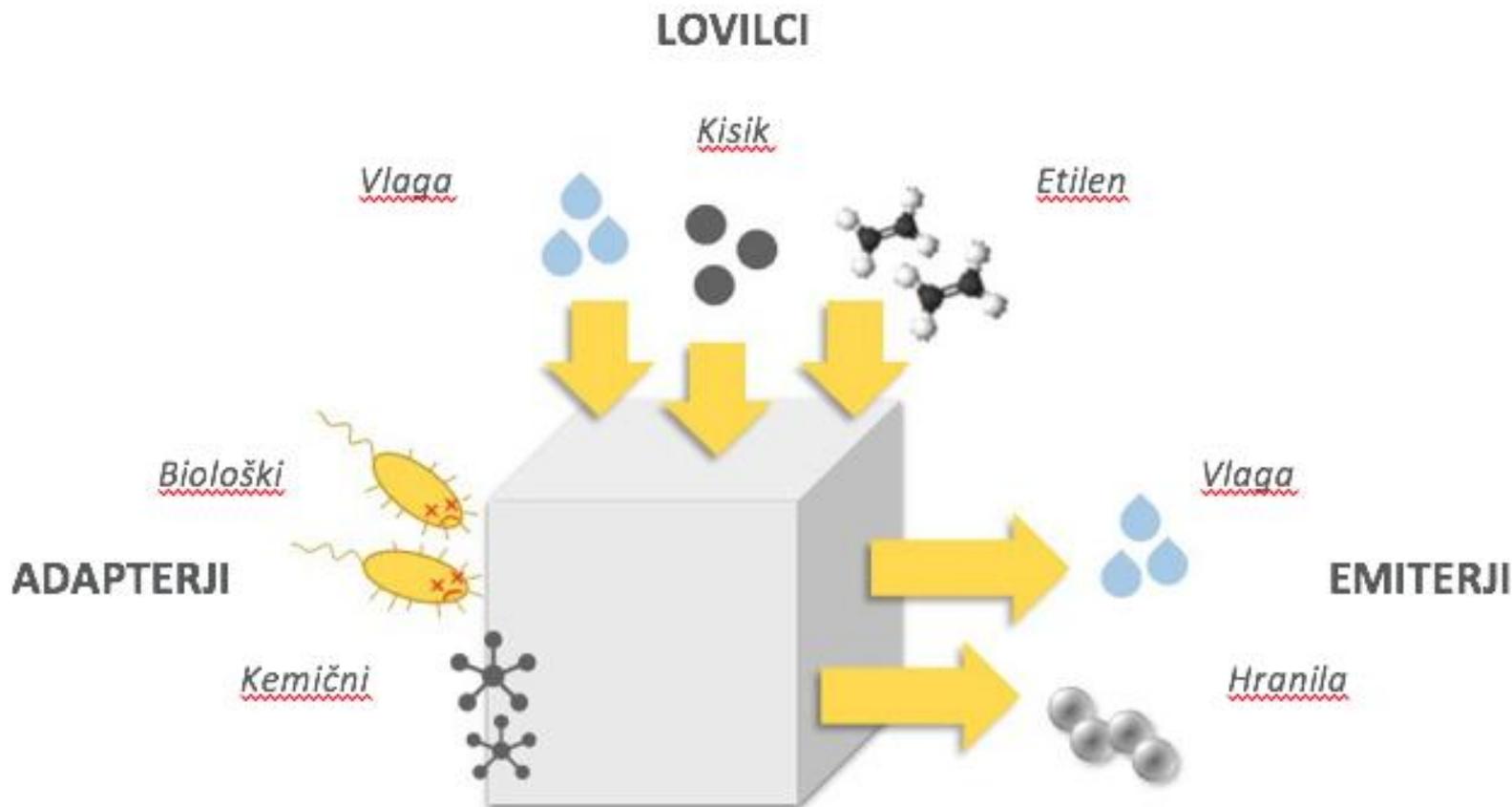
Diana Gregor Svetec, David Ravnjak  
UL, NARAVOSLOVNOTEHNIŠKA FAKULTETA  
B&B, PAPIRNICA VEVČE



<http://www.actinpak.eu/aip-explained/>



označuje material, ki je sestavljen tako, da sprošča aktivne komponente v živila ali jih absorbira iz živila z namenom podaljšati trajnost ali izboljšati pogoje pakiranja (EU odredba – 1935/2004).



Oblika?

vrečice, etikete, funkcionalni premazi, filmi in folije, sestavni del embalažnega materiala

## Sachets or other inserts

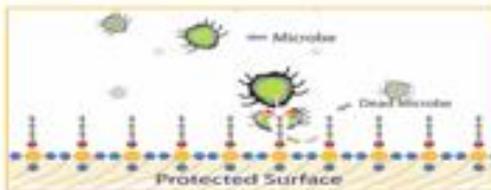


## Label



Incorporated into the packaging material

## Functional coating



## Film



# AKTIVNA EMBALAŽA – LOVILCI KISIKA

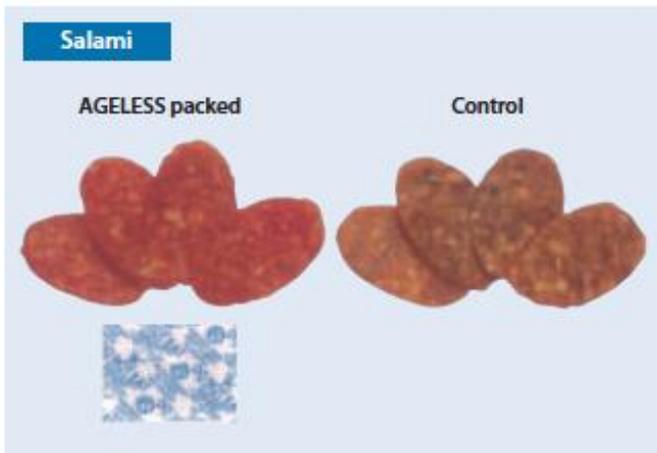
OxyGuard®  
OxyCatch®  
FreshPax®  
Bioka®  
Atco®  
Ageless®



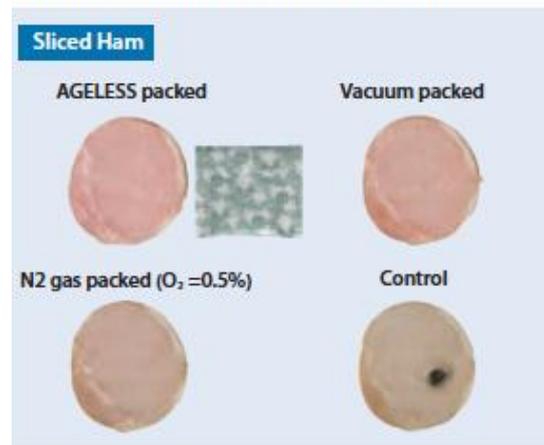
re 1. Oxygen absorber used in pizza (Ageless SS 100).



### 3. Prevention of Oxidation of Oils and Fats (20°C x 1 week)



### 4. Prevents color changes (5°C x 1 month)



### 5. Prevents color changes (-20°C x 6 months)



# AKTIVNA EMBALAŽA – LOVILCI KISIKA



Shelfplus® O<sub>2</sub>

OxyRx®



mit Absorber

ohne Absorber



AgelessOmac®

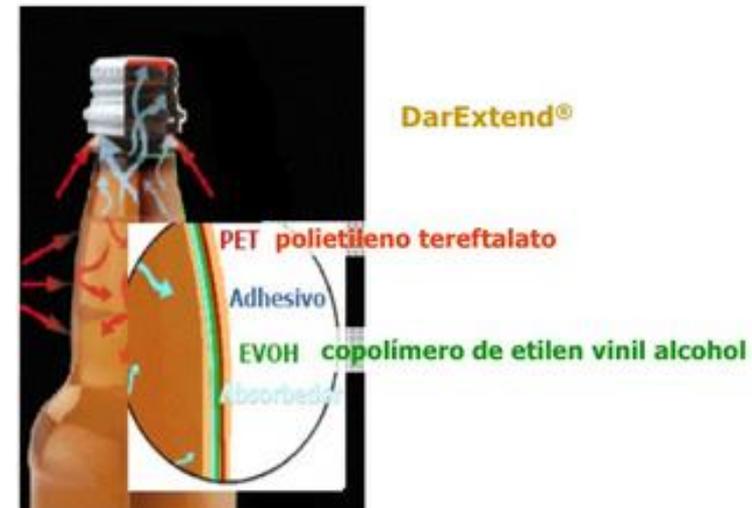
ZerO<sub>2</sub>®

Cryovac® OS

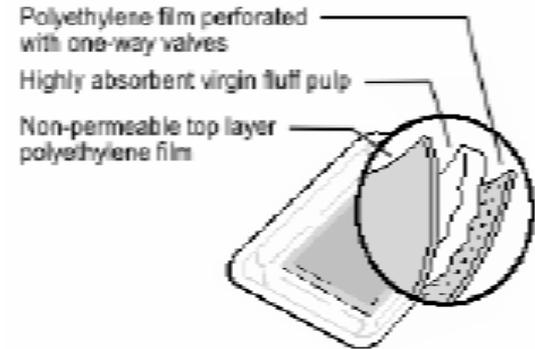


DarExtend®

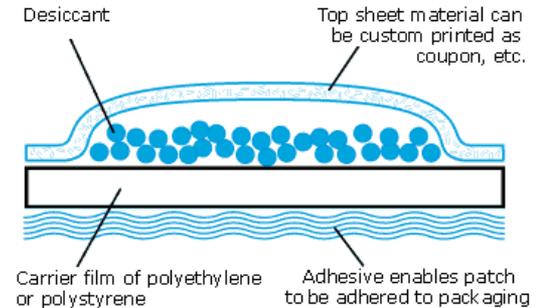
Pureseal®



MeatGuard®  
Toppan Sheet™  
Peaksorb®



DesiMax®  
NatraSorb®



Fresh-R-Pax®  
Dri-It®  
Dri-Fresh®



# AKTIVNA EMBALAŽA – LOVILCI ETILENA, AROM

## ETILEN

GreenPack®  
Ethysorb™



PeakFresh™  
Evert-Fresh®  
Orega Plastic film



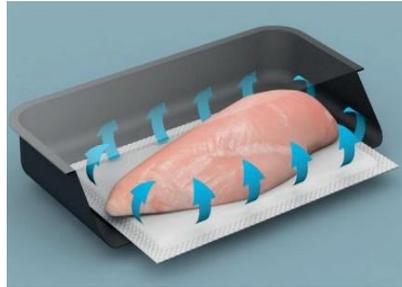
## AROME

Cryovac®  
Bynel IXP101®  
Anico®



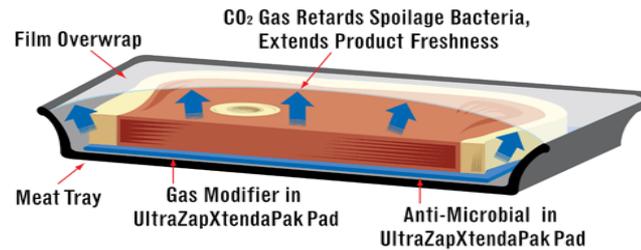
- sproščanje CO<sub>2</sub>

Verifrais®  
Cellcomb®



- absorpcija O<sub>2</sub> in sproščanje CO<sub>2</sub>

Vitalon G®  
FreshPax M®  
Ageless GE®



UltraZAP®Xtenda Pak



- absorpcija CO<sub>2</sub>

FreshLock®  
Ageless E®



# AKTIVNA EMBALAŽA – PROTIMIKROBNA ZAŠČITA



izdelava embalaže,  
premazi



sproščanje  
etanola

Bactiblock®  
Aglon®  
IonPure®  
Irgaguard®  
Surfacine®



Efficacy of ethanol releaser on mould growth on bake off buns



Obtained from Krista Bouma, Enforcement lab, Netherlands

Food Touch®  
Sanic films®  
Biomaster®



Rycoat®  
Flower transport gel



- » zagotavljanje optimalnega hranjenja živil in drugih pokvarljivih izdelkov
- » podaljšanje roka uporabnosti izdelka
- » ohranjanje kakovosti izdelkov skozi celotno verigo vrednosti
- » ohranjanje varnosti živil skozi celotno verigo vrednosti
- » zmanjšanje količine odpadnih izdelkov in odpadne embalaže skozi celotno verigo vrednosti
- » zmanjšanje logističnih stroškov zaradi ponudbe izdelkov z daljšim rokom uporabnosti in s tem manjši promet
- » naredi izdelke bolj privlačne za kupce in uporabnike

označuje materiale, ki spremljajo stanje pakiranih živil ali okolja, ki živila obdaja z namenom podati informacijo o njegovi kakovosti med transportom in skladiščenjem (EU odredba – 1935/2004).

- Nosilci informacij: sledenje izdelka v dobavni verigi
- Senzorji: hitra in kvantitativna določitev analizirane snovi v embalaži
- Indikatorji: vizualna sprememba, ki poda stanje pakiranega živila



INDOORS (WITHOUT UV/SUN)



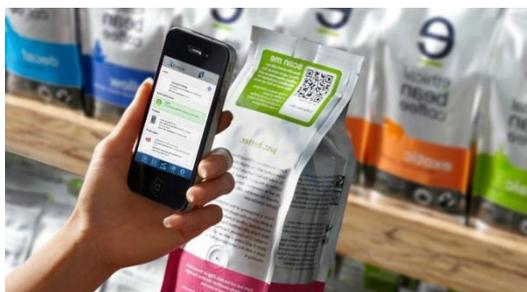
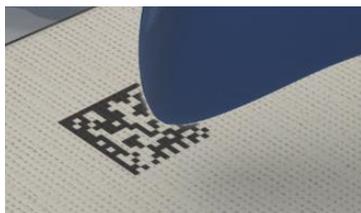
OUTDOORS (WITH UV/SUN)

- 2D kode



DATAG™

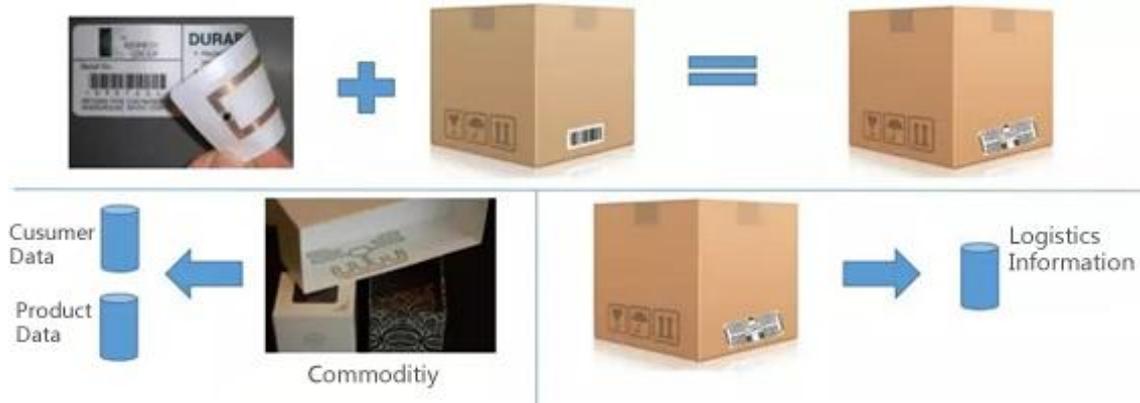
X'track™



# INTELLIGENTNA EMBALAŽA – 2D kode, RFID, NFC

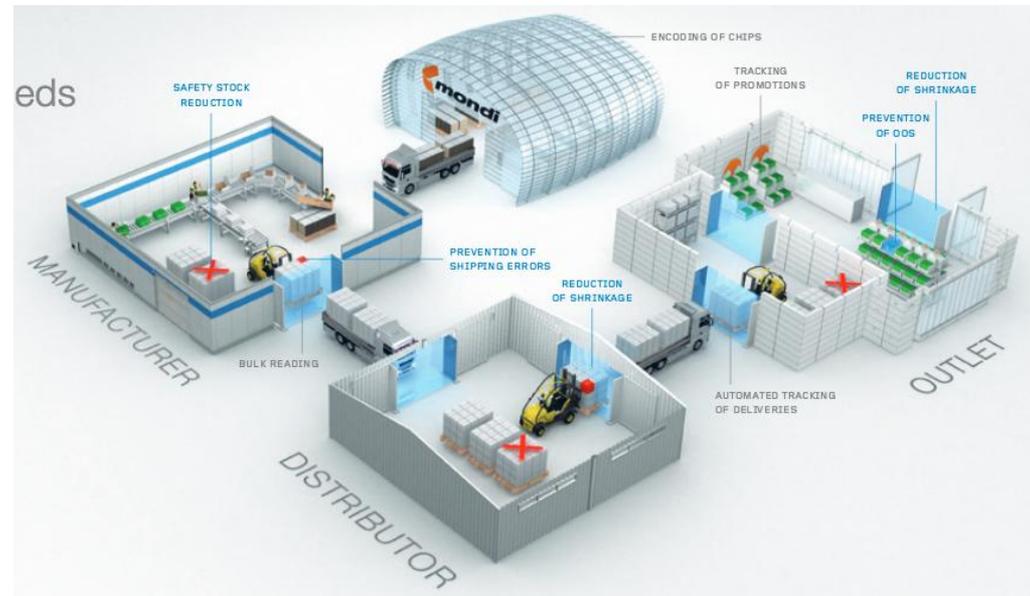


- RFID, NFC



Thinfilm® TempTrip® TurboTag®

Blulog®



- Plinski senzorji

OxySense®  
O2xyDot™

Biosenzorji

Toxin Guard™  
Food Sentinel System®

## Positioning of the O2xyDot® Sensors

### Within a Package



The **O2xyDot®** is placed in the package/container prior to filling and sealing. Afterwards, the oxygen concentration can be determined through the power of non-invasive measurements.

### Within A Pet Bottle



**SAFE PRODUCT**

Bar Code Food Safety Label  
Safe Food Handling Instructions

- Keep refrigerated or frozen.
- Wash working surfaces (including cutting boards), utensils, and hands after touching raw meat or poultry.
- Cook thoroughly.
- Keep hot foods hot. Refrigerate leftovers immediately or discard.

**FOOD SENTINEL SYSTEM:** To assure safe handling, this package is being automatically monitored for proper refrigeration and shelf life by time and temperature-sensitive barcodes. Abused product can also be visually identified by an extra wide, colored bar in the lower bar code.

Sure Pure

|           |            |             |
|-----------|------------|-------------|
| Tare      | Store No.  | Sell By     |
| Net wt/ct | Unit Price | Total Price |

**UNSAFE PRODUCT**

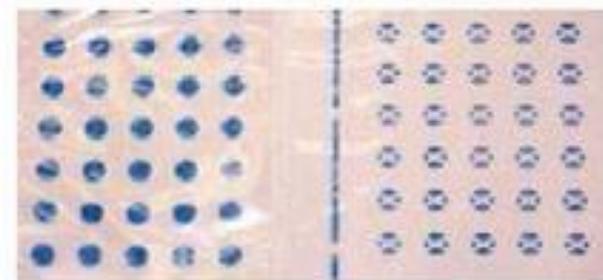
Bar Code Food Safety Label  
Safe Food Handling Instructions

- Keep refrigerated or frozen.
- Wash working surfaces (including cutting boards), utensils, and hands after touching raw meat or poultry.
- Cook thoroughly.
- Keep hot foods hot. Refrigerate leftovers immediately or discard.

**FOOD SENTINEL SYSTEM:** To assure safe handling, this package is being automatically monitored for proper refrigeration and shelf life by time and temperature-sensitive barcodes. Abused product can also be visually identified by an extra wide, colored bar in the lower bar code.

Sure Pure

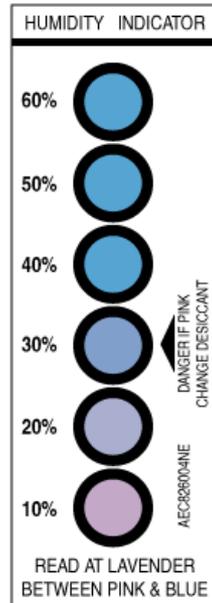
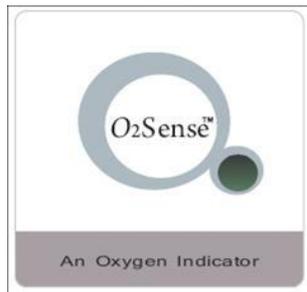
|           |            |             |
|-----------|------------|-------------|
| Tare      | Store No.  | Sell By     |
| Net wt/ct | Unit Price | Total Price |



Toxin Guard®

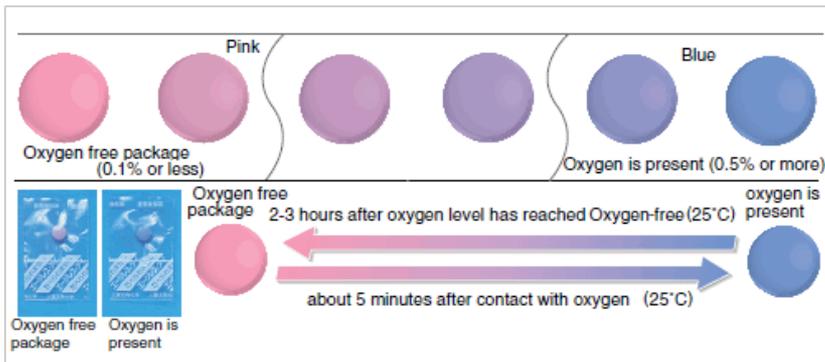
- Plinski indikatorji

Ageless-eye®  
Timestrip®  
O<sub>2</sub>Sense™



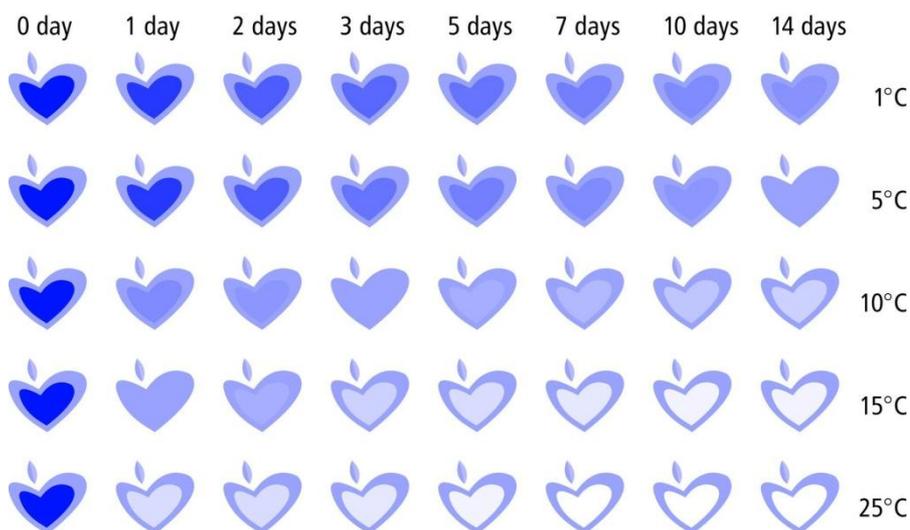
- Indikatorji svežine

FreshTags®  
SensorQ™  
RipeSense®



- Temperatura/čas indikatorji

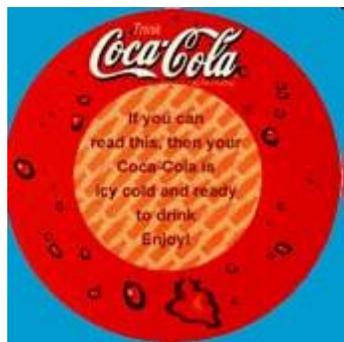
eO<sup>®</sup> in TopCyro<sup>®</sup>  
 MonitorMark<sup>™</sup>  
 CheckPoint<sup>®</sup>  
 Fresh-Check<sup>®</sup>  
 OnVu<sup>™</sup>



# INTELEKTNA EMBALAŽA – INDIKATORJI TEMPERATURE



- Temperaturni indikatorji



**THERMOCROMATIC INK COLD**  
When the beer is perfect cold, the color ink appears, is the "sign of the gods".



**Baby's Bottle**  
The best partner to the new father and mother



- Integrirani pametni sistemi

Ambient Intelligence



System Integration



Smart System



System-in-Foil



Functional Layers



Printable Ink



RFID System

Smart Package

Battery Assisted Label

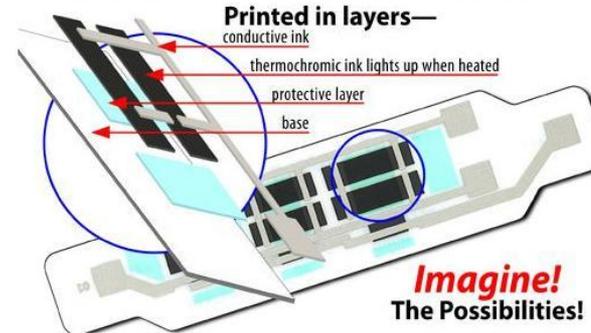
RFID Label

Printed Antenna

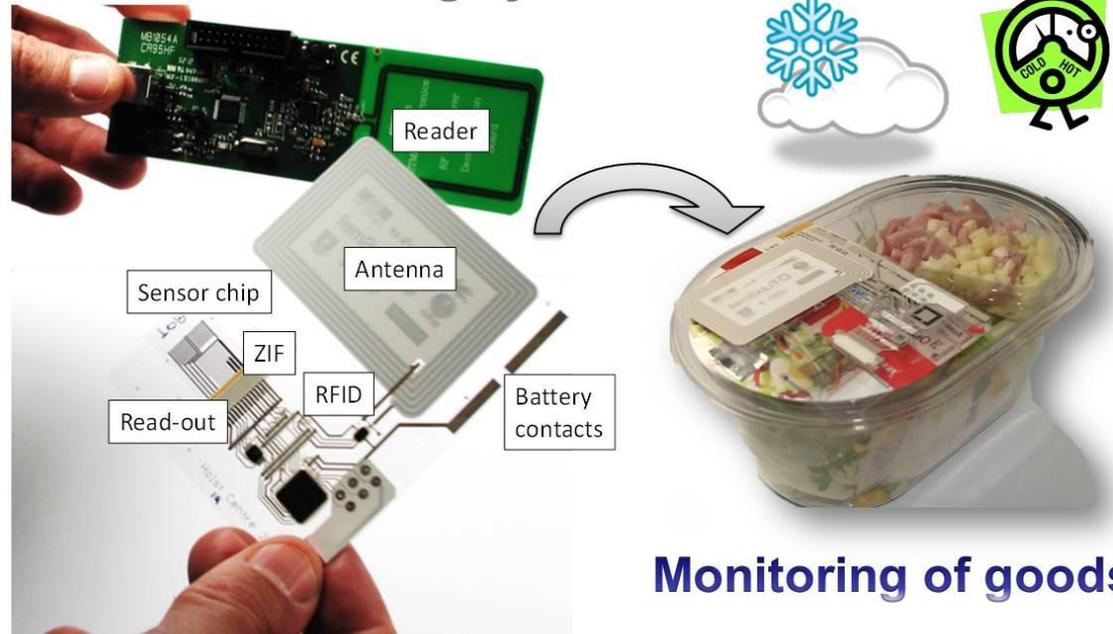
Silver Ink

CONDUCTIVE CIRCUITS WITH THERMOGRAPHIC DISPLAY

## Conductive and Thermochromic Ink



## RFID FlexSmell tag system



- » IE lahko pripomore k zmanjšanju količin zavrženih živil, povečanju varnosti živil, udobju potrošnikov in izboljša upravljanje znotraj oskrbovalne verige.
- » IE lahko pomaga zagotoviti dobro kakovost izdelka in informacije o živilskem izdelku (npr. država porekla, mesec pridelave, alergeni, sestava živila). IE lahko pokaže ali je pakirano živilo sveže ali pa je rok uporabe že potekel; pokaže lahko temperaturo živila, njegovo temperaturno zgodovino; lahko jo uporabimo za preverjanje učinkovitosti in integritete aktivnih embalažnih sistemov.
- » IE ima pomemben potencial kot marketinško orodje in za diferenciacijo blagovne znamke.

- AKTIVNA EMBALAŽA – protimikrobna zaščita

Mondi Group (Austria),

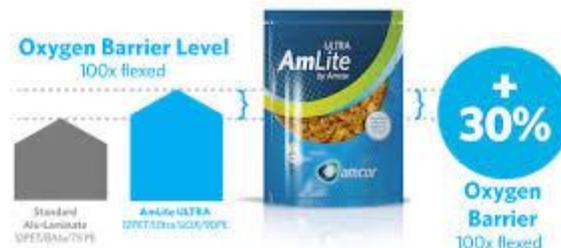
BioCote (U.K.),

LINPAC Packaging (England),

OPLON (Israel),

Amcor Ltd. (Australia)

Sealed Air (U.S.).



- Embalaža za sadje – protimikrobna zaščita  
Saeco + Polytechnic University of Cartagena (UPCT)



- Embalaža za živila – protimikrobna zaščita

Mondi

- Papir/karton / Sanocoat
- Papir / PE / Al / Sanocoat
- Karton / PET / Sanocoat
- Papir / PE / PET / Sanocoat



- Embalaža za živila – protimikrobna zaščita  
Bestack + Bologna University



- Embalaža za živila – protimikrobna zaščita  
Fenugreen



- Embalaža za živila – protimikrobna zaščita – sproščanje ClO<sub>2</sub>  
Worrell Water Technologies + Agricultural Research Service



- Inteligentna embalaža

Preston packaging

Edelmann



- Inteligentna embalaža
- The August Faller group



- Inteligentna embalaža  
Stora Enso



- Inteligentna embalaža

Insignia Technologies  
Temptime Corporation  
BASF

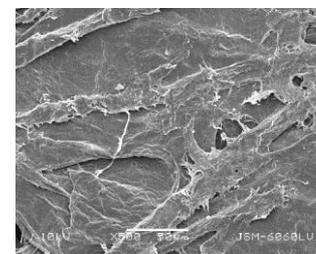




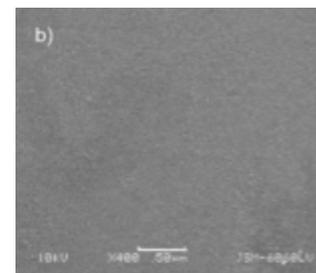
- Aktivna embalaža



Bariera za olja in maščobe:  
ocena KIT = 12; oljevpojnost  
Cobb-Unger = 0,14 g/m<sup>2</sup>

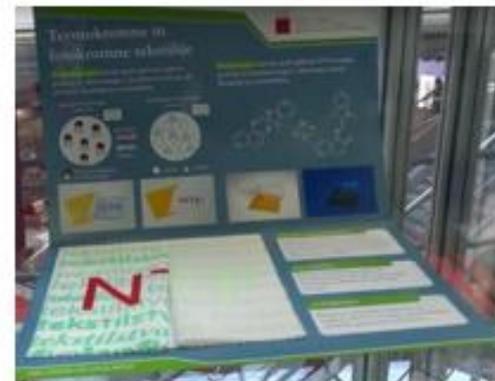


papir premazan s hitozanom



folija iz hitozana

- Tiskana elektronika



# HVALA ZA VAŠO POZORNOST!

<http://www.actinpak.eu/interviews-with-our-wg-leaders/>



Več informacij je na spletni strani COST Akcije ActInPak: [www.actinpak.eu](http://www.actinpak.eu)

[http://plastinfo.com/information/news/5404\\_06.07.2017/](http://plastinfo.com/information/news/5404_06.07.2017/)  
<https://interactive.cflex.com/for-marketeers/smart-packaging/>  
S. Yildirim: Active food packaging: current solutions. 11th International label conference 2016, Zell am See, Austria, March 2016  
S. Yildirim, B. Röcker, M. Pettersen, J. Nilsen-Nygaard, Z. Ayhan, R. Rutkaite, T. Radusin, P. Suminska, B. Marcos, V. Coma: Active packaging for food.  
COST Action ActInPak: International workshop meeting, Budapest, Hungary, September 2017  
ActInPak leaflet: Active packaging. [http://www.actinpak.eu/wp-content/uploads/2018/06/Active\\_packaging\\_English.pdf](http://www.actinpak.eu/wp-content/uploads/2018/06/Active_packaging_English.pdf)  
ATCO® Technical Information (2002) ATCO® oxygen absorbers, Standa Industrie, France.  
Innovations in Meat Packaging Technology: A Review. AMPC, North Sydney NSW, Australia, 2015  
Oxygen absorbers. MGC. <http://ageless.mgc-a.com/>  
<http://thermoformingdivision.com/barrier-breakthrough/>  
<http://www.ipl-plastics.com/zero2-barriertechnology/en/>  
Smart Packaging Technologies for Fast Moving Consumer Goods (eds. Joseph Kerry, Paul Butler), John Wiley and Sons, 2008  
<http://dri-it.com/index.html>  
<http://www.meatpads.info/en/>  
<https://www.multisorb.com/en-US>  
<https://www.albis.com/en/products/products-brands/albis/SHELFPLUS%C2%AE-O2>  
<http://www.cryovac.com/ap/en/food-packaging-products/oxygen-scavenging-active-barriers.aspx>  
<https://www.maxwellchase.com/product/absorbent-pads/>  
<http://www.sirane.com/food-packaging-products/dri-fresh.html>  
<https://dataanalysis24.com/12061/global-active-and-modified-atmospheric-packaging-market-forecast/>  
<https://www.slideshare.net/kiran553/biodegradable-active-packaging-38958606>  
<https://www.slideshare.net/AgnesciaSera1/antimicrobial-packaging>  
<https://www.timesofisrael.com/keeping-milk-fresh-for-a-month/>  
<https://www.amcor.com/product-listing/amlite-standard>  
<https://sealedair.com/food-care/food-care-products>  
<http://southeastagnet.com/2017/07/17/chlorine-dioxide-pouches-produce-safer/>  
<https://www.raconteur.net/sustainability/smart-packaging-brings-challenges-to-privacy-in-the-home>  
<http://clouiotech.blogspot.com/2018/02/rfid-smart-packaging-for-food.html>  
<https://www.cphi-online.com/smart-packaging-and-printed-electronics-prod809068.html>  
<https://preston.pl/en/our-products/smart-packaging/>  
<https://packagingeuropa.com/faller-presents-smart-packaging-prototype-%E2%80%9Ccounting-device%E2%80%9D/>  
<https://www.pharmaceuticalonline.com/doc/transtracker-temperature-indicators-0001>  
<http://iot-spain.com/?p=3504&lang=en>  
<http://freshpoint-tti.com.keam.co.il/article/time-temperature-integrators-the-current-technology-and-future-developments-.aspx>  
<http://www.oxysense.com/portable-oxygen-analyzer.html>  
<https://en.wikipedia.org/wiki/Barcode>

<http://www.sciencedirect.com/science/article/pii/S0924224415301163>  
<https://www.slideshare.net/Sudama04/biosensor-33928243>  
<http://pakbec.blogspot.si/2008/08/crise-de-la-listeria-lemballage.html>  
<http://www.telatemp.com/p/470/reversible-humidity-indicator-card-AEC826004NE>  
<http://www.mgc.co.jp/eng/products/abc/ageless/eye.html>  
<http://www.ripesense.co.nz/>  
<https://www.packworld.com/article/food/proteins/smart-label-sensor-gives-superior-results>  
<http://slideplayer.com/slide/4685866/>  
<http://www.tiptemp.com/Products/Time-Temperature-Labels/THGSEN006-Temperature-Label-Monitor-Mark-Model-9860C-50F-10C-48Hrs.html>  
<http://cerig.pagora.grenoble-inp.fr/memoire/2017/bacteria-detector-label.htm>  
<http://cmuscm.blogspot.si/2014/09/inventory-management-of-perishable-items.html>  
<http://vitsab.com/index.php/en/tti-label/>  
<https://vorbeck.com/>  
[http://soken-asia.com/en/product/OCM/verazo!\\_ht/index.html](http://soken-asia.com/en/product/OCM/verazo!_ht/index.html)  
[https://www.plasticsportal.net/wa/plasticsEU~tr\\_TR/portal/show/common/content/literature/plastics/0110/plastics\\_0110\\_focus\\_packaging\\_label\\_shows\\_freshness](https://www.plasticsportal.net/wa/plasticsEU~tr_TR/portal/show/common/content/literature/plastics/0110/plastics_0110_focus_packaging_label_shows_freshness)  
<https://www.gzs.si/Portals/Panoga-Kmetijska-Zivilska/Vsebine/dogodki-priponke/Veliki%20spomladanski%202018/Diana%20Gregor%20Svetec.pdf>  
<https://slideplayer.com/slide/1430420/>  
<http://www.peakfresh.com/>  
<https://www.evertfresh.com/>  
<https://www.actinpak.eu>