



# Energy Curable Acrylates for Indirect Food Packaging Applications

Radtech Chicago  
April 30<sup>th</sup>, 2012  
Dr. M. Heylen

**CYTEC**

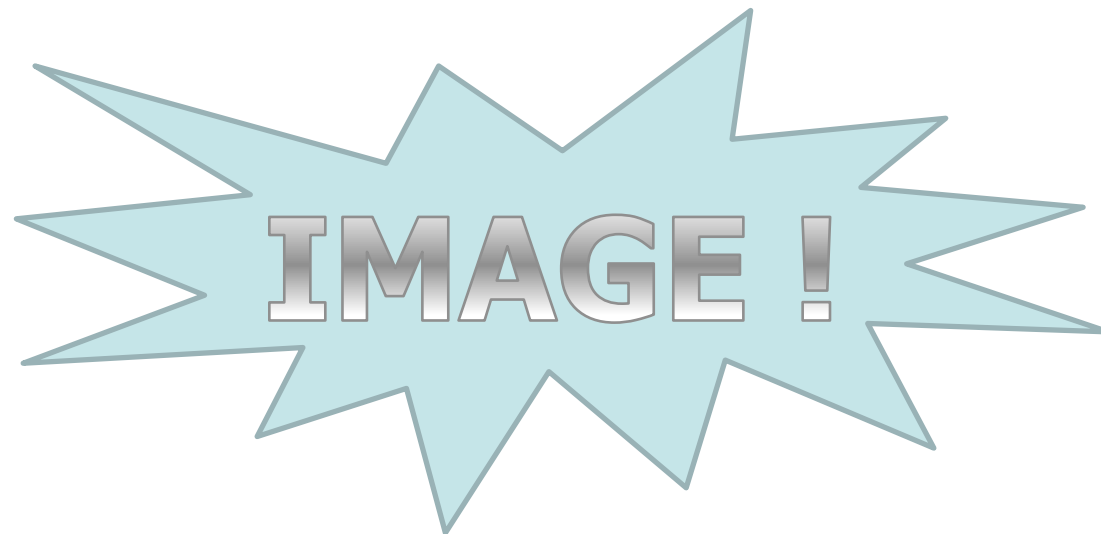
# Agenda

- Role of food packaging
- Safety of food packaging
- Overview of food contact regulations in US, European Union and Switzerland
- Cytec developments for UV/EB food packaging

protection - increase of shelf life

## Brand Recognition

Eye Catching Packaging

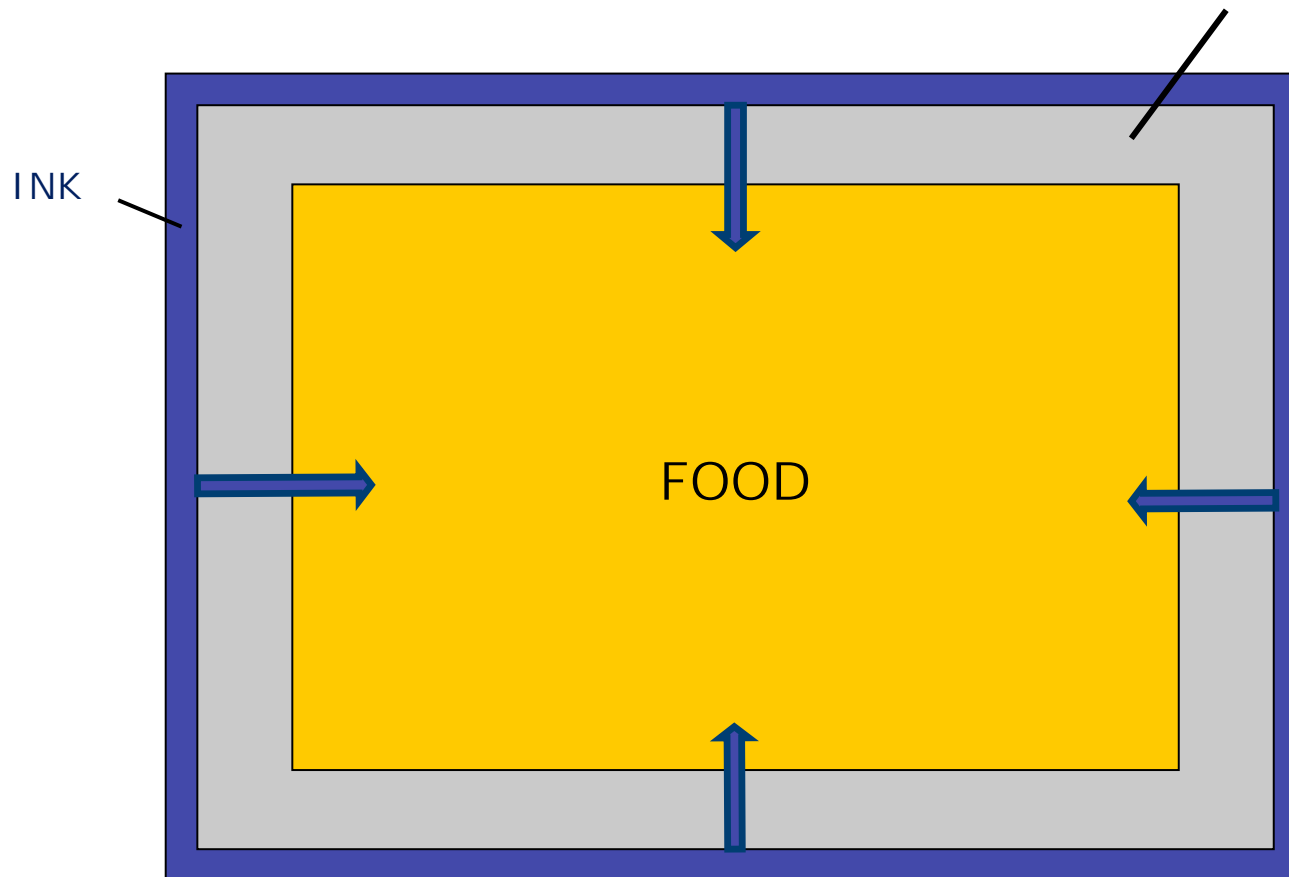


# Food packaging safety – NO CONTAMINATION of food!

NO DIRECT CONTACT with the food!

MIGRATION Case # 1:

Substrate = NO BARRIER

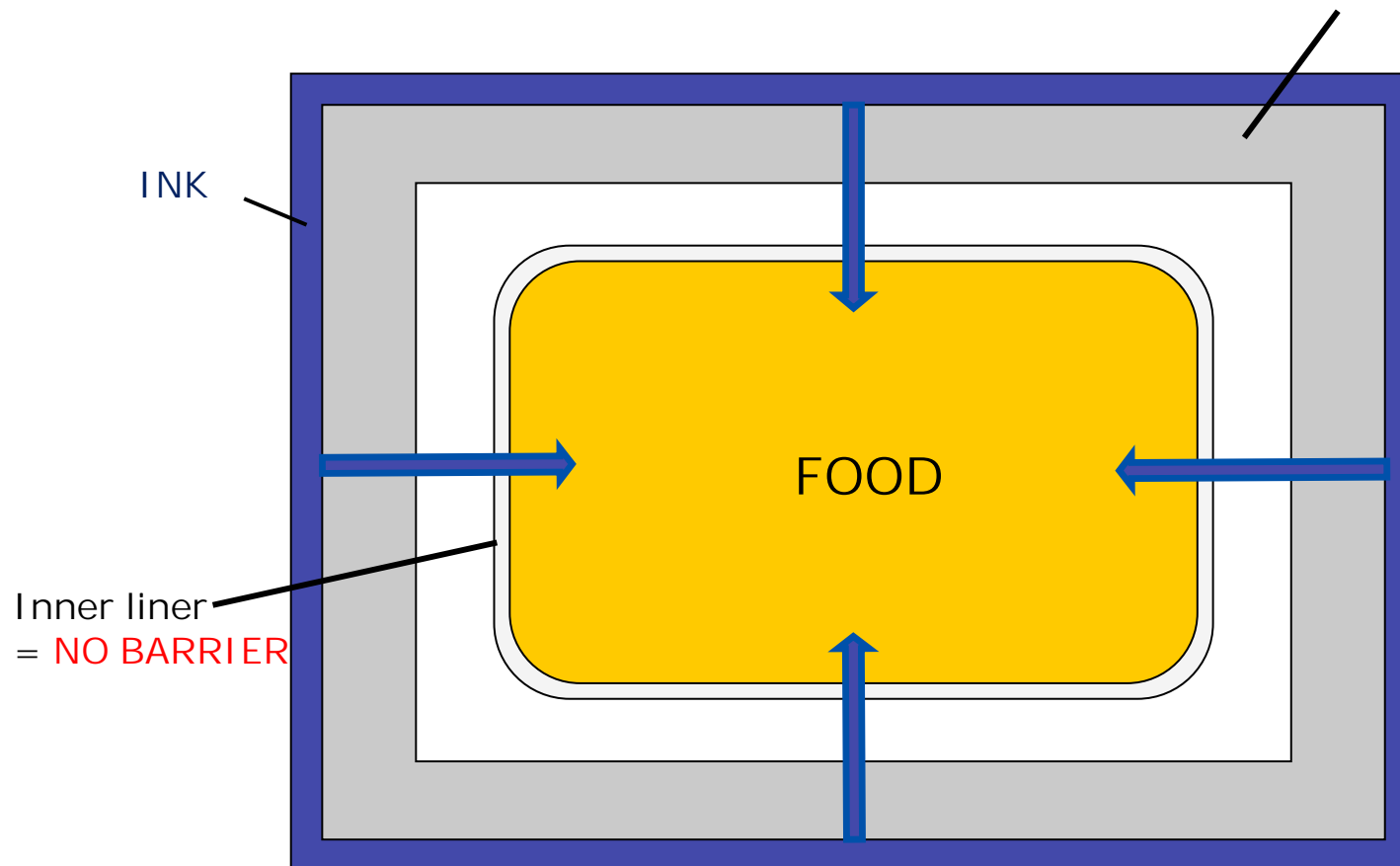


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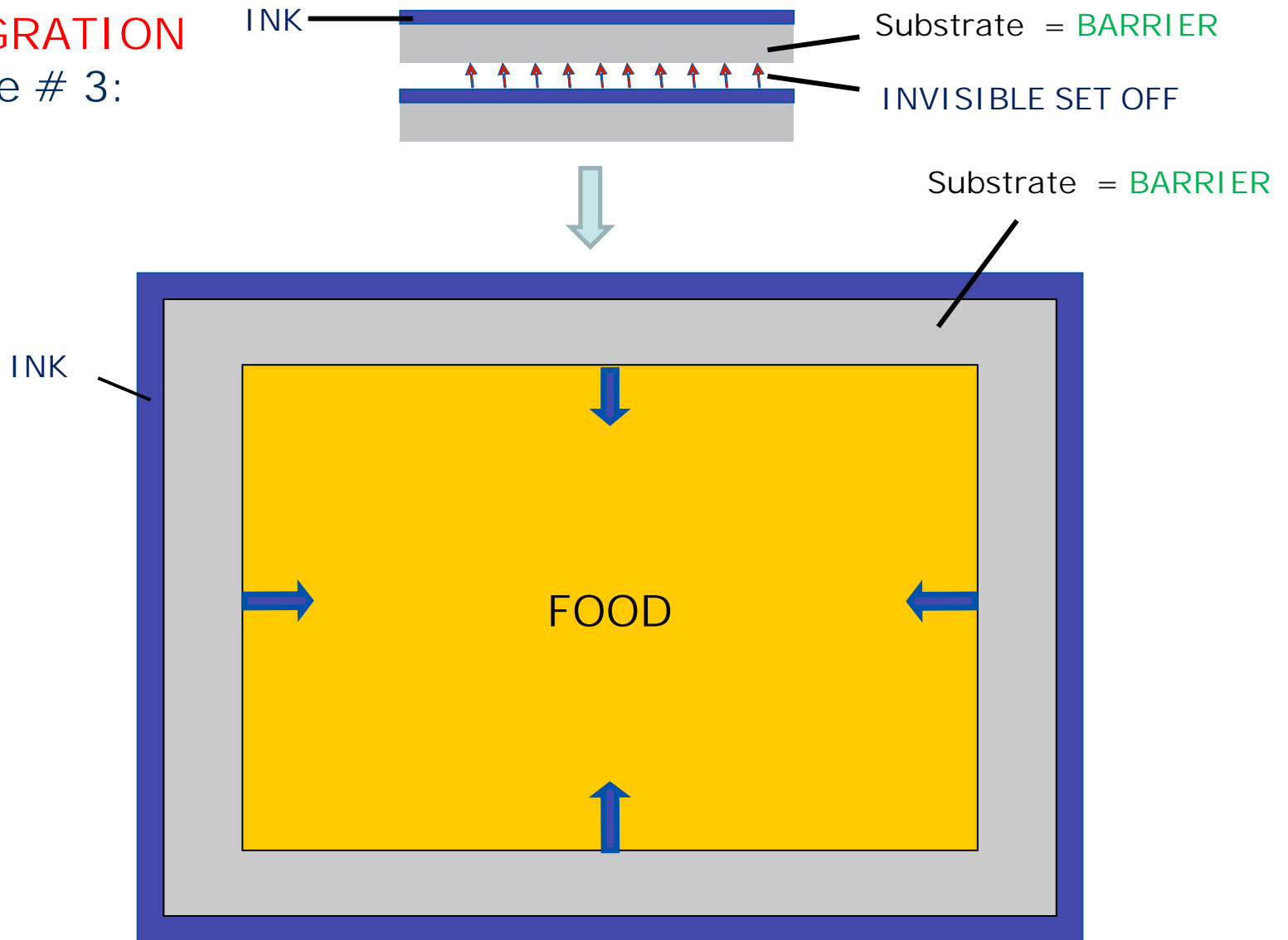
MIGRATION Case # 2:

Substrate = NO BARRIER



# Food packaging safety – NO CONTAMINATION of food!

**MIGRATION**  
Case # 3:



Food packaging safety – functional barrier principle!

BARRIER?

YES



NO



# Food packaging chain – roles/responsibilities



“LEO” Resins

LEO = Low Extractables-Low Odor



## Overview Food Contact Regulations in US

- Printing inks are subject to laws of FDA
- FDA requires that:
  - Inks are manufactured and used under GMP
  - They need to be safe and suitable for the intended use
  - Requirements for food additive are applicable
- FDA defines a food additive as:
  - Substance that is *“reasonably expected to become a component of food under the intended conditions of use”*
  - Printing inks components are generally considered to be food additives ... unless the contrary can be demonstrated
- Use of printing inks must be covered by:
  - A suitable clearance in the food additive regulation or
  - An effective Food Contact Notification (FCN) or
  - A Threshold of Regulation exemption letterUnless “no migration” is demonstrated

## Overview Food Contact Regulations in US

- **Food additive regulations**
  - No single regulation lists all components of a printing ink
  - Each component may be cleared under various regulations
- **Food Contact Notification (FCN)**
  - For substances that have been demonstrated to be safe for their intended use
  - Assessment based on the exposure (consumption factors)
  - Proprietary to the notifying company(ies)
- **FCN 772**
  - TMPTA, TMP(EO)TA, BADGEDA, TRPGDA
  - Mutagenicity & migration data
  - Migration limit of 1 ppm thanks to low consumption factor (5%)

# Overview Food Contact Regulations In European Union

- No Specific European harmonized legislation for inks but several legislative instruments which impacts materials and articles for food
- Some examples
  - Regulation EC 1935/2004:
    - Art 3: use of Good Manufacturing Practice (GMP) in order to avoid transfer into the food
    - Art 16: Declaration of Compliance (conformity)
    - Art 17: Proof of Traceability at all stages
  - Regulation EC 2023/2006: rules on GMP
  - Directive 10/2011 (Plastic Regulation)
    - Relating to plastic materials and articles intended to come in contact with food
    - Overall migration limit (OML): 60 mg/kg food
    - Specific migration limit (SML) for individual substances
    - Contains a positive list of monomers and other starting materials

## Overview Food Contact Regulations In Switzerland

- Swiss ordinance is the first specific and complete legislation on printing inks
- It became market requirement in EU and beyond
- Consists of positive lists: **A lists** and **B lists**
- **A lists** consist of **evaluated substances** (with their migration limits)
- **B lists** consist of **non-evaluated substances** which can only be used if their migration is  $< 10$  ppb

# CYTEC developments for UV/EB food packaging

## Development at different levels

RAW  
MATERIAL  
SELECTION

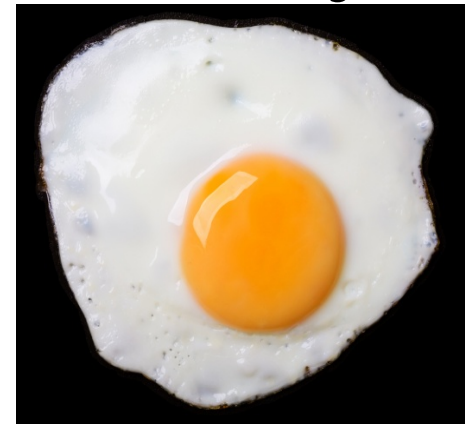


ADAPTED  
PROCESS



GMP  
GOOD  
MANUFACTURING  
PRACTICES

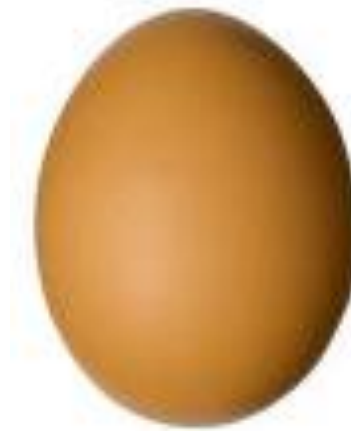
END  
PRODUCT  
SPECS  
Quality



# CYTEC developments for UV/EB food packaging

Development at different levels

RAW MATERIAL  
SELECTION



# CYTEC developments for UV/EB food packaging

## RAW MATERIAL SELECTION: What are potential migrants?



# CYTEC developments for UV/EB food packaging

## RAW MATERIAL SELECTION

Compliant with EuPIA exclusion list

Listed in the Swiss Ordinance on Food Packaging

**EFSA listed**

**NOT EFSA listed**

## WORST CASE CALCULATION

**< SML = OK**

**< 10 ppb = OK**

**> 10 ppb = NOK**

Migration test

EFSA = European Food Safety Authority

SML = Specific Migration Limit

**CYTEC**



# CYTEC developments for UV/EB food packaging

## RAW MATERIAL SELECTION: Worst Case Calculation

- Calculation:

- “Formulation” is 100% of acrylate concerned
- Y g/m<sup>2</sup> print thickness
- 6 dm<sup>2</sup> packaging in contact with 1 l food
- 100% migration:

$$\text{Migration (ppb)} = 0.06 \times Y \times \text{Component content in acrylate (ppm)}$$

$$\text{Ex: } 0.06 \times 3 \text{ g/m}^2 \times 50 \text{ ppm} = 9 \text{ ppb}$$

## CYTEC developments for UV/EB food packaging

### RAW MATERIAL SELECTION: RAW MATERIAL SUPPLIER

- Higher molecular weight
- Higher purity (specs on residuals defined)
- Additives used

# CYTEC developments for UV/EB food packaging

Development at different levels

ADAPTED  
PROCESS

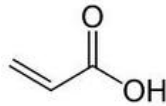


# CYTEC developments for UV/EB food packaging

## Adapted Process

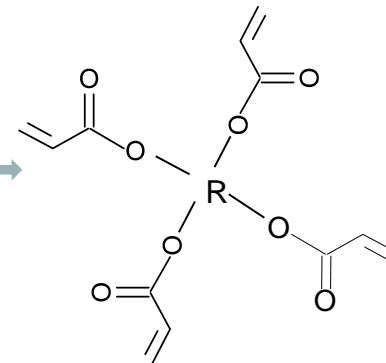
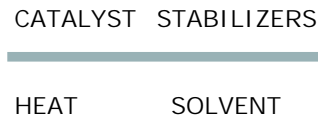
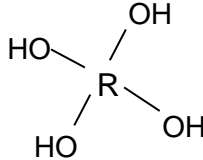
Example: Monomers (*"diluting acrylates"*) process

ACRYLIC  
ACID



+

POLYOL



4 functional  
DILUTING ACRYLATE

- Longer stripping to minimize residuals (solvent and acrylic acid)

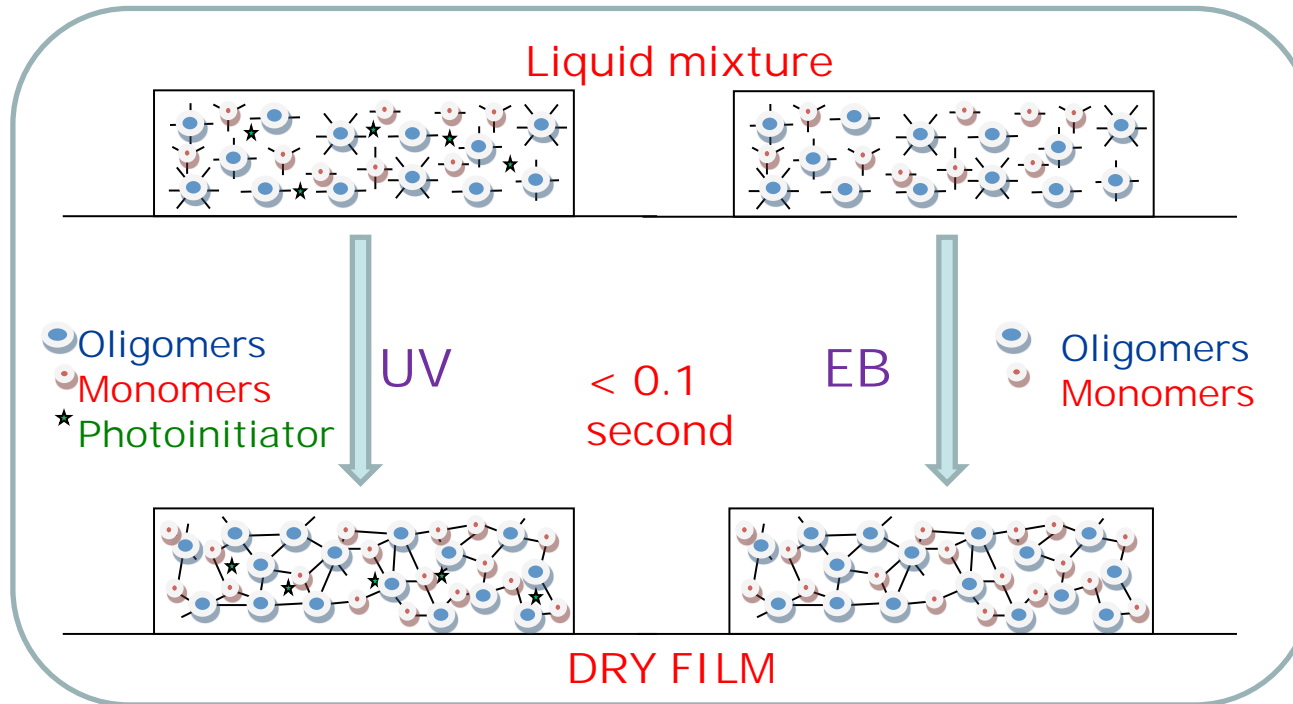
⇒ LOW ODOR

- Higher conversion degree to limit mono and di-acrylates

⇒ LOW MIGRATION

# CYTEC developments for UV/EB food packaging

Adapted process: Why limit amount of lower functional acrylates?

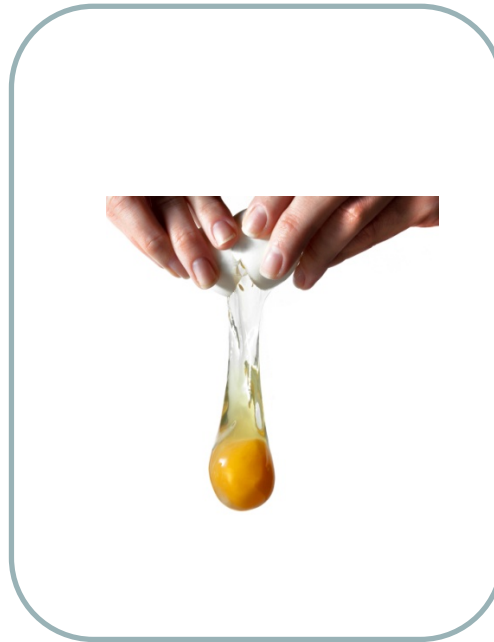


REACTION of AT LEAST 1 ACRYLATE FUNCTION:

NO MIGRATION

# CYTEC developments for UV/EB food packaging

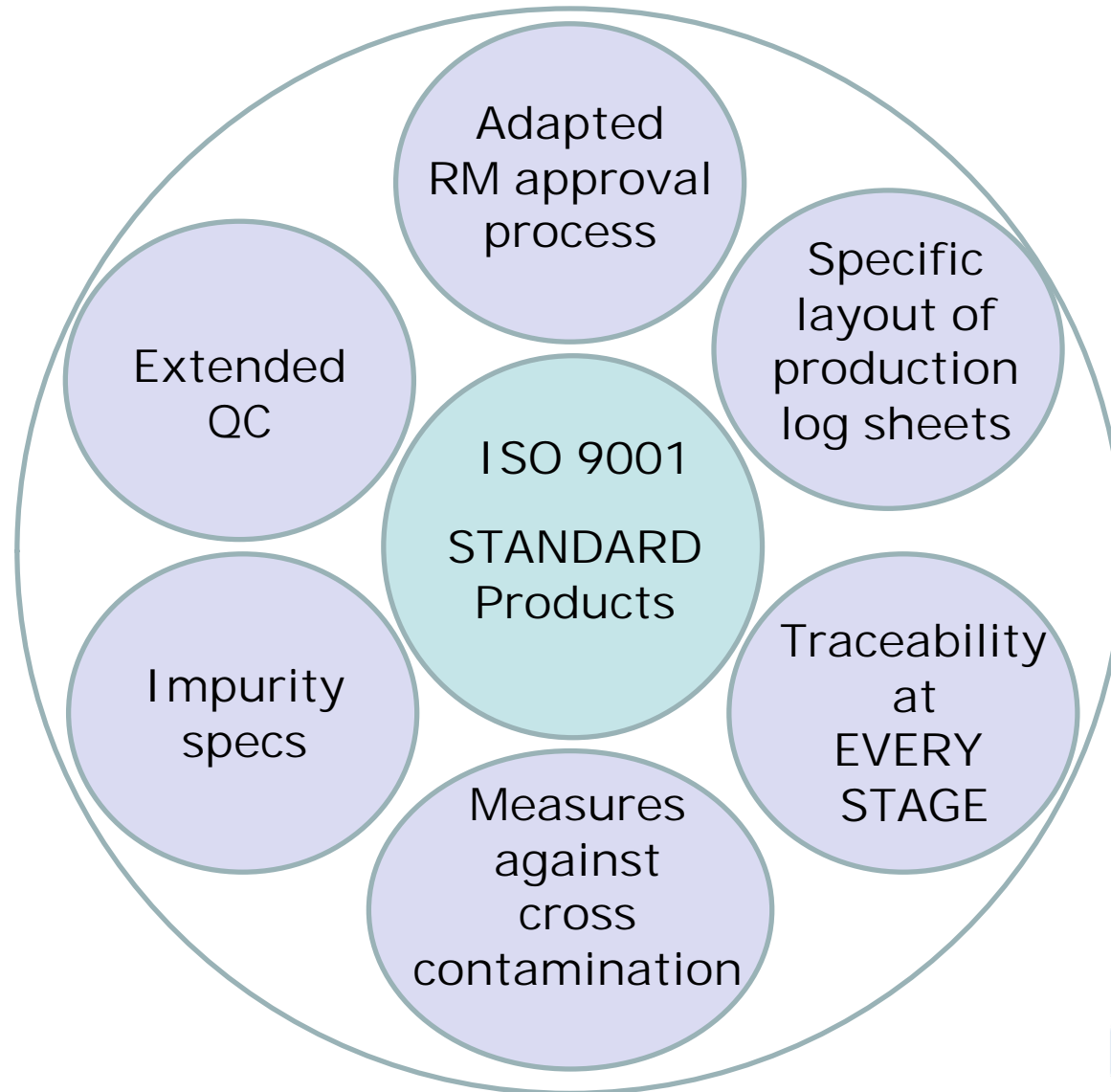
Development at different levels



GOOD MANUFACTURING PRACTICES  
(GMP)

# CYTEC developments for UV/EB food packaging

## Good Manufacturing Practices (GMP) at CYTEC:



CYTEC developments for UV/EB food packaging

## IMPORTANCE OF Good Manufacturing Practices (GMP)

CONFORMITY with QUALITY STANDARDS

Frame Work Directive 1935/2004

**CYTEC**



CYTEC developments for UV/EB food packaging

## Good Manufacturing Practices (GMP) OBLIGATION?

GMP regulation (EC 2023/2006)

1st August, 2008

Keller and Heckman LLP quote:

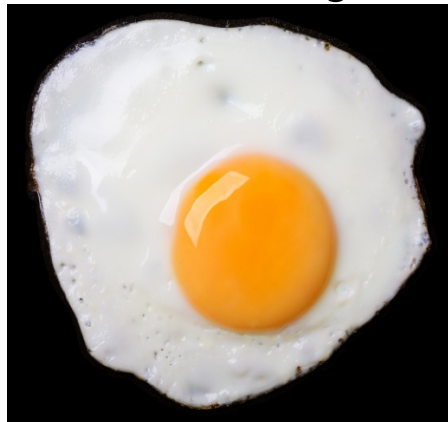
« Up to but excluding  
the production of STARTING SUBSTANCES»

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# CYTEC developments for UV/EB food packaging

## Development at different levels

END  
PRODUCT  
SPECS  
Quality



# CYTEC developments for UV/EB food packaging

## END PRODUCTS SPECIFICATIONS

Standard resins:

- Physical Properties
- Chemical Properties

“LEO” resins:

- Physical Properties
- Chemical Properties
- Residuals (process) A  
B  
C
- Impurities (RM) A  
B
- Potential contaminants (process)



# CYTEC developments for UV/EB food packaging

## END PRODUCTS SPECIFICATIONS

### Transfer of Compositional Information on "LEO" resins



- Brand Owners
- Converters
- Institutes
- ...

FULL composition  
(under NDA)

- CUSTOMERS

Declaration of Compliance (DOC)

~ worst-case calculation of the Migration

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# CYTEC developments for UV/EB food packaging

## ACTUAL PRODUCT RANGE

PRODUCT	Type	Viscosity at 25°C (mPa.s)	Offset	Flexo	OPV
EBECRYL LEO® 10501	3-functional diluting acrylate	80	✓	✓	✓
EBECRYL LEO® 10551	amine modified polyether acrylate	75		✓	✓
EBECRYL LEO® 10552	amine modified polyether acrylate	450		✓	✓
EBECRYL LEO® 10502	4-functional polyether acrylate	170	✓	✓	✓
EBECRYL LEO® 10553	amine modified 4-functional polyether acrylate	220		✓	✓
EBECRYL LEO® 10601	modified epoxy acrylate	200000	✓	✓	✓
EBECRYL LEO® 10620	standard epoxy acrylate	200000	✓	✓	✓
EBECRYL LEO® 10801	6-functional polyester acrylate	50000	✓	✓	

UV (EB) technology

DIVERSIFICATION  
INNOVATION  
in packaging design

NEGATIVE IMAGE  
due to photoinitiator migration  
issues

CYTEC: EBECRYL LEO®

REDUCED RISK  
for migration

UV/EB more ACCEPTABLE  
for Food packaging

To make UV/ EB successful in food packaging

ACCOUNTABILITY  
at EACH stage  
of the value chain  
(GMP)

IMPROVE  
INFORMATION STREAM



THANK YOU  
FOR  
YOUR  
ATTENTION!

[marc.heylen@cytec.com](mailto:marc.heylen@cytec.com)

[www.cytec.com](http://www.cytec.com)

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