

Replacing Nitrocellulose in Modern Packaging Inks: The Rise of THYON™ Acrylic Resins.

By: TERENCE KENNETH

A Safer, Sustainable Path Beyond Nitrocellulose

It's hard to believe but for more than half a century, nitrocellulose (NC) has been the workhorse binder in solvent-based flexographic and gravure inks. Its balance of fast drying, strong adhesion, and good print quality made it indispensable to packaging printers worldwide. Yet the same chemistry that once made NC attractive -its nitrate structure, high solvent demand, and flammability, has turned it into a liability in today's sustainability-driven market.

Now, what I'm about to suggest isn't as far-fetched as it might sound. I remember as a novice ink technician in the 1980s how acrylic resins were, at that time, the preferred modifying resin for gravure food packaging inks on coextruded and PVDC coated films like PROPAFILM-C and MXXT-S. And the resins they modified weren't nitrocellulose!

Around the world, brand owners and converters face tightening controls on volatile organic compound (VOC) emissions and packaging recyclability and environmental regulations, raw-material disruptions, and circular-economy goals become front and center. Under the European Union's new Packaging and Packaging Waste Regulation (PPWR), for instance, every packaging component, including inks, must be compatible with recycling or reuse targets¹. Nitrocellulose, which relies on large amounts of fast-evaporating solvents and contributes to high VOC emissions, falls short of these objectives.

Moreover, NC's classification as a flammable, self-reactive solid, demands expensive storage and handling precautions. It must be transported wet with 25–30 % solvent or water to avoid ignition, creating constant fire-safety challenges. With these factors converging, many converters now view NC as a bottleneck to both safety and compliance.

Fortunately, the industry no longer needs to choose between environmental responsibility and print performance. Solid acrylic resins, like THYON™ developed by Diransa S.R.L. of Buenos Aires, Argentina, offer a next-generation solution that preserves the speed and brilliance of solvent-based inks while eliminating the drawbacks of nitrocellulose.

Why Replacing Nitrocellulose Matters:

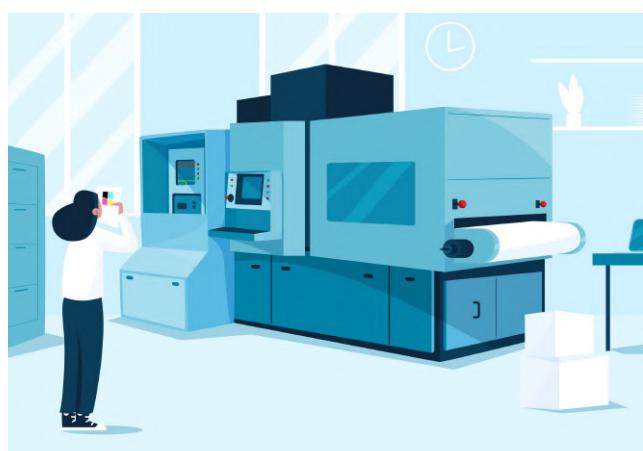
The shift away from nitrocellulose is driven by at least three powerful realities:

1. Safety and Stability. Nitrocellulose is inherently unstable and extremely flammable once dry. It requires damp storage, special transport classification, and dedicated fire-suppression systems. The cost and risk associated with NC storage have grown as insurers and regulators tighten compliance standards.

2. VOC and Environmental Pressure. Traditional NC inks are up to 80 % solvent by weight. Each kilogram of ink applied to film can release hundreds of grams of VOCs into the atmosphere. Modern sustainability frameworks—from the EU Green Deal to local air-quality laws—demand low-VOC or VOC-free alternatives.

3. Recyclability and Supply Chain. NC residues can discolor recycled polymers and generate odor during reprocessing. European recyclability guidelines now classify many NC-printed films as "non-recyclable." On the supply chain side, NC supply has become volatile as global production competes with military and automotive uses of nitrocellulose, causing periodic shortages and price spikes.

Replacing NC, therefore, is both a safety imperative and a strategic business decision. Printers and ink manufacturers that adopt NC-free chemistries gain more stable sourcing, and a cleaner sustainability profile.



Introducing the THYON™ Series

It's important to identify specific products which can be implemented in today's ink formulations. THYON™ represents a family of solid acrylic resins engineered specifically to replace nitrocellulose in solvent-based flexographic and gravure inks. They dissolve completely in alcohol or alcohol/ester blends, providing equivalent or superior press behavior to NC without explosive hazard or high-VOC burden.

PRODUCT OVERVIEW:

GRADE	SOLUBILITY	TYPICAL VISCOSITY	PRINCIPAL USE
THYON SR762	100 % alcohol	Low	Low-VOC flexographic inks
THYON SR862	Alcohol/ester	High	Lamination & high-solids flexo inks
THYON SR763	Ester-soluble	Medium	Gravure inks
THYON SR863	Ester-soluble	Medium-high	Gravure & lamination inks
THYON OX787	Hydroxylated acrylic polyol	-	Adhesion promoter in Acrylic-PU systems

The SR grades provide the backbone for pigment dispersions and surface or lamination inks, while OX787 acts as a co-resin to enhance adhesion and gloss. Together, they form a unified platform capable of replacing NC in virtually every solvent-based packaging ink.

Solvent Flexibility and Low-VOC Advantage

Unlike nitrocellulose, which demands a narrow solvent balance to remain dissolved, acrylic resins offer exceptional solvent tolerance. In practice, ink makers can raise solids content to 45–50 % while maintaining printable viscosity, reducing solvent use and drier energy by up to 25 %. Printers therefore retain fast drying without compromising gloss or adhesion. Ester-soluble grades of these acrylic resins extend their reach to gravure applications requiring slower evaporation or higher transfer uniformity. All of the grades I looked at exhibit clear, non-yellowing films and excellent storage stability.

Printability and Gloss: Performance Beyond Nitrocellulose

Laboratory tests comparing THYON acrylic resins with standard 27 %-solids NC inks show a nearly identical viscosity profile but superior optical performance.

Table 2. Comparative performance (laboratory results):

SYSTEM	VISCOSITY (FORD #4)	GLOSS (60°)	ADHESION
Nitrocellulose (Medium visc.)	26"	15.9	100 %
THYON SR762	21"	24.6	100 %
THYON SR862	26"	24.0	100 %
THYON SR763	22"	25.8	100 %
THYON SR863	25"	25.4	100 %

In lab testing, THYON based inks exhibited 30–60 % higher gloss than their NC counterparts while maintaining full adhesion and scratch resistance. They also allow greater pigment loading with white inks containing up to 45 % TiO₂ retain both flexibility and brightness. This efficiency lets converters achieve equal opacity with thinner films, cutting overall ink consumption.

Improved Flexibility and Film Integrity

One persistent challenge with nitrocellulose inks is film brittleness, especially on low-density polyethylene (LDPE) or deep-freeze packaging. NC films can micro-crack during flexing or cold storage, dulling gloss and weakening lamination bonds.

THYON acrylics form tough yet elastic films, maintaining adhesion across substrates such as LDPE, BOPP, PET, PVC, aluminum foil, and even bio-based PLA. Because they require less plasticizer, THYON inks avoid the migration issues that plague many Nitrocellulose formulations printed on flexible films.

This flexibility ensures consistent performance across diverse applications—from high-speed snack packaging to freezer pouches, where ink films must endure repeated bending without whitening or delamination.

Compatibility with Polyurethane Systems

Flexographic and gravure laminating inks often blend NC with polyurethane (PU) to achieve bond strength and heat resistance. THYON resins not only match NC's compatibility with PU—they can improve it.

When used in combination with a product called THYON OX787, a hydroxyl-functional acrylic polyol, THYON-based inks display stronger inter-resin cohesion and excellent adhesion to treated films. In my lamination trials we found:

- Adhesion to PET, BOPP, and aluminum foil equaled or exceeded that of NC-PU blends.
- Gloss retention remained high after lamination and curing.
- Solvent release improved, lowering residual-solvent values in finished films.
- Re-solubility on press was maintained, preventing buildup and print defects.

This synergy gives converters an ideal scenario where they wish to keep polyurethane as part of their laminating ink system while removing nitrocellulose entirely. This isn't possible with some of the other resins that are touted as NC replacements or alternatives. The result is a safer, low-VOC formulation that fits seamlessly into existing press workflows.

Technical and Operational Advantages

1. FAST DRYING AT HIGH SOLIDS

Because THYON acrylic resins have low intrinsic viscosity, they allow high-solids inks that still flow and level properly. Production tests have demonstrated printing speeds above 500 m/min, roughly double those of standard polyamide inks.

2. BROAD SOLVENT LATITUDE

Their wide solubility window simplifies inventory management—one resin grade can cover multiple ink systems simply by adjusting the alcohol/ester ratio.

3. OPTICAL CLARITY AND GLOSS

Acrylic chemistry inherently enhances light reflection and transparency, giving THYON inks a distinct visual brilliance compared to the slightly hazy films formed by NC.

4. LONG SHELF LIFE

As a non-nitrated polymer, THYON is chemically stable. It does not release nitrites or form nitrosamines, eliminating discoloration and odor problems during storage.

5. SAFE HANDLING AND TRANSPORT

Supplied as a dry solid flake, THYON poses no explosion risk and requires no damp storage or special fireproof facilities. It dissolves readily at room temperature with no heating needed, reducing both energy use and workplace hazard.



Environmental and Economic Benefits

Adopting acrylic resins like THYON allows ink makers and printers to advance sustainability goals without sacrificing productivity.

1. Reduced VOCs

Alcohol-soluble grades enable near-complete replacement of high-volatility solvents, lowering emissions dramatically.

2. Improved Recyclability

These inks leave no reactive nitrogen residues and remain fully compatible with mechanical recycling streams for polyolefin and PET films.

3. Energy Efficiency

High-solids inks dry faster, allowing lower oven temperatures and shorter dwell times.

4. Simplified Logistics

Non-hazardous shipping classification reduces insurance and regulatory costs.

5. Competitive Economics

On a total-cost basis, including handling, solvent recovery, and safety compliance, THYON inks often equal or outperform NC formulations in cost efficiency.



For converters, these advantages translate into cleaner operations, improved sustainability metrics, and greater confidence when supplying multinational brand owners who now demand NC-free packaging inks.

Typical Formulation Framework

Below are a couple of starting point formulations for ink development. White lamination ink Formulation (percentages by weight):

- TiO_2 dispersion - 50 %
- Polyurethane resin - 8 %
- THYON resin solution - 20 %
- Crosslinker (e.g., TYTAN AP100) - 1.2 %
- THYON OX787 solution (3 %) - 2 %
- Ethanol/Ethyl Acetate - 18.8 %

White Surface print ink Formulation (percentages by weight):

- TiO_2 dispersion - 50 %
- THYON resin solution (40% solids) - 20%
- Polyurethane resin - 8 %
- Polyethylene wax - 1.5%
- Crosslinker (e.g., TYTAN AP100) - 1.2 %
- THYON OX787 solution (3 %) - 2 %
- Ethyl Acetate - 5 %
- Ethyl Alcohol - 12.30%

For color inks, solvent balance and THYON grade can be adjusted accordingly. These systems typically require no aromatic or ketone solvents, simplifying compliance with global food-packaging standards.

End-Use Applications

In the work we did, THYON-based inks have proven successful in both surface and reverse-printed structures, including:

- Frozen and refrigerated food packaging (LDPE, BOPP films).
- Snack and confectionery wrappers (BOPP/CPP laminates).
- Retort and pet-food pouches (PET/Al/CPP).
- Pharmaceutical blister foils.
- Sustainable films such as PLA and other bio-derived substrates.

Because THYON resins maintain adhesion on diverse substrates, converters can streamline ink inventories; one resin platform serving both flexo and gravure lines.

A Practical Path Forward

Transitioning from NC to an acrylic resin like THYON is straightforward. Formulators can begin by substituting THYON for NC on an equal resin-solids basis and fine-tuning solvent balance. Early adopters report identical viscosity behavior and re-solubility on press, with measurable gains in gloss and storage stability.

For converters, moving away from nitrocellulose means:

- Eliminating the fire risk and regulatory complexity of nitrocellulose.
- Reducing VOC emissions and solvent usage.
- Meeting recyclability and sustainability mandates without costly equipment changes.

Brand owners benefit as well. Packaging printed with acrylic based inks aligns with corporate sustainability targets, reduces environmental liability, and ensures compliance with global recyclability standards.

What if acrylic resins like THYON became a new standard?

The printing-ink industry stands at a turning point. Nitrocellulose, long the workhorse of solvent inks, no longer fits the realities of modern production, environmental responsibility, safety, and supply resilience. These acrylic resins provide one such solution. They deliver all the hallmarks of nitrocellulose - fast drying, high gloss, and reliable adhesion, while offering superior safety, lower VOCs, and compatibility with today's polyurethane and alcohol-based systems. It's this latter reality- one of broad compatibility, which makes this approach achievable.

By adopting a resin like THYON, ink makers and converters can maintain current printing infrastructure, improve operational safety, and ensure full alignment with future environmental legislation. In short, these new resins enable the versatility and speed of solvent-based printing—without the legacy risks of nitrocellulose.

Endnotes

1. European Commission, Packaging and Packaging Waste Regulation (PPWR), 2024.
2. Diransa S.R.L., THYON SR Series Technical Brochure, 2025.
3. Ink World Magazine, "Sustainability Trends in Packaging Inks," 2024.
4. Diransa Application Laboratory, Comparative Tests: THYON vs. NC, 2025.
5. OECD, Chemical Safety Profile: Nitrocellulose, 2023.

About the Author

Terence Kenneth is a coatings chemist and technical consultant specializing in sustainable ink formulations. He founded Ink Intelligence LLC and has over 40 years of experience in solvent-based, water-based, and UV ink systems.



Diransa SRL. Headquarters & Industrial Plant

Pres. Roberto M. Ortiz 2485
B1852OJK Burzaco, Buenos Aires, Argentina
Phone: (+54) 11 2152 -1010
ventas@diransa.com.ar
www.diransa.com.ar



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