Anna Berggren, Perstorp, highlights the importance of environmental responsibility in the coatings and chemicals industry

100 years of sustainable chemistry

In recent years, the focus on the environmental impact and health concerns surrounding the chemicals used in coating products has increased dramatically. This has seen a growth in 'greener' and more sustainable options, but what exactly do we mean when we talk about 'going green' in the chemicals and coatings industry? For Perstorp, the drive towards renewable, low carbon footprint solutions is part of the company's future but it also takes it back to its roots. By developing products using renewable raw materials and energy provided by nature, in some ways it is returning to the second generation fuel and bio-based chemicals that it produced more than 100 years ago. Industry has become more aware of the need to be sustainable. This is particularly true in the chemicals and coatings industry, which since the start of the plastic age has relied heavily on fossil-based raw materials and organic solvents that emit Volatile Organic Compounds (VOC).

Today we are seeing a move away from fossil-based to renewable resins and coatings. There is also a strong trend towards low/no VOC and waterborne solutions. From the very beginning, Perstorp has used renewable raw materials for chemicals. Since then, the company has continued to take an active lead in finding new ways for leveraging sustainability in different parts of its business.

SUSTAINABLE CHEMISTRY 2030

Some 100 years ago, Perstorp cultivated an awareness of environmental responsibility. The company was started by utilising the local natural resources of the heavily wooded region of southern Sweden to produce what we today call second generation bio-based chemicals and fuels. So, there really is a 'retro chemistry' aspect integrated into sustainable chemistry.

That is why in 2010, Perstorp, along with the four other international chemical companies in Stenungsund, Sweden, developed the Sustainable Chemistry 2030 vision of a sustainable society and a thriving chemical industry. According to the vision, the group of companies forms the centre for sustainable products with production based on renewable and recycled raw materials and energy.

The Sustainable Chemistry 2030 vision includes the aim for organic molecules, such as ethylene, propylene and natural gas to be derived from renewable and recycled sources such as bio-feedstock and recycled plastics. In doing so, the industry's dependence on fossil oil and gas can be significantly reduced, or even removed altogether. This can often be achieved without affecting either the chemical processes in the factories or the quality of the end products.

This vision also ties in closely with the goals of the Skogskemi (Forest Chemistry) innovation development project, financed by the Swedish Government's VINNOVA's programme 'Challenge-Driven Innovation'. Here, Perstorp and the Stenungsund hub have joined with other interested parties in Sweden to investigate and develop the value chain with the forest industry as a supplier of renewable feedstock for the chemical industry. This sustainable focus has remained a core part of Perstorp. In fact, the company's initiatives are now centred around contributing to six of the United Nations' Sustainable Development Goals – one of which is ensuring a climate-neutral world through sustainable and environmentally positive developments.

SUSTAINABILITY MATTERS

It is one thing to push the development of sustainable chemistry, however, in the past few years customers have become increasingly aware of the benefits of sustainable chemistry, resulting in a steady growth in market demand. Discussions with key customers have shown that sustainability is of increasing importance, and product requirements now include renewable raw materials and low carbon footprint products.

In addition to eliminating fossil-based raw materials, the overall sustainability and environmental impact of a customer's end-product is becoming key. For Perstorp that means also looking at product end-of-life (biodegradability and recyclability) and improving the sustainability of the basic building blocks and feedstock elements. It also means enabling more sustainable end-product properties, such as lead-free PVC, next generation plasticiser, bioplastics and, especially relevant to coatings, reducing the level of VOCs released as the coating dries.

VOCs are neither good for the environment or for the people applying the coatings, so minimising VOCs is a focus

area for the paint/coatings industry. One way to do this is to use waterborne acrylics instead of solventborne alkyds for paints and coatings.

An even better solution is to use waterborne alkyds based on sustainable chemistry. Perstorp is supporting the industry in making this move with its 'beautiful alkyds' project, offering technical support and in-depth knowledge of three waterborne alkyds technologies.

As well as having a low VOC, waterborne alkyds also have a high renewable content and a lower carbon footprint. They offer superior wood protection in comparison to acrylics and can be combined with other resin technologies to provide enhanced protection while still helping to minimise the environmental impact of coatings.

Another natural beauty of the waterborne alkyds is that only exposure to air is needed for the drying process to occur, with no other additives needed. Other hazardous chemicals, such as cobalt and MEKO (Methylethyl ketone oxime), that are often present in solventborne alkyds can be replaced or are simply not needed at all.

REDUCING CARBON FOOTPRINT

Switching to waterborne alkyds is an important first step to sustainable products. To go even further, waterborne alkyds

can be made even more sustainable with renewable pentaerythritol solutions, such as Perstorp's Voxtar.

Voxtar is the world´s first renewable pentaerythritol product and was first introduced to the market in 2010. Based on partly or fully renewable raw materials through a mass balance concept, the Voxtar products give the same trusted efficiency, security and high performance as fossil-based pentaerythritol products. From cradle-to-grave, Voxtar can reduce the carbon footprint by up to 80% compared to conventional, fossil-based pentaerythritol products.

The main application area of Voxtar in coatings is as a branching monomer for alkyd resins used in paints. Voxtar improves the sustainability profile of waterborne alkyd resins by offering a reduction in carbon footprint and compared to acrylics it also delivers outstanding protection of wood and other coated materials.

As part of its ongoing development, Perstorp is working on renewable replacements for other fossil-based products. This will present manufacturers with a choice of sustainable solutions, based on renewable resources, to meet the needs of different markets.

When it comes to 'going green' in the chemicals and coatings industry, it is all about being renewable and sustainable; two cornerstones of Perstorp's commitment to the industry and a core focus within the company. While other companies may talk about sustainability, for more than 100 years Perstorp has been letting its actions show its ongoing and active commitment to sustainable chemistry.

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Scientists develop plant-derived sprayable nanocoating technique

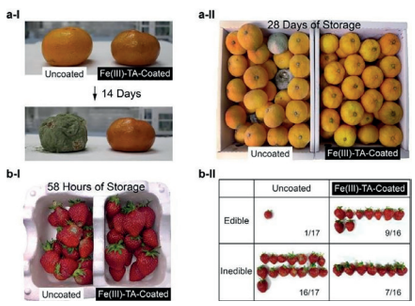
A research team from the Korea Advanced Institute of Science and Technology (KAIST) led by Professor Insung Choi of the Department of Chemistry has developed a sprayable nanocoating technique using plant-derived polyphenol that can be applied to any surface.

This new nanocoating process can be completed in seconds to form nanometer-thick films, allowing for the coating of commodity goods, such as shoe insoles and fruits, in a controlled fashion.

The technology has been patented and is currently being commercialised for widespread use as a means of preserving a wide range of products. The research results have recently been published in *Scientific Reports* on August 1, 2017.

Polyphenols, a metabolite of photosynthesis, possess several hydroxyl groups and are found in a large number of plants showing excellent antioxidant properties. They have been widely used as a nontoxic food additive and are known to exhibit antibacterial, as well as potential anti-carcinogenic capabilities.

Polyphenols can also be used with iron ions, which are naturally found in the body,



A-I, II: Uncoated and coated tangerines incubated for 14 and 28 days in daily-life settings. B-I: Uncoated and coated strawberries incubated for 58 hours in daily-life settings. B-II: Statistical investigation of the resulting edibility

to form an adhesive complex, which has been used in leather tanning, ink, etc.

The research team combined these chemical properties of polyphenol-iron complexes with spray techniques to develop their nanocoating technology.

Compared to conventional immersion coating methods, which dip substrates in specialised coating solutions, this spray technique can coat the select areas more quickly.

The spray also prevents cross contamination, which is a big concern for immersion methods. The research team has showcased the spray's ability to coat a variety of different materials, including: metals, plastics, glass and textile fabrics. The polyphenol complex has been used to form antifogging films on corrective lenses, as well as antifungal treatments for shoe soles, demonstrating the versatility of their technique.

Furthermore, the spray has been used to coat produce with a naturally antibacterial, edible film. The coatings significantly improved the shelf life of tangerines and strawberries, preserving freshness beyond 28 days and 58hr, respectively.

Professor Choi said: "Nanocoating technologies are still in their infancy, but they have untapped potential for exciting applications. As we have shown, nanocoatings can be easily adapted for several different uses and the creative combination of existing nanomaterials and coating methods can synergise to unlock this potential."