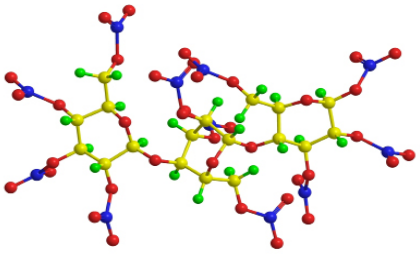
SunSustain Series: Understanding Nitrocellulose

Understanding the issues with Nitrocellulose and the impact on Sustainability:

Just what is going on with nitrocellulose? Chances are you have heard some buzz about nitrocellulose (NC) and you may be wondering what it's all about. And if you haven't already heard something, this article is still for you, too, because you should be aware of what is happening with respect to this very important binder resin that goes into a huge volume of our commercial inks and coatings.



What is nitrocellulose and why is it important to Sun Chemical and the industry? Nitrocellulose is an essential component in most of the solvent-based ink and coating formulations, which is the single-largest category in the market. This resin offers excellent formulation, printing, and application

What's the issue from a sustainability/recycling standpoint?

The issue is what happens once the application phase of printed plastic products is fulfilled, most notably packaging. With increasing global focus on plastic recycling to avoid the adverse ecological effects of landfilling, incineration or leakage into the open environment, the end-of-life properties of plastic packaging printed with nitrocellulose inks come into play.

In an ideal plastic package life cycle (figure left), the discarded item is collected, sorted by material type, then sent to a recycling facility where it is shredded and washed to remove impurities, and finally melted and extruded to recover the plastic for reuse as a new product. This melting and re-extrusion process happens at high temperatures, typically around 230-250°C. Nitrocellulose, despite all its outstanding properties, is not thermally stable at such elevated temperatures, and any residual nitrocellulose-containing inks and coatings on the plastic will degrade, forming volatiles, odor, severe discoloration, mechanical defects, and chemical contamination in the recovered material. This negatively impacts the value of the recycled plastic, limiting its use for higher-end new applications, relegating it to so-called downcycling outlets thereby decreasing the profitability for the recyclers.

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How is the market reacting?

The plastics and plastics packaging market and value chain are increasingly aware of these recyclability limitations, even if not fully knowledgeable of the details behind them. Various studies surrounding the issue have been circulated publicly, creating concerns with converters, brand owners and most importantly, recyclers. Starting in Europe, producer responsibility organizations that publish packaging design guidelines and that define minimum recyclability standards have taken action to restrict nitrocellulose use, both directly and indirectly. In Sweden, for example, local packaging design guidelines specify that printing inks should have thermal stability up to 240°C. Similarly, in Germany, the most recent update on minimum standards for determining packaging recyclability issued in August 2023 by the ZSVR (translated as Central Agency Packaging Register) explicitly prohibits nitrocellulose in polyethylene-based laminated flexible film packaging. The same agency has signaled intent to include surface-printed, non-laminated structures as of later in 2024.

> "While the nitrocellulose challenge is significant for the packaging market, Sun Chemical is uniquely positioned to offer a wide range of solutions from its existing commercial portfolio, and is simultaneously designing new alternatives with its internal resin development capability."
>
> **Dr. Nikola Juhasz, Global Technical Director, Sustainability**

More broadly, RecyClass, which publishes Europe-wide plastic recyclability guidelines under the auspices of Plastic Recyclers Europe (PRE), issued updates to its printing ink guidance, putting nitrocellulose-containing products into the low or, most predominantly, no compatibility categories. This forces brand owners to remove recycling claims from their packages, which can cost them revenue as an increasing number of consumers consider environmental fate a key buying factor.

What solutions are there?

It's important to note that these recyclability issues with nitrocellulose happen only when printed plastic materials are exposed to high temperatures. If inks or coatings are first washed off the substrates (that is, deinked) before being re-extruded, then the resin isn't subject to thermal decomposition. This approach also removes pigment that would otherwise discolor the recycled material, so the washing/deinking concept is one that is endorsed by cross-industry groups like CEFLEX (who are working to improve sustainability of flexible packaging) and EUPIA (the European printing ink association). In fact, Sun Chemical co-authored a position paper published by EUPIA about the benefits of deinking plastic packaging waste. This solution is most relevant for surface-printed applications, where the inks and coatings are accessible to washing liquids.

When inks are sandwiched between films in a more complex lamination structure their removal is much more difficult, but our development teams are working on this scenario. The other solution to the nitrocellulose stability challenge is alternative chemistries formulated on different resin systems. Sun Chemical already offers a wide range of non-nitrocellulose inks and coatings commercially, including products based on polyurethane (PU), polyvinyl butyral (PVB), polyamide (PA), polyester (PET), acrylic, blends of these and more. The choice of the best replacement alternative comes down to the specific requirements of the application in question. And work continues in our laboratories towards innovative new materials that will further expand the range of available options.

How will Sun Chemical respond today and in the future?

Today, Sun Chemical's commercial and technical teams are working closely with our customers across different market segments, as well as with the brand owners that they supply, to help them understand the full life cycle impacts of printed products, including on recyclability, and to find the best alternative solutions from our extensive portfolio. We are also working through numerous industry and cross-industry associations, especially those that are focused on defining recyclability standards (and eventual regulation), to ensure that those guidelines are well grounded in scientific facts and data. As a company with a key position in the value chain, Sun Chemical remains committed to delivering color, differentiation, and functionality through our product portfolio, while also enabling sustainability in the applications and markets we serve.

Join the Sustainability discussion and follow our journey on LinkedIn and follow #SunSustainability!

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