Improving Packaging Sustainability with Inks and Coatings

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09/15/2023

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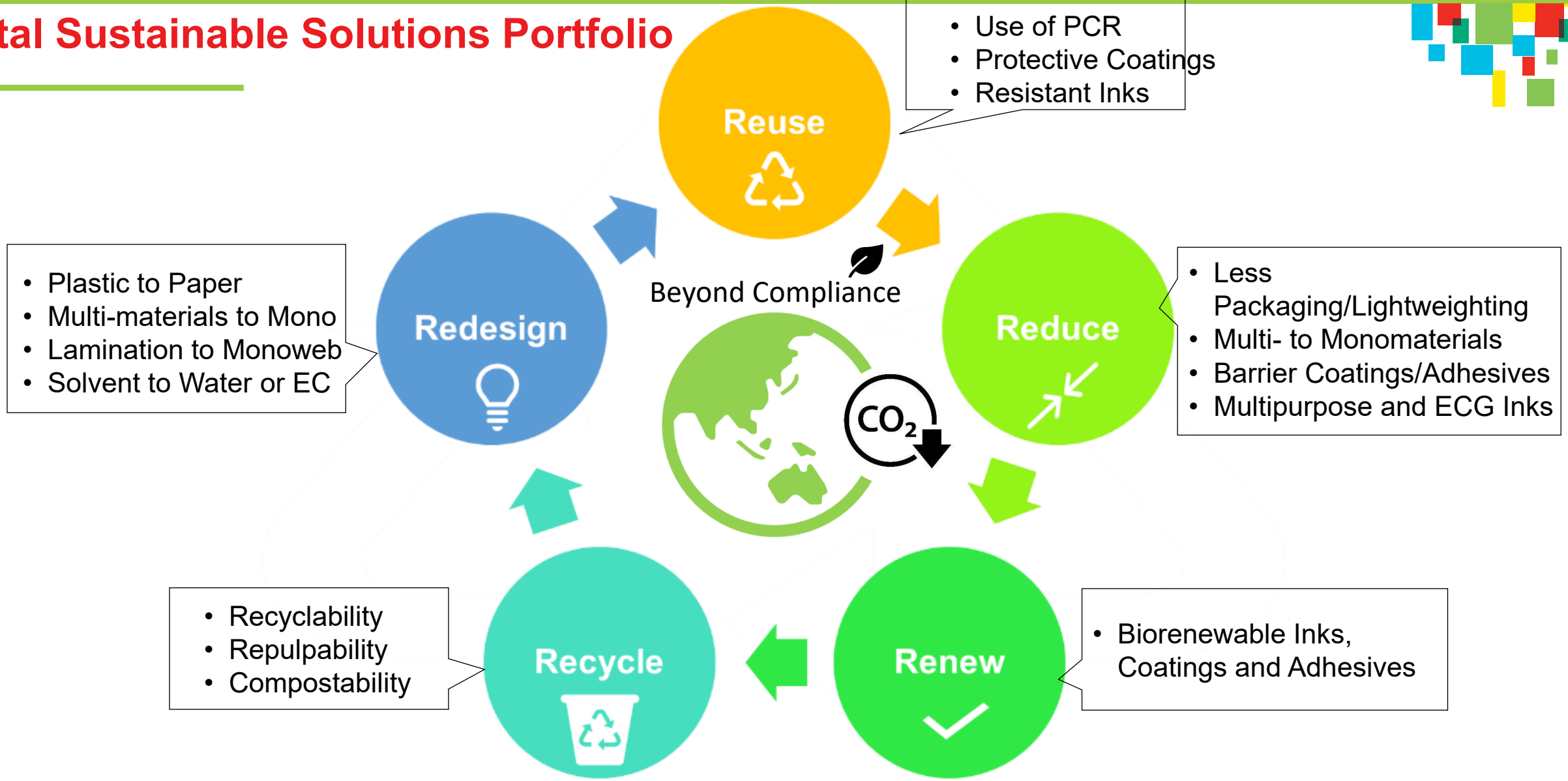
Total Sustainable Solutions Portfolio



The 5 Rs of Sustainability Support Reductions in Carbon Footprint

Sustainability Trends

Less Packaging

Plastic to Paper

Bio-renewability

Compostability

Recyclability

A Word on Compliance and Safety

Inks and coatings supplied for Pharma and food applications do not contain PFAS chemicals. PFAS has been banned from our factories

Ink and coating formulations comply with all state laws and are reviewed for Substances of Very High Concern (SVHC), endocrine disrupters, heavy metals, animal origins and Sun Chemicals corporate restrictive substances list

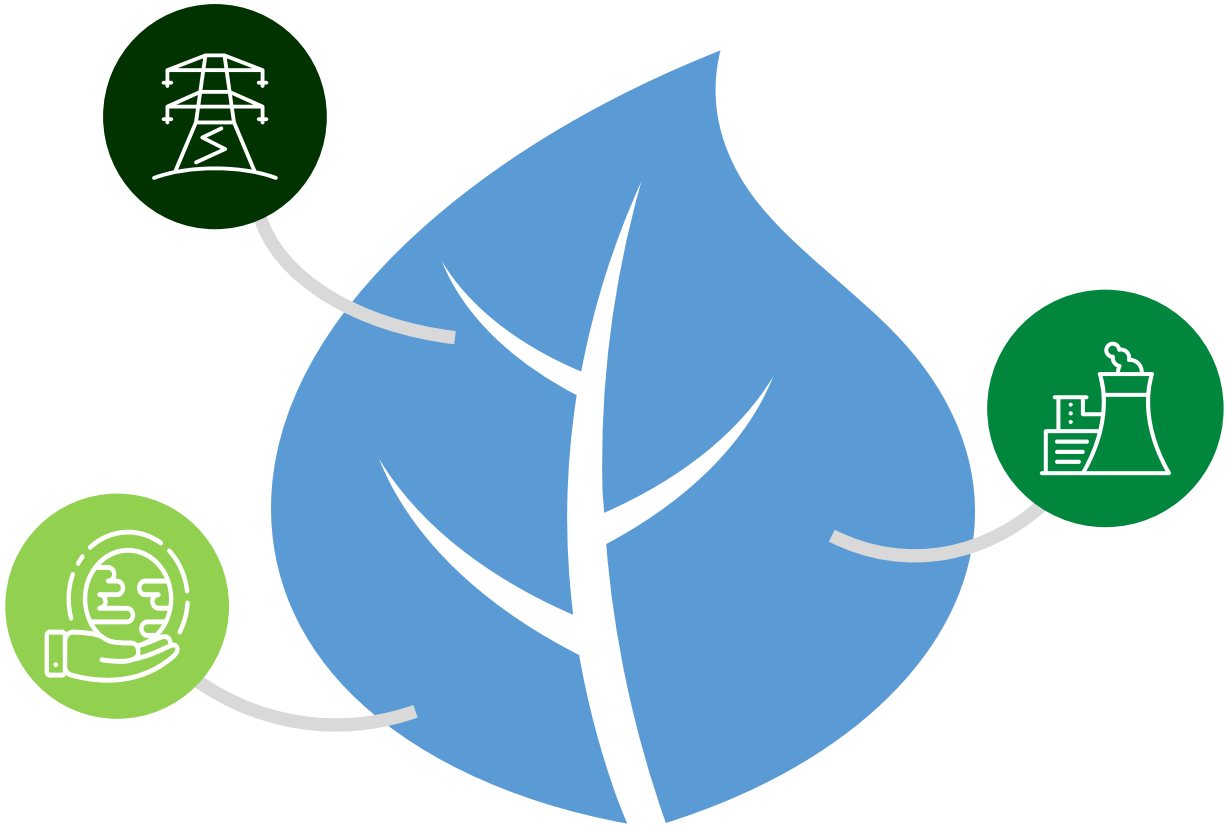
Biorenewable inks are suitable for compostability and do not contain biocides etc. that would prevent germination of plants. They are from non-food sources that are fast growing

Inks comply with Consumer Product Safety Improvement Act of 2008 (CPSIA) and Public Law 112-28 (amendment to CPSIA of 2008) Compliance Status of Sun Chemical Printing Ink Products

Scope of Product Portfolio Sustainability Initiatives

Drive sustainability during the research and development phases of product development

- Promote using sustainable / bio-renewable raw materials
- Reduce the environmental impact of our products
- Increase packaging recyclability or compostability



Product Development Drives Sustainability Beyond Compliance

Bio-derived Content

Carbon dating is used to determine the bio-based content of our products:

- Increasing bio-renewable content of water-based, solvent-based, and energy curable inks and coatings

Printed with SunVisto® AquaGreen™ water-based inks

These Initiatives Reduce the Carbon Footprint Associated with Global Warming

Commercial successes reducing carbon footprint

Substituting Biorenewable inks for conventional types reducing carbon footprint

Deinking shrink sleeves to enable recycling

Replacing polycoated board with coatings allowing recycling

Converting multilayer film structures to recyclable structures

Using compostable Adhesives improving carbon footprint

Eliminating laminations and using monoweb packaging

Creating paper pouches replacing plastic

Laminations free of PAA primary aromatic amine, Monomer free, VOC free technology Biorenewable

Using amber glass coatings to improve recyclability of Amber bottles

Inks

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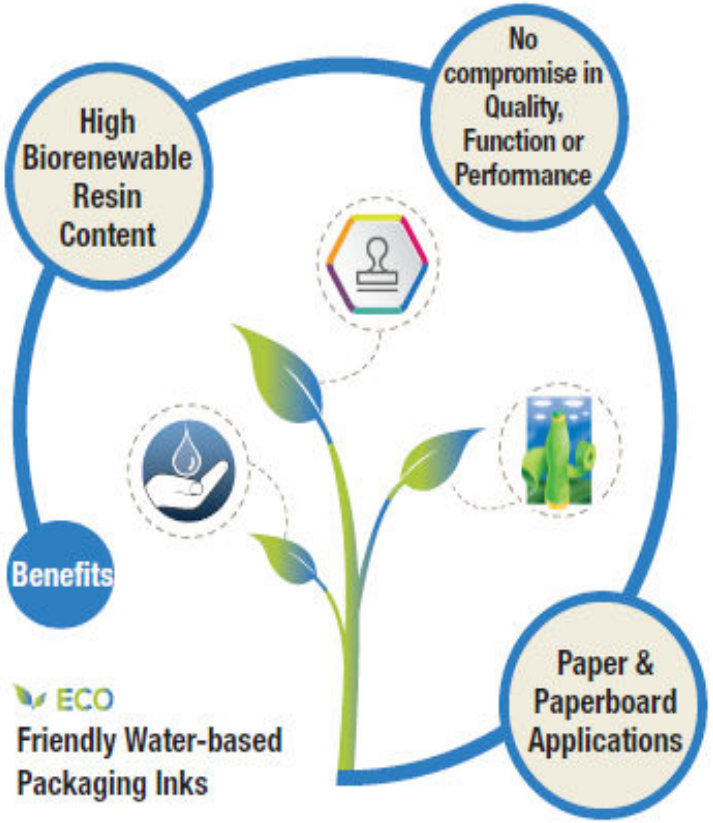
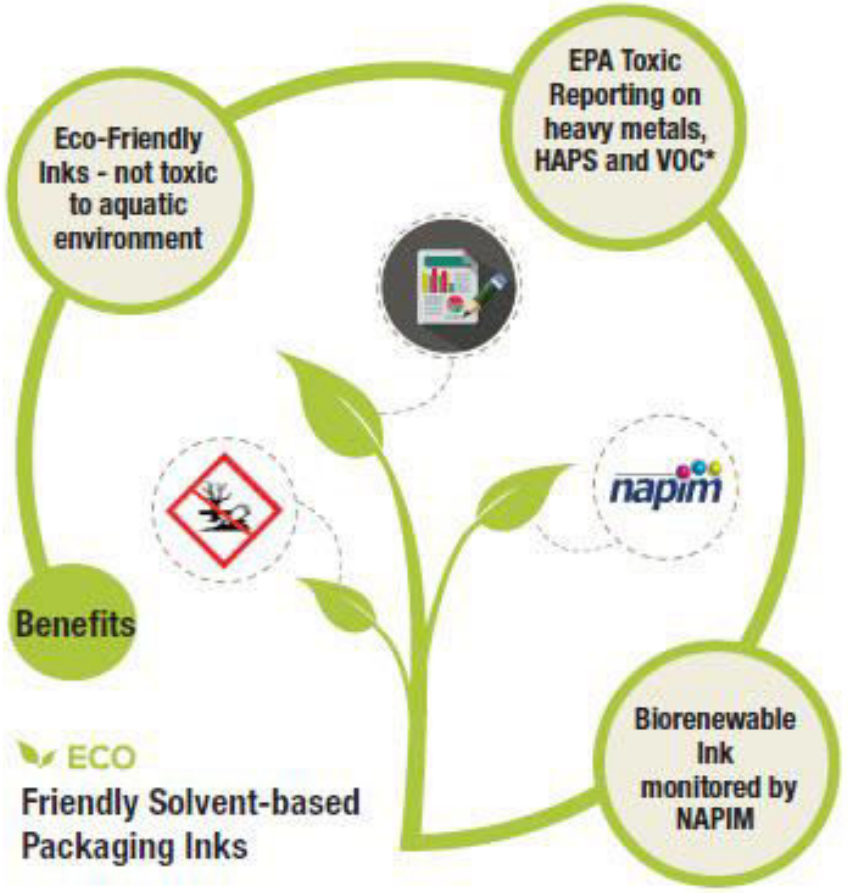
High Bio-renewable Content Water-Based Inks

- Patented technology based on plant-derived resins, starch and other natural raw materials
- Market-leading renewable resin content
- Designed for paper, board and PE-coated board applications
- Exceptional resistance properties: rub, abrasion, water, grease
- Outstanding print fidelity and ink resolubility on press
- Improved print mileage
- Quick setting and property development to allow in-line converting
- Cost neutral



High Bio-Renewable Content Solvent-based Inks

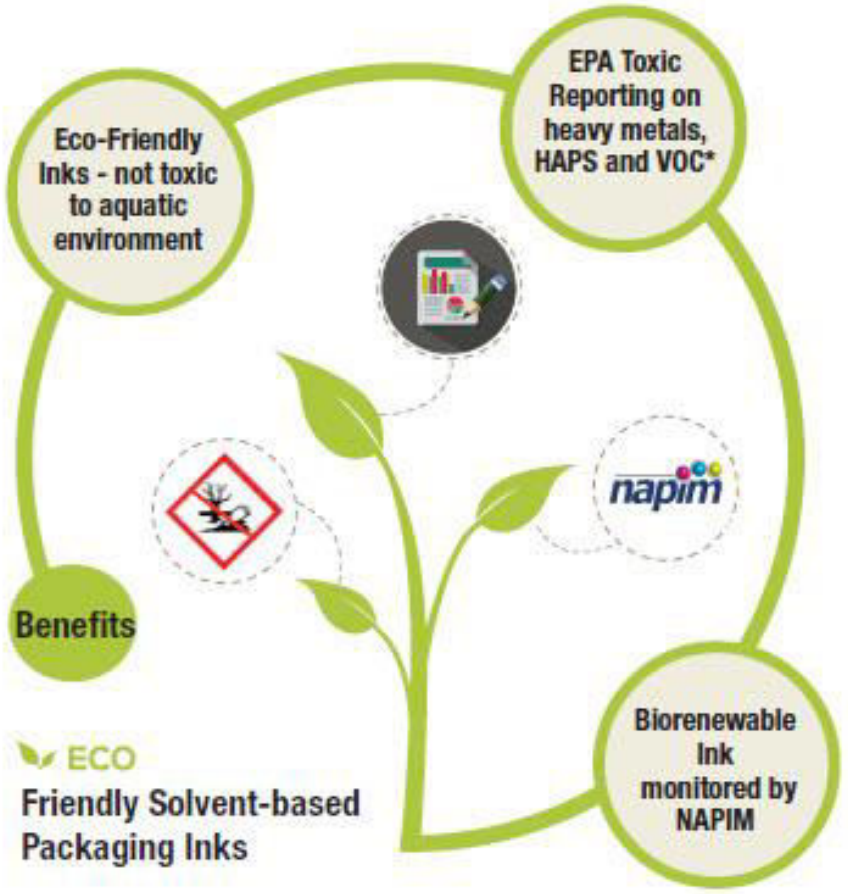
- Designed for cellulosic & biopolymer film printing
- High bio-renewable content
- Excellent adhesion & non-blocking properties on bio
- Resistance comparable to standard inks
- Enables enhanced biodegradability / composability



Contains Naturally Derived Resins for Printing on Biodegradable Films. Suitable for Organic & Natural Food Packaging

High Bio-Renewable Content Oil Based inks

- Designed for paper and plastic printing
- High bio-renewable content
- Excellent printability
- Resistance comparable to standard inks
- Enables enhanced biodegradability / composability

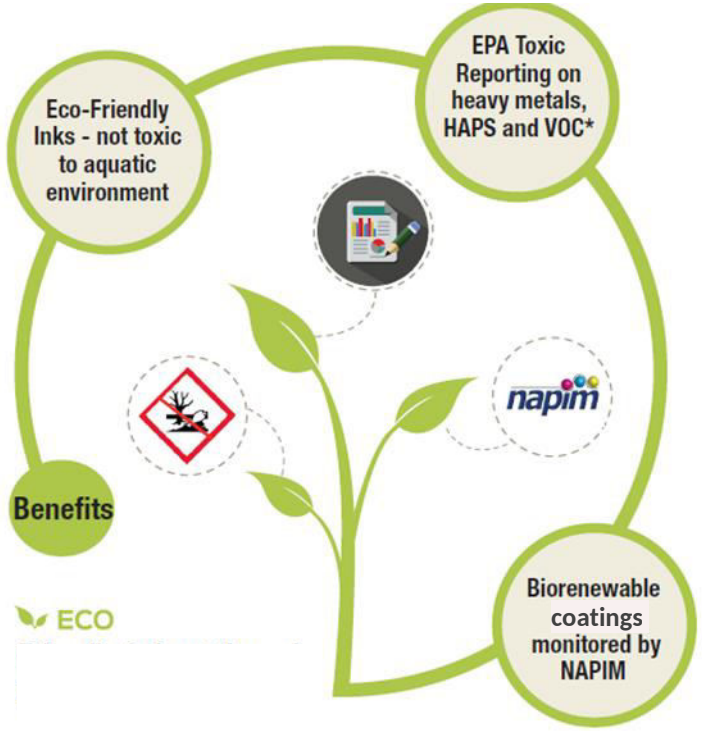


Contains Naturally Derived Resins for Printing on Biodegradable Films. Suitable for Organic & Natural Food Packaging

Adding Sustainability to Packaging - High Bio-renewable Content Coatings

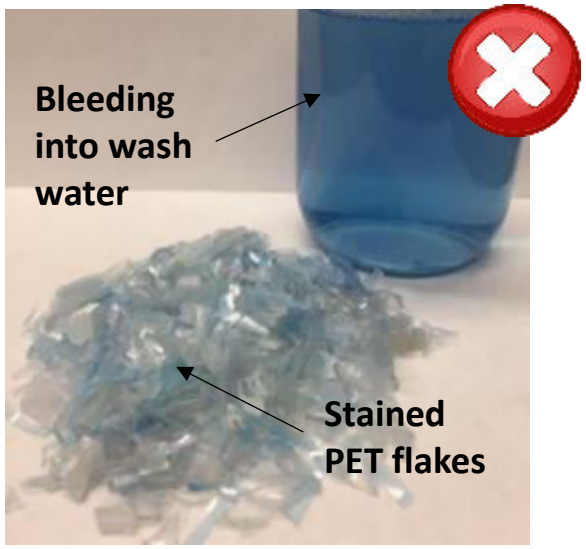
High Bio-renewable Content Coatings

- Substrates
  - ✓ Paper
  - ✓ Board
  - ✓ Self-adhesive label
  - ✓ Selected synthetic substrates
  - ✓ Films
- Flexo, Sheetfed, Offline Coaters, Gravure
- High Gloss
- Good Rub and slip



EMG#	Description	Gloss	Features
SYSCW1505	Vallocoat 1505 WB HBRC Gloss Coating	40-55	WB Gloss, everyday coating
SYSCW1515	Vallocoat 1515 WB HBRC High Gloss Coating	30-40	WB High gloss everyday coating, with added water resistance
SYSPW1629	Vallochem 1629 WB HBRC Gloss OGR Coating	35-50	WB Gloss, good water and oil resistance
NLDFS0111133	Vallocoat 1133 SolvaGreen OPV	40 - 55	SB Gloss everyday coating
RESR738	Vallogo 738 Gloss C PL CSRL	40 - 55	SB Gloss release coating, cold seal release lacquer
RESR736	Vallogo 736 Gloss C PL CSRL	40 - 55	SB Gloss release coating, cold seal release lacquer

Recyclable Ink Solutions: PET Bottle Sleeves



System 1: **Crystallizable PET Shrink Film**

Inks wash off label, do not bleed in hot caustic bath. Ink residues can be filtered in the rinse step. Clean shrink film collected with PET flakes.

Status:

- Commercially available for Gravure printing as SolvaWash GR Ink
- Multiplele successful customer print trials completed.
- Flexo version development in progress

System 2: **Floatable Shrink Film**

Inks stay on label and do not bleed during bottle wash or sink/float steps. Label with inks is separated from rPET flakes.

Status:

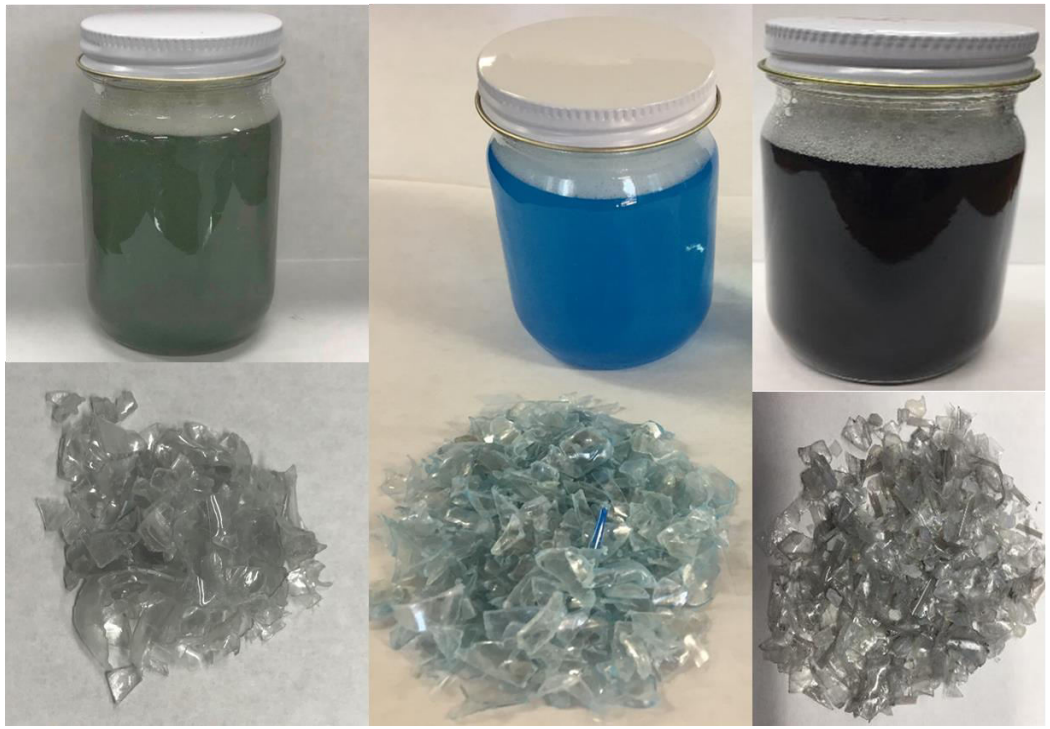
- Commercially available, Harmony ink system with DPY-433 2K White.
- Approved on various floatable films (Taghleef, Klockner and Polysack).

Technology developed initially for PET sleeve labels to meet recycling guidelines. However application of concept to other recyclable film packaging formats (pouches, laminates, cut & stack labels) is proceeding.

Deinking / Wash Off Ink Technology For Recycling of Post-Consumer PET

Value Proposition: Plastic packaging printers will purchase inks that can be removed and separated from recoverable plastic substrates in a variety of recycling processes. Initial focus is on printed sleeve labels for PET bottles, the most well-developed recycle stream.

CURRENT STATE OF THE ART INK TECHNOLOGY



SEVERELY CONTAMINATED CAUSTIC WASH WATER

SEVERELY STAINED RECYCLED PET FLAKE

Current state of the art ink technology causes increased waste & reduced yield at recycling facilities of PET bottles due to Ink bleeding in the hot caustic wash:

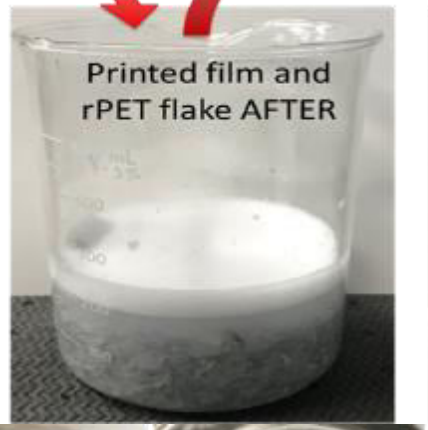
- Ink dissolves and stains the Polyester flake, which downgrades its quality and reduces its value in the recycled PET (rPET) commodity markets.
- Ink dissolves and contaminates the wash solution, increasing operational costs for wastewater treatment and creating potential environmental issues.

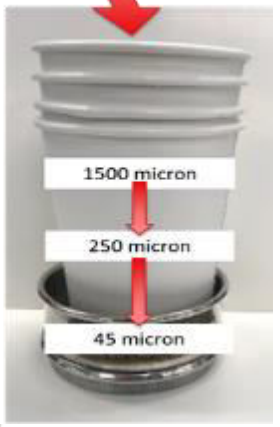
Objective: Develop Ink Technology That Enables Recyclability of Post-Consumer PET Bottles and Aligns with New Plastics Economy (NPE)

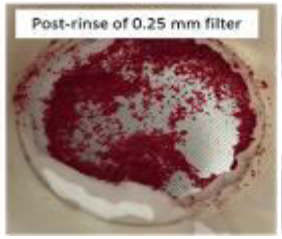
Deinking / Wash Off Ink Concept

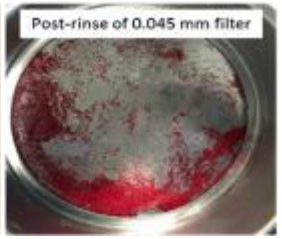
PET Flake & label + ink

Caustic Wash









Filtration / Separation

CLEAN PET Flake & label
No INK

Removable Ink Technology That Enables Recyclability of Post-Consumer PET

Coatings and Adhesives

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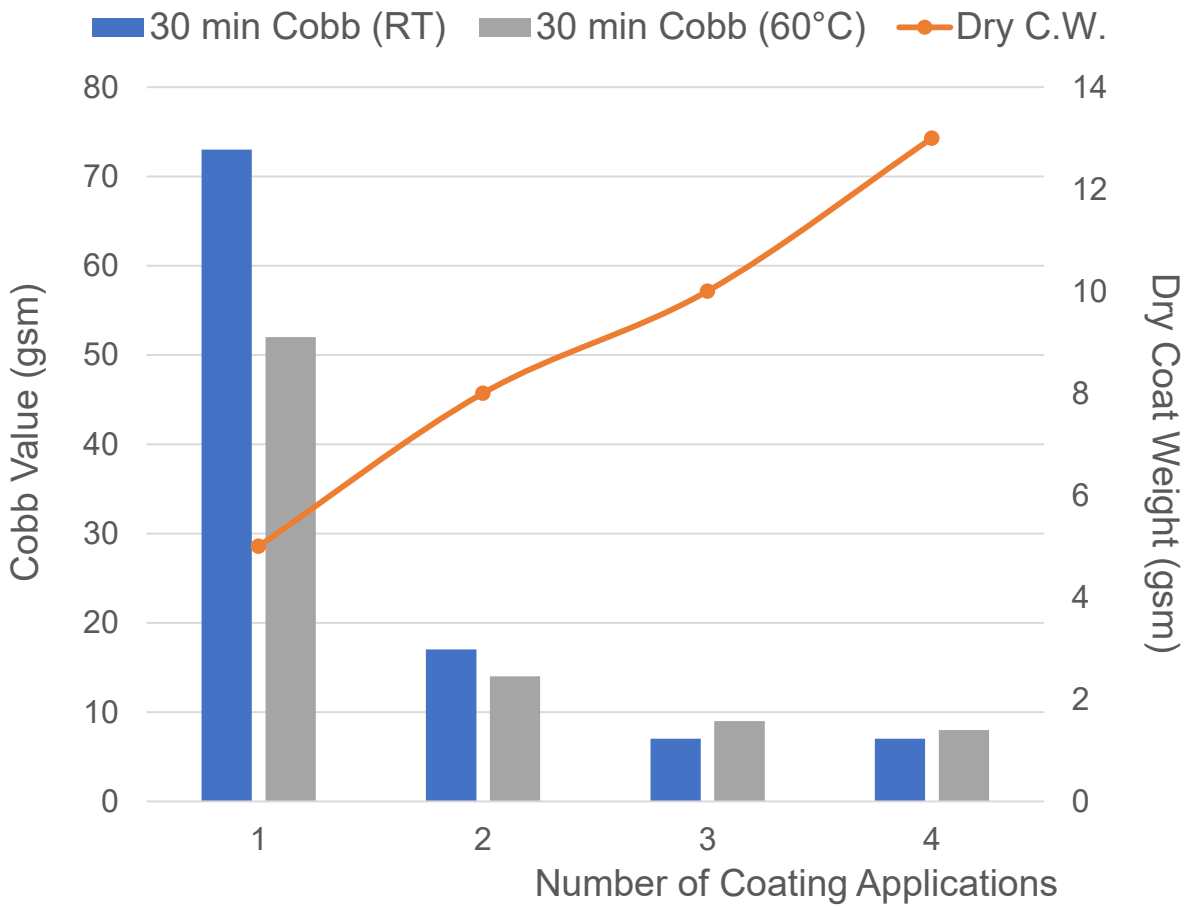
Barrier Coatings – SunStar PE Replacement Coatings



Coating	Pass	Heat Seal Strength [N/25 mm]				Block		3M Kit Level
		Coating to Coating		Coating to Board				
		180℃	200℃	180℃	200℃	C-C	C-B	
SunSys SYSPW005	1	8.8	9.7	1.0	0.7	No Block	No Block	1
	2	9.5	13	6.2	6.7	No Block	No Block	12
	3	11.3	10.8	7.2	6.3	No Block	No Block	12
	4	10.5	11.8	8.0	7.7	No Block	No Block	12

- 3M Kit Values of 12
- COBB of < 10 gsm
- Good Heat Seal
- Surface Energy of outer coating layer > 40 dynes
- 99% Repulpable – UWM

Coatings for Monoweb

- MW coatings are super-durable over-print varnishes designed to replace laminate and extruded layers of plastic film. This allows for down-gauging of flexible packaging, bundle-wrap, and labels. By replacing a laminate layer, the resultant mono-polymer film constructions allow for the design of structures that are recyclable.

Features:

- Sustainability
- Rub resistance
- Heat Resistance

Recyclable Film Packaging

Sun Confidential

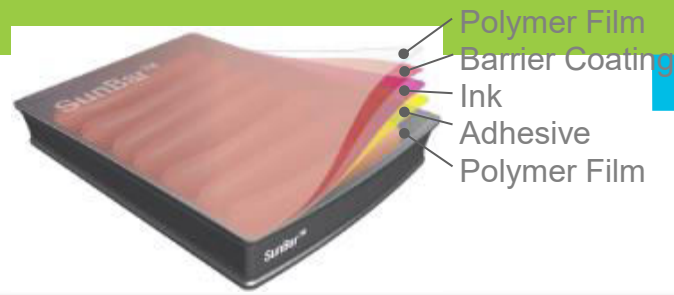
SunBar Aerobloc Oxygen Barrier Coatings

- Adds Oxygen Barrier to film substrates
- Enhances or maintains shelf-life of products
- Allow for redesign to downgauge; Mono-material (PE) or Mono-web recyclable
- Flexo, gravure
- BARX698U
  - ✓ OTR >1.0 cc/100in^2/24 hr. (23°C, 50% RH), 4 gsm wet*
  - ✓ Only be applied to the inside of the package, sandwiched on a laminated structure
    - 1-part system, no pre-press cross-linking is needed
    - can be overprinted with solvent-base inks, so can be printed in-line
  - ✓ Chlorine-free
  - ✓ Transparent
  - ✓ Dry food
- BARX221/222
  - ✓ OTR 1.0 cc/100in^2/24 hr. (23°C, 50% RH)
  - ✓ Chlorine-free
  - ✓ Transparent
  - ✓ Overprintable
  - ✓ Dry, chilled or wet-food

PET – polyester, polyethylene terephthalate
OPP – Oriented polypropylene film
AlOx PET – Aluminum oxide coated PET
VM PET – vacuum metalized PET

* OTR will depend on the smoothness and the thickness of the film being coated as well as the uniformity and coat weight applied. Typical values tested according to ASTM F1927

SunBar Aerobloc Oxygen Barrier Coating



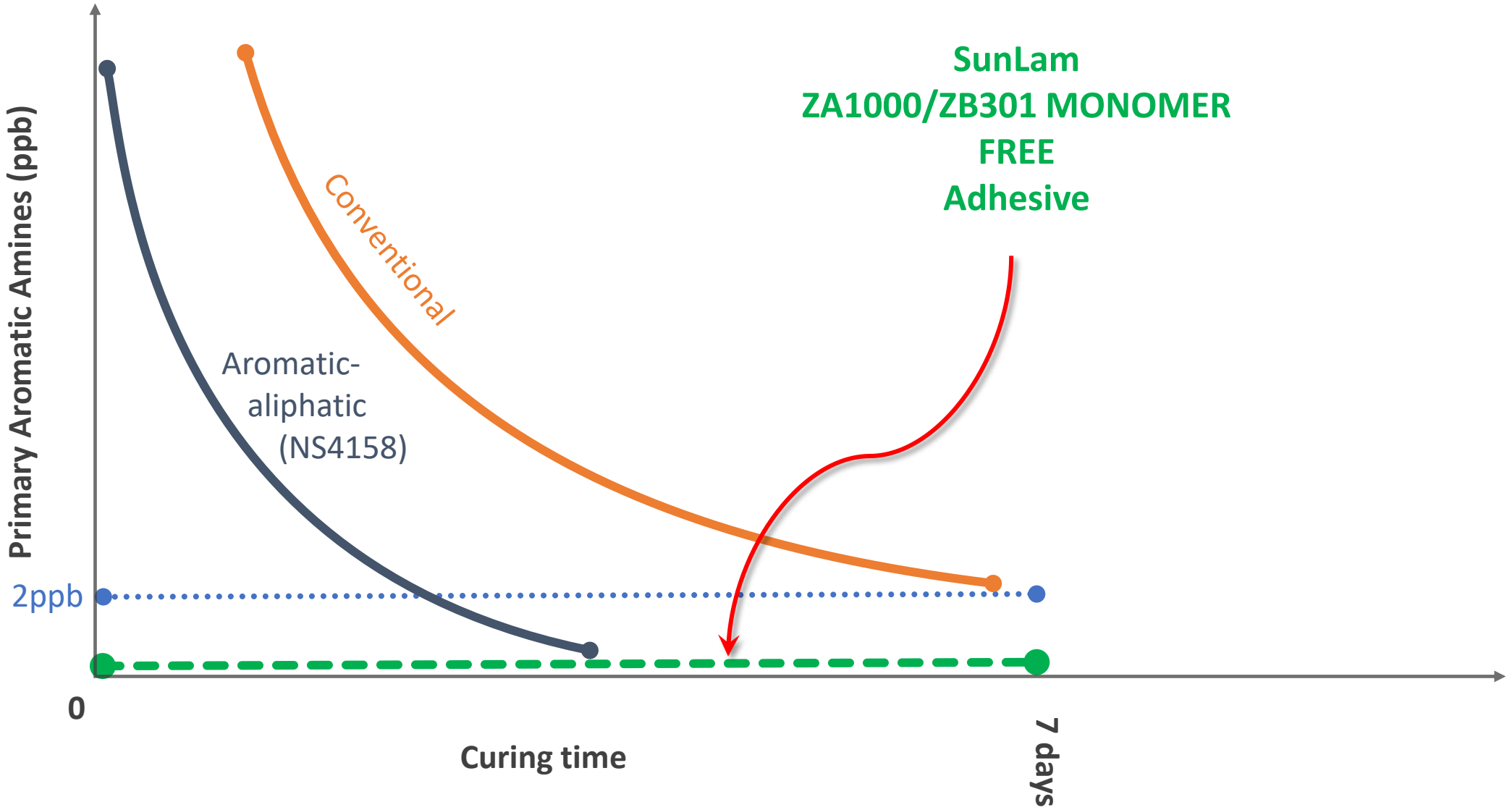
Description	Parts	Sun Codes	Blend Ratio	Primary Substrate	Application	OTR; cm^3/m^2-day 4 g/m^2 Wet *
Dry PETCDT 1.0	2-Pack	A: BARX001 B: BARX002	1A:1B	PET	Dry	<2.0; 50%RH, 23ºC
Dry PET 1.1	2-Pack	A: BARX011 B: BARX012/BARX012U	1A:2B	PET	Dry	<1.0; 50%RH, 23ºC <10; 75%RH, 23ºC
Dry PE/PP 1.5	3-Pack	A: BARX007 B: BARX008 C: BARX009	6A:3B:1C	OPP	Dry	<20; 50%RH, 23ºC
LP PETM	2-Pack	A: BARX013 B: BARX004	2A:1B	VM-PET AlOx-PET	Liquid.	<0.5; 75%RH, 23ºC
WR PET	3-Pack	A: BARX021 B: BARX102 C: 1M Dilute Acid	1A:2B:2%C	PET	Wet	<2.0; 50%RH, 23ºC <10; 75%RH, 23ºC
ENHANCE	2-Pack	A: FCDEV221 (BARX221) B: FCDEV222	96A:4B	AlOx- VM-	Wet	<0.5; 75%RH, 23ºC
SP PET (NEW)	1-Pack	BARX017	-	PET	Dry	<10; 50%RH, 23ºC

* OTR will depend on the smoothness and the thickness of the film being coated as well as the uniformity and coat weight applied. Typical values tested according to ASTM F1927

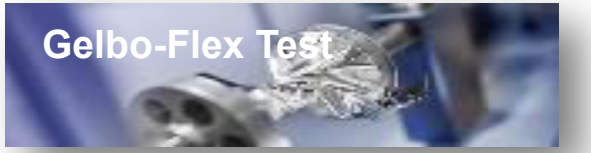
SunLam SFC100/HAC306 Compostable Solventless Adhesive

- Industrial compostable certification EN 13432 and home compostable certification NF-T51-800 French. Australian testing is underway.
- Monomer Free Technology = SAFE
- Bio based content = 74% (certified by C14 analysis)
- Low viscosity = High Lamination Speeds
- Good thermal resistance, suitable for up to pasteurization
- Slitting time = 48 hours at Room Temperature
- Works on most compostable structures available in the market, but for paper substrate use

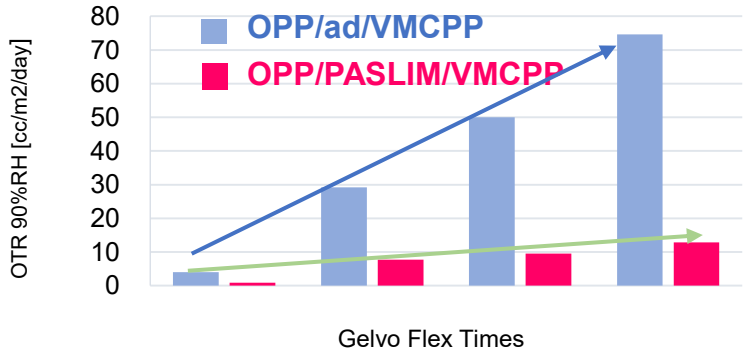
PAA Decay vs Time



PASLIM - Oxygen Barrier Laminating Adhesives

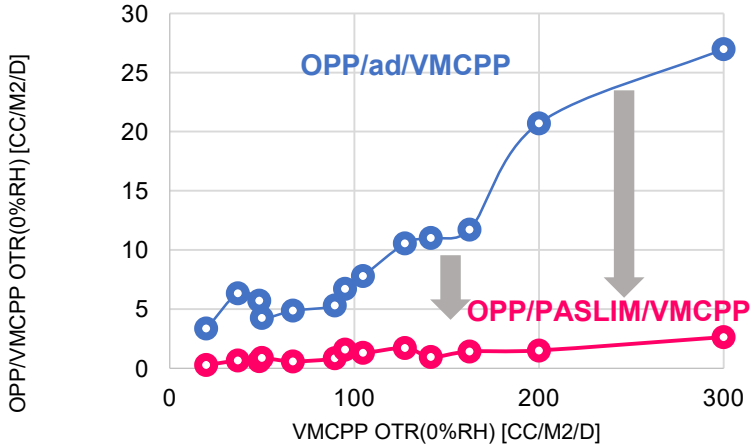


Current Substrates		Proposed Substrates	
PET/ad/LLDPE	OTR 120 cc MVTR 5 g	**OPP/PASLIM/CPP**	OTR 120-140 cc MVTR 4 g
PET/ad/VMCPP	OTR 10 -20 cc MVTR 0.1 g	**OPP/PASLIM/VMCPP**	OTR 0.5 -2 cc MVTR 0.1 g
PET/ad/VMPET/ad/LLDPE	OTR 1-3 cc MVTR 1 g	**OPP/PASLIM/VMOPP/ad/CPP**	OTR 0.5-2 cc MVTR 0.5 g



PASLIM improves “flexibility” of metalized substrates.

OTR with various VMCPP

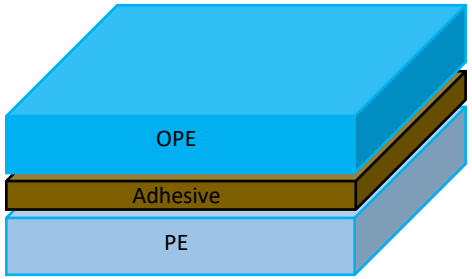


PASLIM stabilize high level of oxygen barrier even with lower quality metalized film.

PASLIM and SunBar – Working well Together

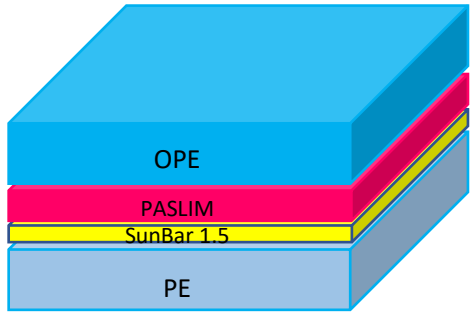
Trial no.	Film Structure	Barrier Coating	Curing Conditions	OTR at 23°C, 50%RH (cc/[m^2 -day]) Average
Control	OPE	None	N/A	3582
Control	PE	None	N/A	3530
Traditional Adhesive	**OPE/PE**	**None**	**40°C 50% RH**	**101**
Paslim VM001	**OPE/PE**	**SunBar 1.5**	**40°C 50% RH**	**5.88**
Paslim VM001	**OPE/PE**	**BARX221/FCDEV222**	**40°C 50% RH**	**6.51**

OPE/ad/PE



OTR	101 cc
MVTR	5 g

OPE/PASLIM/SunBar 1.5/PE



OTR	5.8 cc
MVTR	4 g

Adhesive for Compostable Packaging

Compostable Solvent Free Adhesive

- SunLam SFC-100 + HAC-306
- Free of PAA primary aromatic amine, Monomer free, VOC free technology
- Formulated with a biobased content up to 74% (certified by C14 analysis).
- Application temperature 30-35°C, post cure at 40°C to accelerate the process
- High lamination speed, improves productivity, reducing converting cost
- Lamination of most of compostable film substrates
- Good thermal resistance, suitable up to pasteurization.
  - ✓ Industrial Composting: European EN13432 and Australian AS 4736.
  - ✓ Home Composting: French NF-T-51-800 and Australian AS 5810.

Heat Seal Adhesives

Adding Sustainability to Packaging – Recyclable Paper Packaging

Heat Seal Coating for Paper

- **Thermaseal ADHW406US, ADHW411**
- WB coating formulated to provide heat seal properties to paper and board substrates, can work on some foil and polymeric.
- Replace non-recyclable structures: non-recyclable coating, poly-board, plastic liners, extruded plastic.
- Applied flexo, gravure
- Key Specifications:
  - ✓ Low sealing temperature 203ºF to 243ºF
  - ✓ High gloss and transparency
  - ✓ A-A seals, can seal to paper and PE* and B-B*
  - ✓ PFA-free, Fluorochemical-free
  - ✓ Block resistant
  - ✓ Repulpable
  - ✓ FDA compliant for direct food contact

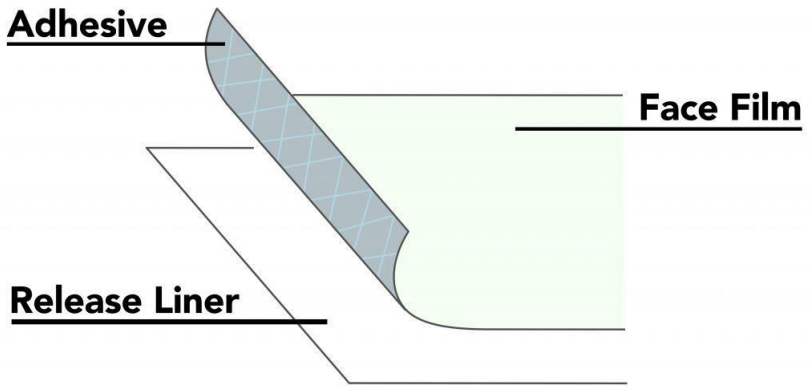
Sun Chemical Heat Seal Products

	ADHS301	ADHS302	ADHW406US	ADHW707US
	Thermaseal G LID MIXPAP	Thermaseal G LID PET	Thermaseal PAP BAG PAP	Thermaseal WB HS
Chemistry	Solvent	Solvent	Water	Water
Substrates	Foil, PP, PVC, PS	PET, PS	Paper, Foil, Film	Paper, Foil, Film
End Use	Foil yogurt lidding	PET yogurt lidding	Multi-Purpose	Multi-Purpose
Seal Temp	160-180°C 320-350°F	160-180°C 320-350°F	95°C/ 140°C 203°F/	176°C 350°F
Application	Gravure 4.0-6.0 g/m^2	Gravure 3.0-5.0 g/m^2	Flexo or Gravure	Flexo or Gravure
FDA	175.300	175.300	175.300	175.300

Recyclable and Compostable Release Coating

SunSys Vallogo RESR490, RESR1814

- WB Release coating for paper
- High bio-based content 96% C14
- Repulpable, compostable – to be tested
- Free: silicone, PFA
- Opportunities:
  - ✓ Release liner replacement:
    - Silicone coating replacement
    - Release film replacement



Glass Coatings

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Introduction –Glass Coatings

Value Proposition: Sun's WB glass coatings offer decorators a better response to EH&S concerns (e.g. low VOC, no BPA, no heavy metals, no formaldehyde) in anticipation of regulatory changes and in light of increased environmental responsibility policies at brand owners.

Key Benefits

- ✓ Low VOC (<1%) whereas competitors are up to 35%
- ✓ More EH&S friendly (e.g., no heavy metal, BPA-free)
- ✓ Excellent pencil hardness (6H or more)
- ✓ Extended dishwasher resistance
- ✓ Good optical clarity / transparency
- ✓ No special glass pre-treatment required
- ✓ Easier cleaning of spray line / guns with water & soap

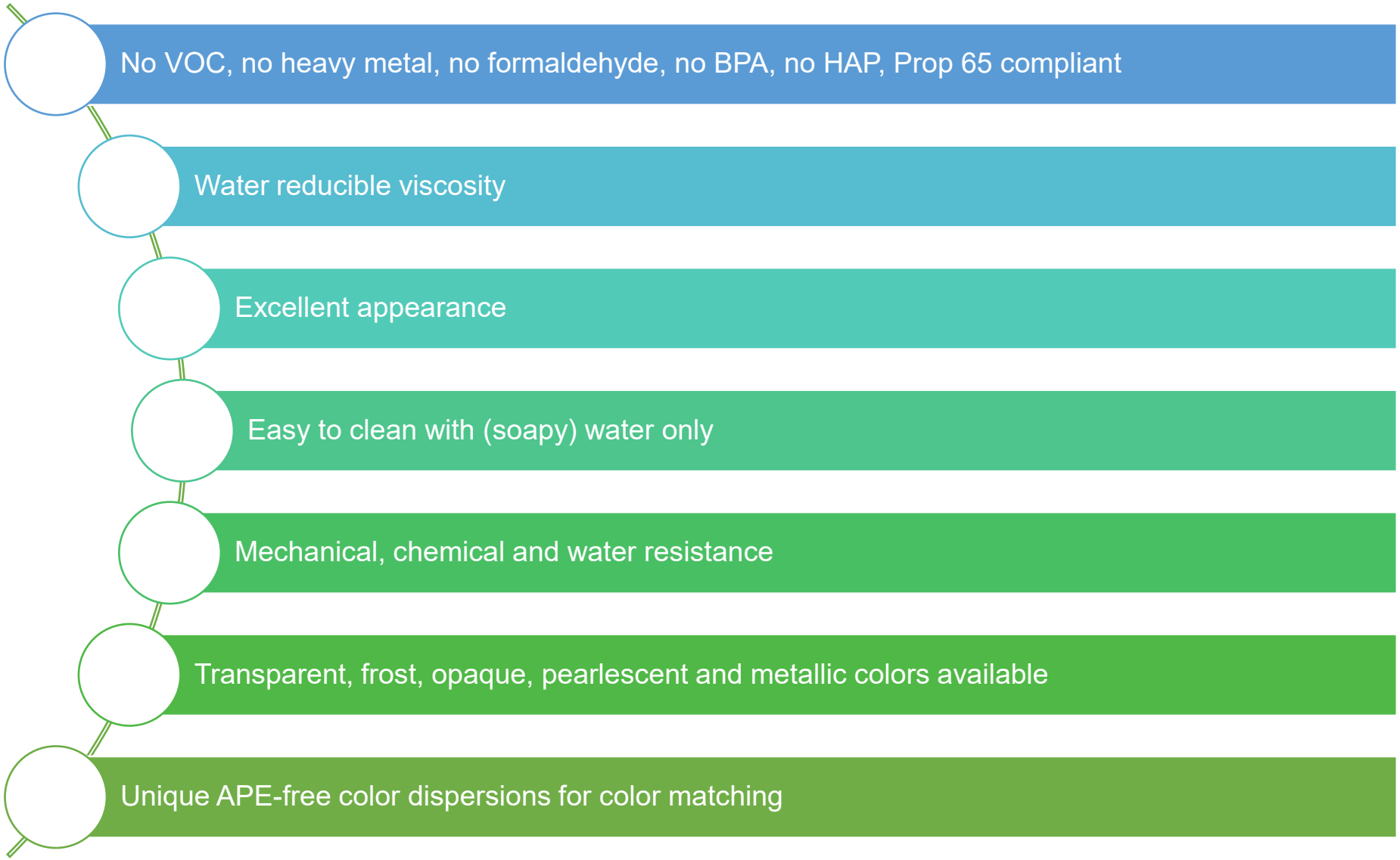
WBSPG = " Water Based Sprayable Product for Glass"

SunSpray®

- Options available for both HVLP sprayer and electrostatic bell gun
- 6 standard vehicles
- 10 Alkylphenol ethoxylates (APE)-free pigment dispersions
- Solids content: 30 – 50%
- Viscosity: 50 – 500cP (or EZ Zahn Cup #3: 10 – 30sec)
- pH >7
- Water dilutable
- Recommended spray viscosity: 50 – 100cP (or 10sec on EZ Zahn Cup #3)
- Typical cure conditions: 175°C/30min or 220°C/10min
- Minimum cure conditions: 185°C/3min (depending on the glass and performance requirements)

SunSpray® WBSPG is a patent-pending heat curable water-borne coating formulated specifically for industrial and commercial glass applications.

Water-based Spray Differentiators



SunSpray WB vs. Competitors – EHS Considerations

	SunSpray WB	Comp. A	Comp. B
Chemistry	Polyurethane	Epoxy-alkyd	Epoxy
VOC	< 1%	30 – 35%	20 – 25%
BPA	No	Yes	Yes
Formaldehyde	No	Up to 0.25%	No
Heavy metal	No	No	Up to 6% Cobalt complex
Prop 65 compliance*	Yes	No	No
Cleaning solvent	Water & soap	Acetone/Denatured alcohol	

*

Security Solutions & Brand Protection

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LUMINESCENCE
Sun Chemical Security
a member of the DIC group
Color & Comfort

Security inks

C.T.LAY
Sun Chemical Security
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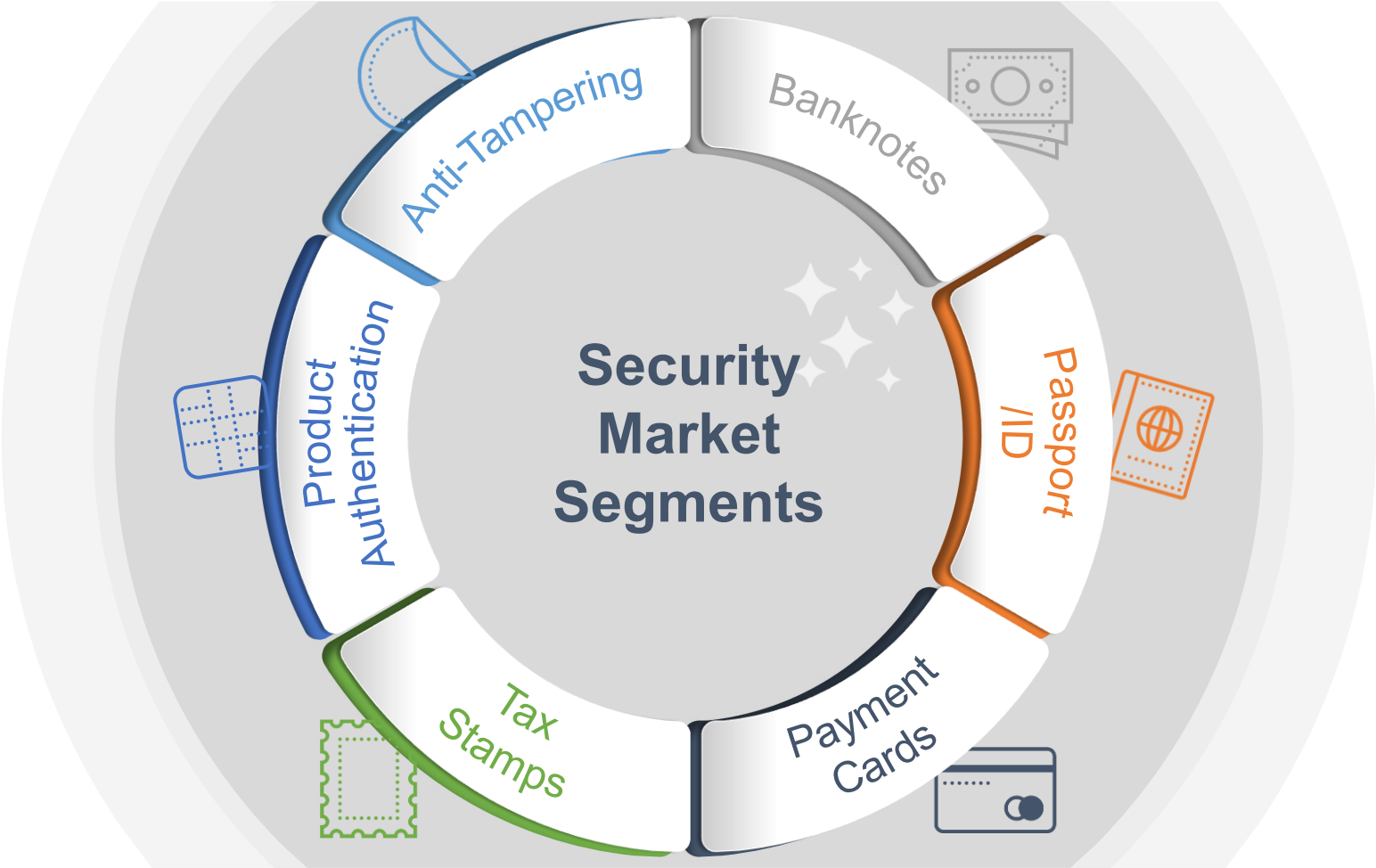
Security hologram & overlay

4PLATE

Security lamination plates

SAPICI

Adhesives



PSA tape

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Security pigments

SunChemical
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Color & Comfort

Electronic materials & industrial inks

SunChemical
a member of the DIC group
Color & Comfort

Novel devices

The strongest range of technical competency as a supplier to the market
firewalled from Sun Chemical/DIC but using resources/capabilities wherever possible

Thank You

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