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Statement on recycling, sustainability, and end of life options of Sun Chemical products

To whom it may concern

The umbrella standard (EN 13427:2004) defines the standards that apply to packaging with regards to recycling. This standard recommends the level in the supply chain at which the various assessments for conformity should be carried out. As part of this process, packaging must be assessed against at least one of the three recovery standards:

- **Material recovery (EN 13430:2004)**
  EN 13430 (Requirements for packaging recoverable by material recycling) defines the requirements that recyclate needs to adhere to, to be determined to be recoverable in the form of material recycling.
- **Energy recovery (EN 13431:2004)**
  EN 13431 (Requirements for packaging recoverable in the form of energy recovery, including specification of minimum interior calorific value) sets out the requirements for packaging to be considered as suitable for energy recovery.
- **Organic recovery (EN 13432:2000)**
  EN 13432 (Requirements for packaging recoverable through composting and biodegradation) defines the requirements for packaging to be considered as recoverable through composting and biodegradation

Every product that is placed on the market should include some thought as to its end-of-life and how its associated packaging will be disposed of and recycled.

The circular economy (as championed by the Ellen MacArthur Foundation) is widely accepted and is increasingly influencing regulations across Europe and worldwide - for example, the influence in the EU Green Deal roadmap and the EU Chemicals Strategy for Sustainability.

The circular economy illustrates that there are two routes for processing waste products:

1. Mechanical/chemical recycling, or
2. Recycling via a biological/composting route

Both routes are equally viable, and it is important to maximise the value of a recyclate generated by the recycling process. In addition to considering end-of-life recycling options, we can also consider environmental impact. The most considered environmental impact is Global Warming Potential (GWP) or carbon footprint and this can be influenced by using sustainability sourced bio-renewable content or recycled content.

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Mechanical/chemical recycling

The requirements for making packaging recoverable by material recycling are set out in EN 13430. The route for recycling depends on the substrate that the product is printed onto.

Due partly to the low w/w% of inks in packaging, most inks, coatings, or adhesives do not significantly impact the mechanical or chemical recycling process enough to affect a packaging's recyclability. If requested, Sun Chemical can assess the potential impact of specific products on specific recycling processes.

Printed paper/board can be recycled without being deinked, however, there can be some residual ink in the recycled paper/board meaning that it is slightly discoloured. In some situations (most commonly with post-industrial paper-based waste) the printed paper/board is deinked using a floatation process following the separation of the paper fibres. The European Paper Recycling Council have a scorecard that can be used to rate how easily an ink can be separated from the paper fibres. [1]

Today, many plastics are commonly recycled without being deinked; however, with the emergence of new deinkable ink technologies and with increasing interest from the market, this is an evolving situation, which Sun Chemical is supporting through new product developments. When plastic packaging is recycled without deinking there may be an effect on the physical properties of the material, which may limit the end market applications the recycled plastic can be used in. The main issues that printing products can cause with recycling plastic are:

- **Issues related to sorting**
  - **Black ink**

    MRF's (Municipal Recycling Facilities) use NIR optical sorting technology to sort plastic recyclate. However, when black ink made from carbon black completely covers a plastic material the NIR sensor is absorbed by the carbon black which results in non-reflection and therefore the packaging is unable to be correctly sorted. To address concerns, the European Printing Ink Association (EuPIA) completed testing to determine the effect of black ink printed onto packaging. The testing concluded that if a black ink (made with pigment black 7) is printed at 100% coverage on plastic packaging, then it will block the NIR reflection. Furthermore, even at lower concentrations of black pigment (medium grey shades), the signal can be blocked when printed with full (100%) coverage. However, if the coverage is less than 80%, then the NIR sensor can correctly identify the plastic packaging. Therefore, if packaging is not printed with greater than 80% coverage of carbon black ink, then it will be able to be sorted using NIR sensors. There are also carbon black free alternatives that can be proposed for heavier ink coverages.

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- **Issues related to recycling**
  - **Polyvinyl chloride (PVC)**

    When PVC is broken down and heated to reform, it can result in the production of HCl and other solid hazardous waste which can damage the extruder and become a safety hazard.
  - **Nitrocellulose (NC) based inks**

    Temperatures in a plastic extruder can exceed 200°C. At temperatures above 160°C, nitrocellulose is unstable and can break down. Therefore, NC based inks can break down in extruders, which can produce gel particles and/or small amounts of brown discolouration (charred particulates) in the recyclate.

    NC based inks can also decompose at these temperatures to release gas, which can affect the quality of the recyclate. This can be mitigated by using degassing units on the extrusion machines.
  - **Other ink resin chemistries such as polyurethane**

    These resin chemistries have no direct detrimental effect on the extruder but because they have a different melt temperature to the bulk recyclate, they have the potential to cause gel particles, which compromise the mechanical properties of the recycled plastic. This can to some extent be mitigated using compatiblising additives.

Biodegradability

To determine the biodegradability of a product with fixed conditions for variables such as temperature and time, we use compostability standards. The harmonised European standard, EN 13432 is used to determine the compostability of packaging waste.

For this standard, if each individual ink is present at less than 1% of the total pack weight, and the weight of all the ink is less than 5% of the pack weight, then the printed ink itself doesn't need to be compostable. Further, the ink itself must not be ecotoxic, have no negative effect on plant growth and not contain any heavy metals.

The two substances commonly found in inks that may be an issue are:

- Copper – from copper phthalocyanine pigments
- Zinc – from some metallic pigments.

If a product contains any ecotoxic materials, then we can calculate the amount allowed to remain compliant to EN 13432. This information is available upon request on a per-product basis.

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Carbon footprint

The European Printing Ink Association (EuPIA) conducted work that confirmed that a printing ink, regardless of its composition, makes a small contribution (between 1-3%[2]) to the carbon footprint of printed products.

EuPIA also conducted a life cycle assessment (LCA) of many different printing ink technologies and concluded that the type of printing ink technology did not significantly change the LCA results. The LCA (cradle-to-gate) determined that 1kg of printing ink has a GWP or carbon footprint of 3293g CO_2 eqv. This CO2 eqv is based on a printing ink that has no bio-renewable materials. If the amount of sustainably sourced bio-renewable materials is increased by 50% this reduces the carbon footprint by approximately 50% (a carbon footprint of ~1647 g CO2 eqv).

Therefore, to consider the carbon footprint of our products we must look at the sustainably sourced bio-renewable content (BRC) of our inks. The bio-renewable content of an ink can be calculated in two ways:

1. Carbon isotope (carbon-14) analysis
2. Theoretical calculations by assessing each raw material individually

Where possible we can inform our customers of the testing results of the carbon isotope (C14) analysis by independent laboratories. If requested, we can also assess products that have not been tested using declarations from our raw material suppliers.

To conclude, Sun Chemical can help our customers understand how our products affect the recycling process, whether they interfere during the composting process and their carbon footprint.

On behalf of Sun Chemical

Callum Parkins
Product Stewardship
Sun Chemical Ltd.

[1] - European Paper Recycling Council, 2017. Assessment Of Printed Product Recyclability. Deinkability Score. [online] Available at: <https://www.paperforrecycling.eu/publications/> [Accessed 27 May 2020].

[2] - EuPIA, 2010. Carbon Footprint Of Printing Inks. [online]. Available at: <https://www.eupia.org/fileadmin/FilesAndTradExtx_edm/2010-06-17_Carbon_Footprint_final_01.pdf> [Accessed 27 May 2020].