

Radcure Market Trends

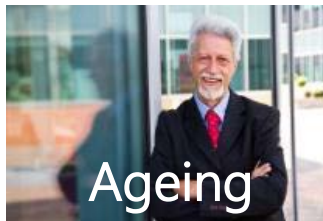
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How Radcure can address Global Trends

Mega Trends



Macro Trends

Climate change
Resource efficiency
Cost savings
Convenience
Quality
Health and safety
Emission reduction
Energy
Renewables

Radcure Trends

VOC free
Waterborne
High reactivity
Surface cure
3d Printing
Adhesion
Outdoor materials
Low Migration
Low energy LED
Bio based

VOC free / Waterborne acrylates

- Radiation curing is inherently a more sustainable solution to all solventboren alternatives but many radiation curing formulations still require solvent.
- One way to improve the sutainability of the UV formulations further is to go to waterborne UV PUD (Polyurethane dispersion).
- The many advantages of polyurethane dispersions have been known for traditional coating technologies for a long time and this can also be applied to uv technology.
- Perstorp offers products to help make your UV PUD sucessful both in terms of sustainability and performance.

Dispersing monomers

Bis-MPA™: Is an anionic stabilizer and is the most common solution to make PUD due to giving efficient and robust stabilization

Ymer N120 – Nonionic stabilization

pH independent stabilization

Possibility to make zero VOC and solvent free PUD

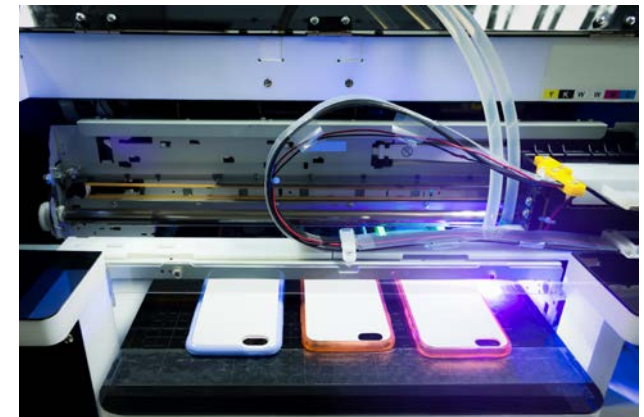
Macrodiols

Oxymer™ HD - hexanediol based polycarbonate for PUDs with excellent outdoor durability, chemical and hydrolytic resistance



High Reactivity/Low energy (LED)

- As all technologies Radiation curing is continuously developing to be more efficient and cost effective.
- The switch from Mercury Lamps to LED has means a significant reduction in the energy consumption to cure UV inks and coatings. However this have also lead to challenges at the lower output and more narrow wavelength band of LED has increased the pressure on the formulation to compensate the reduced reactivity caused by LED.
- At the same time the availability and cost for the photoinitiator are increasing. So compensating the lower reactivity by adding more photoinitiator is not really an option.
- By using high reactivity monomers and oligomer in the formulation the reactivity can be increased compensating for LED and also enabling lower amounts of the expensive photoinitiator in the formulation.
- Example of Perstorp products giving high reactivity and low viscosity is:
 - **Di-TMP**, high reactivity, low toxicity, low viscosity and good pigment wetting, high scratch resistance.
 - **Di-Penta**, Highest hardness, scratch and chemical resistance. High reactivity.
 - **Polyol R6405**, High reactivity alkoxyate, safe and easy to handle giving top performance.
 - **Boltorn P500/P1000**, High functionality in combination with low viscosity. High reactivity, chemical resistance, toughness, abrasion resistance, very low migration.



3d Printing

- More and more industries discover the advantages of additive manufacturing and 3d printing is on the verge of moving from just being a niche technology for rapid prototyping, to taking a step into full scale production.
- The growth of 3d printing is expected to exceed 15% per year making it one of the fastest growing markets.
- SLA (stereo lithography) is a type of 3d technology using a cationic uv resin that hardens upon exposure to specific light patterns enabling the printing of complex, high quality parts with excellent surface finish.
- Perstorp range of performance boosters Curalite™ is well known for its advantages in SLA 3d printing. Giving both an extreme boost in reactivity at the same time as it helps to reduce viscosity as required to give high quality printed objects.

Surface cure/Outdoor

- A more active outgoing population has increased requirements on the durability and weatherability of coatings.
- It is important to use the right type of polyols for your uv coating to get a long lasting durable coating with high scratch resistance.
- Perstorp high functionality polyols like Di-TMP, Di-Penta and Boltorn are well known to give extremely durable coatings that will last long times no matter the exposure.



Low migration

- Public awareness of possible hazard connected to chemicals is increasing and legislations are adjusted to this.
- There are many regulations and requirements for printing inks and coatings used for food packaging:
 - Regulation (EC) No 1935/2004, Art 3
 - GMP regulation 8EC) No 2023/2006
 - Swiss Ordinance SR 817.023.21
 - Nestle list
- What is in common is that they all have strict limitations on migration and safety of printing inks and coatings.
- Uv Curing is often the best alternative as migration is very low compared to alternative technologies but it can of course always be improved.
- Perstorp range of alkoxylates with very high purity and low level of glycols are excellent for enabling safe low migration coatings
- For the most demanding applications cationic offers even lower migration due to the superior curing completion and here Perstorp range of Curalite is available to boost performance.



Bio based

- Perstorp is one of the first companies to offer a wide range of bio based Pro environment polyols for UV Curing technology with:

- | | |
|-------------------|----------------------|
| • Evyron | Biobased TMP |
| • Evyron DT | Biobased Di-TMP |
| • Evyron CT | Biobased CTF |
| • Voxtar M | Biobased Penta |
| • Voxtar DP | Biobased Di-Penta |
| • Neeture | Biobased NEO |
| • Curalite Pro Ox | Biobased Curalite OX |



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