

Indirect Food Packaging: New developments in UV/EB resins

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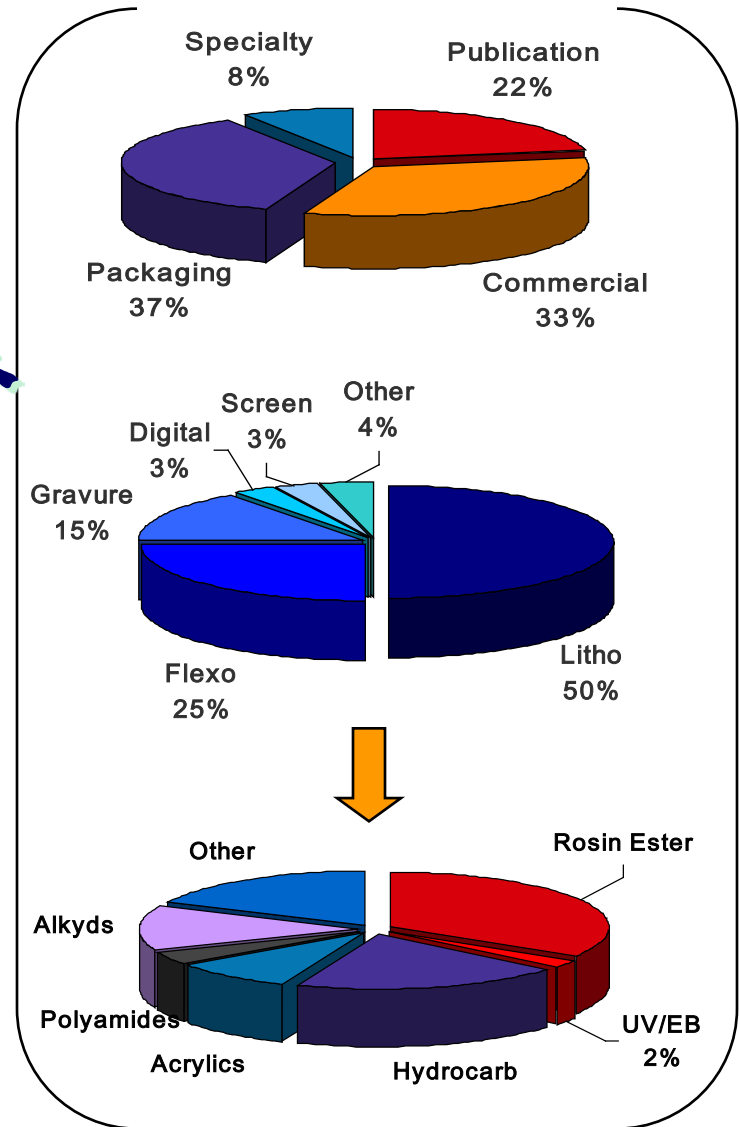
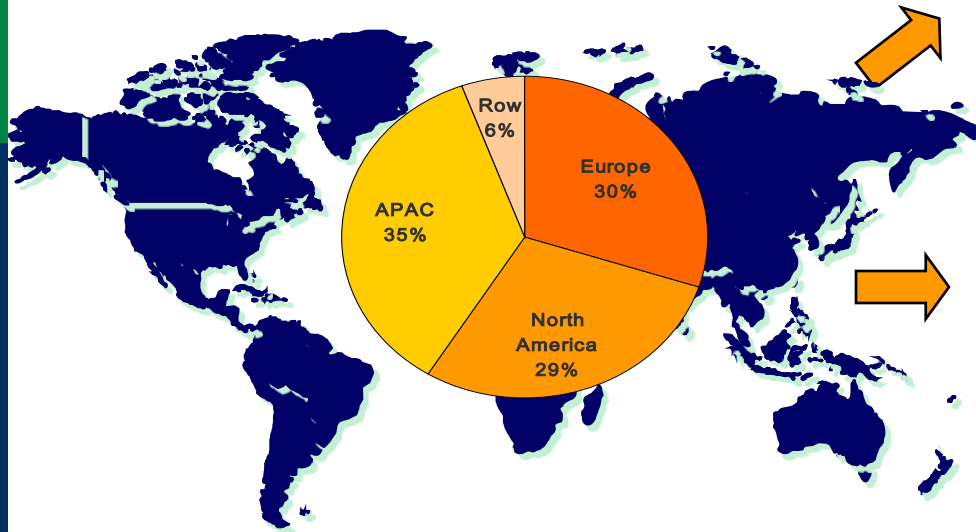
Maarssen, 9 April 2010

1. **Market Overview**
2. **European regulation for food packaging**
3. **UV/EB for printing/vanishing of food packaging**
4. **Cytec developments in UV/EB resins specifically for food packaging**
5. **Conclusion**

Global Printing Industry

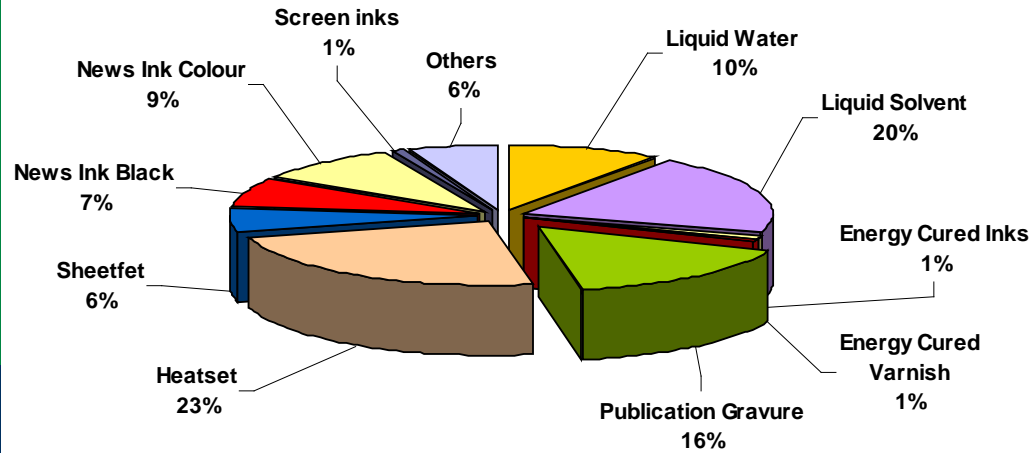
Global Ink Market :

- Est 15.9 Mrd \$
- Est 4.1 Mio T
- CAGR ~2-3%

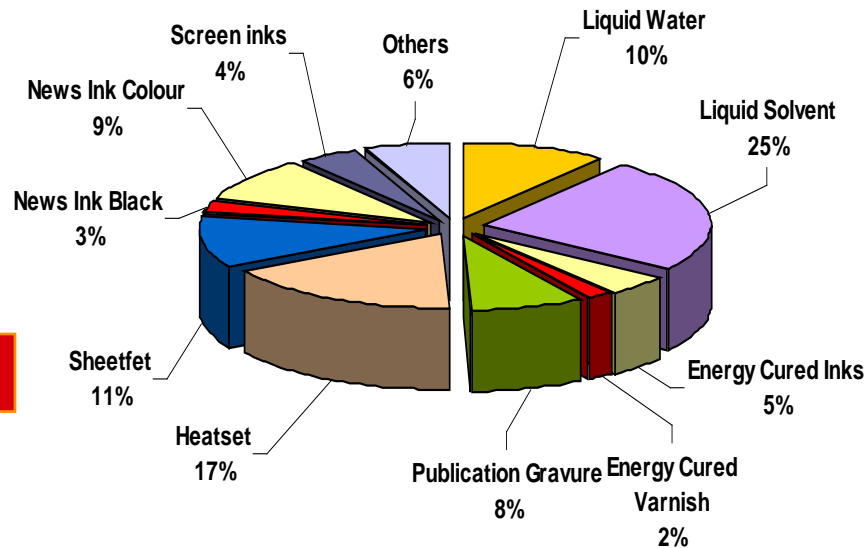


Source: Specialty Chemical Overview June 2008, Ink World, PRINTING INKS
 A GLOBAL STRATEGIC BUSINESS REPORT ©
 Global Industry Analysts 2004
 Data Monitor IT Strategies, 2006
 Cytec Marketing

Ink market Western Europe



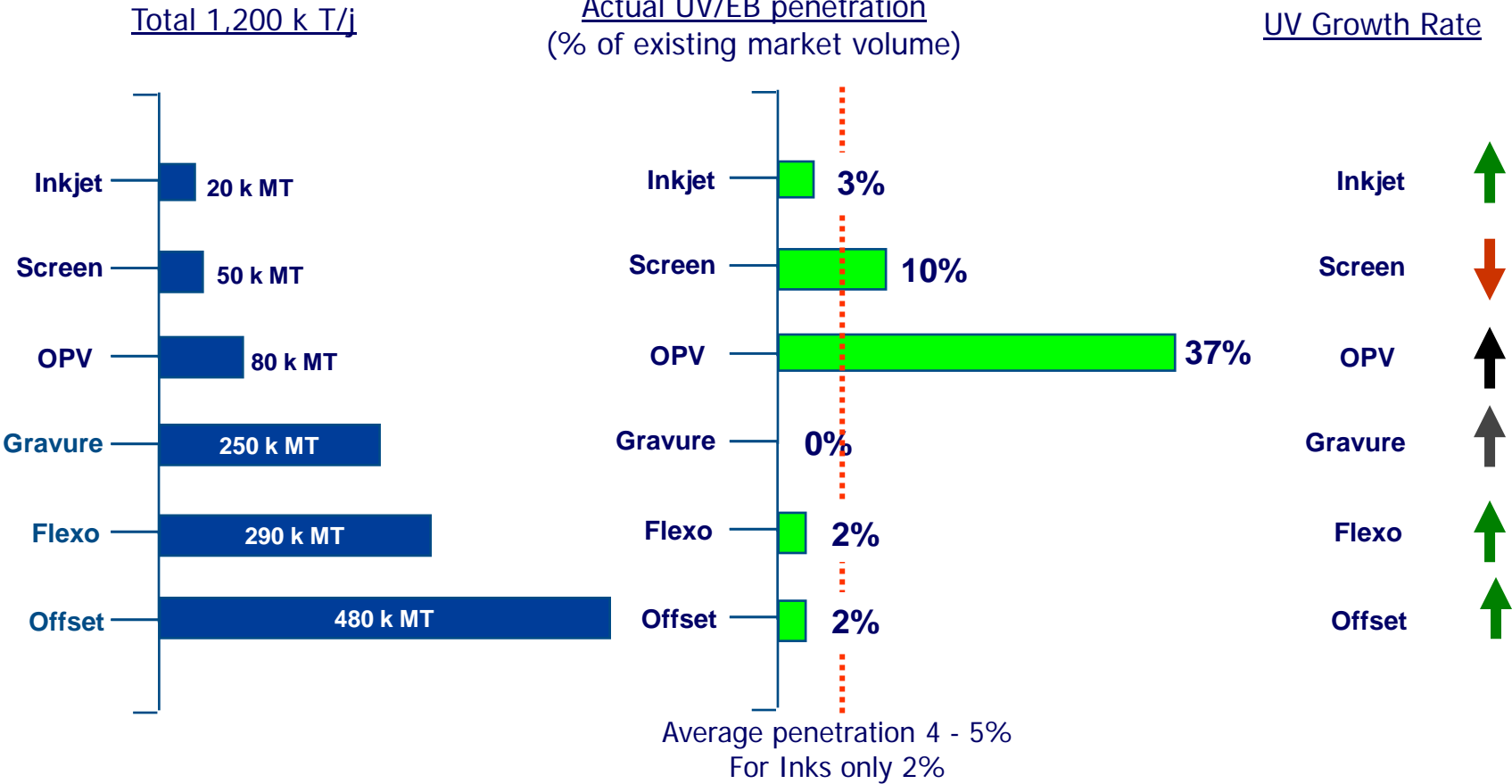
Total volume : 1.2 Mio T



Totale value: 3.76 Mrd €

Source: EuPIA

Penetration of UV/EB technology in Western Europe



Significant penetration potential for UV/EB technology in offset, flexo and inkjet

Trends in printing industry (2008-2012)

FASTER, BETTER, SHORTER

1. Increasing demand for quality

- Faster printing/turn around: reduction of total print costs
- Improved print quality: reduction of print quality of flexo vs offset
- Increased adhesion: on plastics substrates like PP, PE, PET, PA, and Aluminium in all printing methods (flexo, offset and digital)

2. Technology Transitions

- Food packaging: move from rigid (plastic, glass, metal) to more flexible materials supporting with reduction of packaging materials (sustainability)
- Flexo: continuous growth through increasing penetration in “narrow web label and flexible packaging” and emerging medium (wide) web packaging applications
- Digital: taking over more and more screen printing applications

3. Regulation

- Regulation regarding VOC (volatile organic components) stimulates research to alternative systems which can replace solvent based technologies
- Food packaging regulation: frame work directive, GMP (good manufacturing practices)

European Food Packaging Regulation

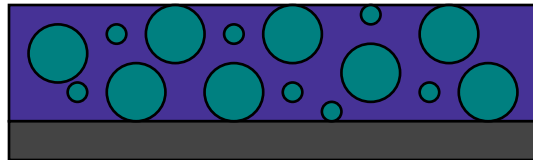
No specific and harmonized regulation for food packaging inks!

- **Framework Regulation (EC 1935/2004)**
 - Art.3: no transfer of ink components in food
 - Art.16: conformity statements
 - Art.17: traceability in all stages
- **GMP (Good Manufacturing Practice) regulation (EC 2023/2006):** (August 1, 2008)
- **Directive 2002/72/EC:** related to plastic materials and objects in contact with food
 - Overall migration limit (OML): 60 mg/kg food
 - Specific migration limit (SML) for individual substances
- **“Industry standards” (EFSA guidelines)**
 - < 10 ppb without tox data
 - < 50 ppb met 3 favorable mutagenicity test results

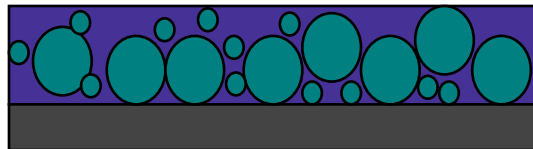
Drying versus curing

Physical drying

- Solvent evaporation
- Physical drying
- No network creation!!
- > Big and small wholes



↓ *Heat*

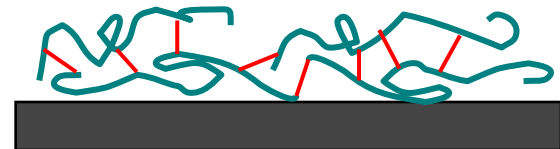


Chemical drying = creating a network

- No solvent evaporation
- Chemical polymerisation
- Cross linking leads to rigid dense network



↓ *UV Irradiation*



Why UV/EB in Food packaging?



- In-line finishing (laminating, die cutting, folding, etc...)
- Significantly higher productivity (time and costs savings)
- Just-in-time delivery
- Diversification and innovation in packaging design (high quality)
- Production of eye-catching packaging to attract customers!!
- Significantly lower process costs for small runs (trend in EU)
- Use on different substrates (paper & cardboard, foils, metal, ...)
- NO volatile components!! (VOC)
- Less space in production required (no thermal ovens, less warehousing due to no after curing)

CYTEC developments in UV/EB resins for food packaging

Standard formulation UV/EB Inks and OPV:

	Offset	Flexo	OPV
Pigment	14-24%	12-20%	-
Fillers	4-8%	-	Matting agents
Dispersion agents	0-2%	2-4%	-
Additives (wax, rheo, slip)	1-2%	1-2%	1-2%
Monomers	10-20%	50-60%	40-60%
Oligomers	50-60%	10-30%	10-20%
Photoinitiators (UV)	6-10%	6-10%	3-6%

Monomers: polyol acrylates (mono to hexa functional)

Oligomers: epoxy acrylates, polyester acrylates, urethanes acrylates....

CYTEC developments in UV/EB resins for food packaging

Portfolio of new acrylates:

- RM selection together with RM supplier
- Use of registered (evaluated) RM
- Use of RM with high purity rate
- Purity criteria for the final product
- Produced according to GMP (Good Manufacturing Practice)
(legally required since 1 august 2008)
- Migration assessed in set-off (< 10 ppb): acrylates & additives
- Toxicity evaluated
- Statements of conformity

CYTEC developments in UV/EB resins for food packaging

Commercial Product Portfolio

Name	Type	Offset	Flexo	OPV
EBECRYL LEO 10501	3-functional diluting acrylate	√	√	√
EBECRYL LEO 10551	amine modified polyether acrylate		√	√
EBECRYL LEO 10552	amine modified polyether acrylate			√
EBECRYL LEO 10502	4-functional polyether acrylate		√	√
EBECRYL LEO 10553	amine modified 4-functional polyether acrylate		√	√
EBECRYL LEO 10601	modified epoxy acrylate	√	√	√
EBECRYL LEO 10801	6-functional polyester acrylate	√	√	(√)

LEO = **L**ow **E**xtractables low **O**dor

Conclusion

- **UV/EB curing systems:**
 - Bring diversification and innovation in packaging (eye-catching,.....)
 - Perfect solution for actual market trends (JIT, shorter runs)
- New developments in acrylated resins **reduces migration risks** en makes UV/EB technology more exceptable as probably the safest technology for food packaging
- To increase successfully more use of UV/EB technology in food packaging, following important steps need to be taken
 - Everybody **in the value chain** needs to take his responsibility (eg. GMP)
 - Necessity of creation of an information flow through the whole food packaging chain
(Statements of Conformity; release of composition information under non-disclosure)