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COMFORTABLE & SAFE FACE MASKS

ON THE WORKFLOOR AND IN CROWDED AREAS

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During the second corona wave, everyone is urged to wear a face mask in crowded areas and at work to protect themselves and/or others from being infected with the covid-19 virus and to stop its spread. Many different masks are now being marketed, making it difficult to see the wood for the trees. How and who does the mask protect? Which mask is the best choice in which situation? How do you recognize approved masks? How do you manufacture a mask that is comfortable to wear while providing the right protection level?

During the first corona wave, many (textile) companies changed their production to meet the shortage of protective equipment, and more specifically face masks for healthcare and community purposes. It soon became clear that the required machinery (for the production of nonwoven material and the assembly of face masks) was not available in Flanders and that the product knowledge was insufficient.

Companies then used their production equipment and available materials, but not all masks met the safety and comfort requirements. Meanwhile, wearing face masks on the workfloor and in community life has become common practice. However, it often turns out that some face masks are rather uncomfortable due to the use of insufficiently breathable material, a low heat and moisture dissipation (fogging glasses), and poor fit (adult vs. children, as well as anthropometric differences of the face).

POORLY FITTING, UNCOMFORTABLE MASKS COMPROMISE SAFETY!

Centexbel, **VITO** and the **FTILab+ of HOGENT** joined forces and launched the Covvid-PBM project in October 2020. During this 1-year project, the three partners will compile and disseminate information on requirements, testing, and certification (if applicable) of the different types of face masks (surgical, FFP, and community). As the COVVID-PBM project will strongly emphasize the comfort aspect of face masks, a series of community face mask models and fits will be tested for their comfort during wearing tests, both at school and on the workfloor to gain more insight into the choice of materials and fit.

The information will be disseminated to purchasers, manufacturers and citizens. **Purchasers** (hospitals, residential care centres, local authorities, prevention advisers) will be informed about the types of face masks suitable for their target group and about selection criteria. **Manufacturers** will receive information about the material (combinations), design and fit, production processes and the expected level of protection. **Citizens** will be informed about the different types of face masks and their field of application as well as on how to make their own masks.

Project website: https://www.centexbelpresents.be/en/covvid-pbm

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

Covvid-PBM is a COOCK-corona project supported by the Flemish Agency for Innovation and Entrepreneurship under number HBC.2020.2741

BIOcoat

EXPLORING BIO-BASED CHEMISTRIES AND INGREDIENTS FOR COATINGS

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The promotion and marketing of bio-based polymers far exceeds the offer in the field of bio-based coatings. COOCK project Biocoat therefore creates a collective platform to evaluate a whole series of bio-based chemistries on different types of substrates. Biocoat is a joint initiative of Sirris and Centexbel coating experts and will investigate bio-based coatings on metal, polymer, stone, textile, and non-woven substrates. The project's user group is composed of companies from different sectors, including both suppliers and end-users.

Why is the difference in supply between bio-based polymers and bio-based coatings so great? One of the reasons might be that a coating is only a very thin layer and therefore the smallest part of a product. However, a coating often protects the substrate. Because coatings need to be tough, provide barrier properties or protection, the choice to make these durable strong polymers from fossil resources is standard and seems to make sense. Furthermore, the fact that most coating formulas contain lots of additives, rheology modifiers, pigments, dyes and fillers makes it hard to produce fully bio-based coatings, in which all ingredients are replaced with bio-based ones.

Centexbel and Sirris guide you through the plethora of bio-based and/or biodegradable chemistries and polymers by providing a free "white paper", describing different bio-based coating chemistries. During regular events we showcase practical studies in our laboratories, and, twice a year, we organize an industry-oriented course on biopolymers.

The Biocoat project aims to explore a wide variety of bio-based ingredients/chemistries for coatings and to demonstrate their possibilities and limitations to the industry. We are open to questions and suggestions throughout the project.

The final aim of all COOCK projects is to prompt the industry to initiate its proper R&D projects, to create new products and to introduce more innovation.

On the next page we describe a few coating developments that are being shown during the events we are organizing during the Biocoat project.

The project is free of charge and anyone can join. If you are interested, feel free to contact us, or have a sneak peek at our white paper!

Read more and subscribe to the project: https://www.centexbel.be/projects/biocoat

Download the biocoat white paper: https://mailchi.mp/sirris.be/biocoat-white-paper

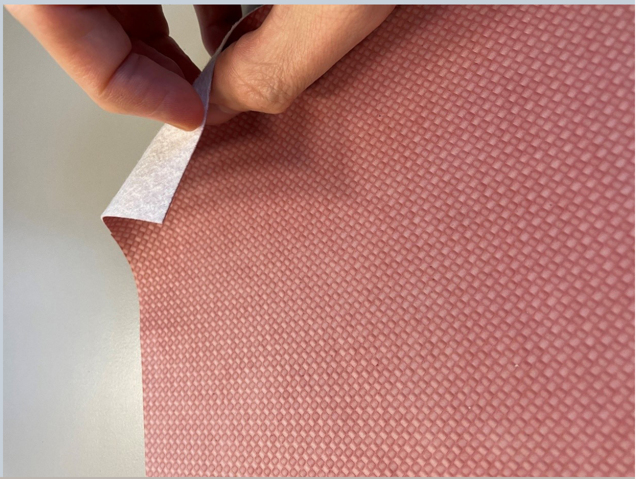
Biocoat is an initiative of Sirris and Centexbel. It is part of the COOCK collective R&D initiative of Vlaio under the grant agreement HBC.2019.2493

One example of an exploratory study is the choice of existing bio-based fillers. A filler is the first and most obvious choice to increase the bio-based content in any product, but in the case of coatings, dispersibility, availability, color and particle size are particularly important. We explored cellulose particles, pulp, cork, wood dust, bacterial fillers and polysaccharides as fillers. In many cases dispersing agents were required, which are also available in bio-based versions. The extent to which fillers can be used is also often dependent on the viscosity increase of the formulation and is highly dependent on the selected coating chemistry.

Picture 1: This 100% bio-based and fully biodegradable coating uses a polymer produced by bacteria as binder and has cork as a filler material, giving the coating a velvety touch.

The binder choice is obviously the most important parameter in the development of a coating. Especially in the case of biodegradable binders, it is difficult to create a balance between a good durability of the coating and a good biodegradability. Polymers produced by bacteria, such as polyhydroxyalkanoates, are highly biodegradable, but the coatings are fragile. Partially bio-based polyurethanes - offered as 2K systems or water-based dispersions - are more durable and require a careful formulation with bio-based fillers, plasticisers and dyes.

Picture 2: More durable coatings are currently still partially bio-based. This artificial leather has a >80% bio-based content, enough for many bio-based labels and is based on the newest generation of bio-based polyurethanes. The coating contains cellulose-based fillers and bio-based pigments and dyes, and is applied on a ecologically friendly produced viscose.



Our latest patent-pending development is based on polylactic acid, to create mildly washable printing inks as an alternative to PVC screen printing inks.

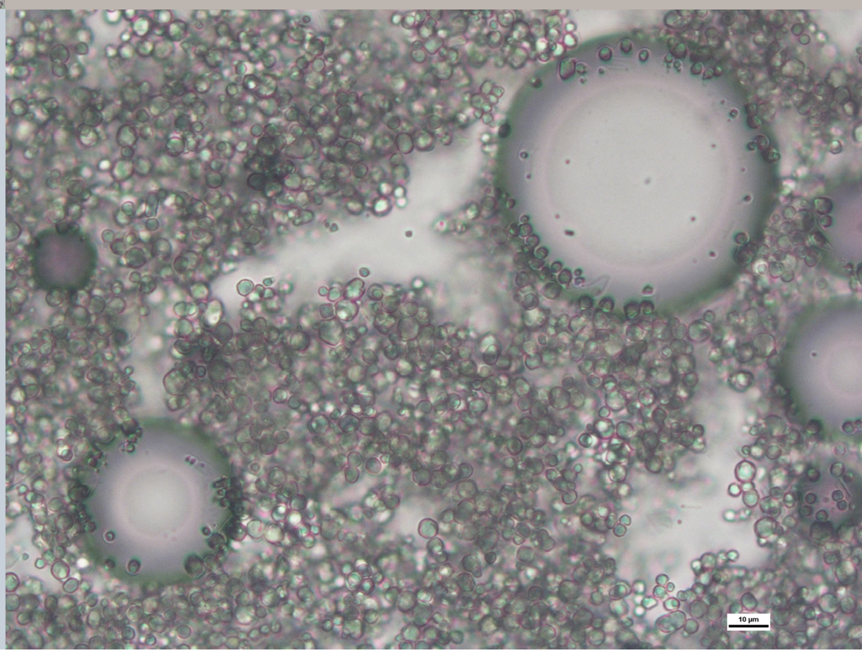
One of the greatest advantages is the biodegradability of these prints, meaning that the fragments of the prints that are washed away will degrade over time and will not end up as polluting microplastics.

Picture 3: A screen-printing ink based on polylactic acid, they are mildly washable at 30°C and do not contribute the microplastics as it is mixed with highly biodegradable eco-friendly plasticisers.

The Biocoat project also examines other aspects of coatings, including their processability.

For example, vegetal waxes are difficult to process on paper or textiles. Although they can be applied as hotmelt, their extreme low viscosity makes it nearly impossible to apply thin flexible layers. We therefore prepared emulsions of vegetal waxes that can be used for dipping or coating on a variety of substrates, including textiles and paper, providing a hydrophobic effect.

Picture 4: Vegetal waxes were dispersed in as a fine emulsion suitable for coatings



BIO-BASED ISOCYANATE FREE POLYURETHANE TEXTILE COATINGS

THE NEW KID IN THE BLOCK

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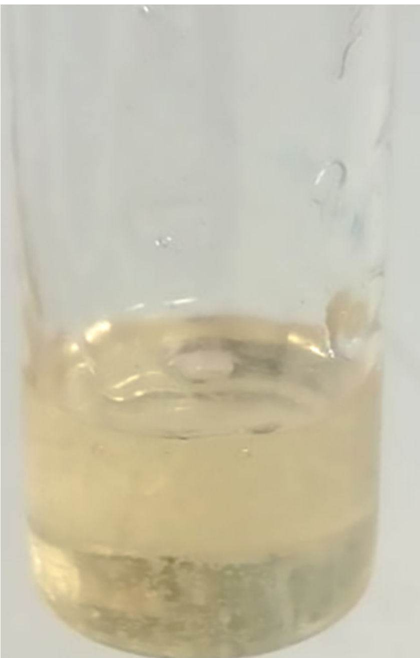
The Interreg Flanders-Netherlands BioNIPU project focuses on the development of 100% bio-based and isocyanate-free polyurethane (bio NIPU) for end products in the textile and synthetic rubber industry. The production of biopolymers for commercial applications is increasing each year. However, biopolymers for textile coatings and synthetic rubber (elastomers), such as polyurethane, are only available for a limited number of applications and not fully bio-based. Polyols and isocyanates are used for the synthesis of polyurethane. A proposal to limit the use of isocyanates has been adopted at European level.[1]

The Bio NIPU project therefore focuses on research into alternative building blocks for the synthesis of polyurethane. Fully renewable raw materials - such as residual flows from sugar refining and the production of biodiesel and natural oils and fats - are used to develop bio NIPU. The project consortium consists of Centexbel, Limburgse Urethaan Chemie, Maastricht University, Stahl and Thomas More.

1 https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e180876053



BioNIPU prepolymer

BioNIPU project's chemistry is driven by two targeted applications: bio-based waterborne NIPU coatings and bio-based NIPU elastomers. In order to obtain good properties for these applications, NIPU synthesis must lead to relatively long polymer chains. Building long NIPU chains has already been described in the literature to be one of the toughest challenge for the development of these new materials. To tackle this issue, a two-step synthesis route inspired by the conventional polyurethane synthesis has been designed. In a first step, a NIPU prepolymer with reactive ends is synthesized and, in a second step, this NIPU prepolymer is chain extended by reactive extrusion to form long NIPU chains. Structure of the NIPU can be tuned depending on the chosen building blocks, to adapt its final properties to the needs of coating or elastomer applications.

In the coming months Centexbel will formulate and apply these bio-based NIPU as a coating on textiles. The process parameters will be optimised and the performance and mechanical characteristics (elongation and tensile strength) of the developed bio-based NIPU coatings will be assessed and compared to benchmark waterbased (bio-based) PU.

PROJECT UPDATES WILL BE PUBLISHED ON THE BIONIPU WEBSITE

HTTPS://WWW.BIONIPU.EU

The project 'Bio NIPU' is financed within the Interreg V program Flanders-Netherlands, the cross-border cooperation program with financial support from the European Regional Development Fund with co-financing from the province of East Flanders, the province of Antwerp, the Dutch Ministry of Economic Affairs and Climate and the Flemish government. More info: www.grensregio.eu

PROJECT RESULTS ARE PUBLISHED!

ECOLOGICAL HYDROPHOBIC ADDITIVES AND ANTIBACTERIAL PRODUCTS BY NATURE

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The aim of Duratex, an Interreg V France-Wallonie-Flanders project, was the search of ecofriendly repellents and bio-based antimicrobials for textiles in view of the European legislation that will prohibit and limit the use of (long chain) fluorocarbons. The alternative superhydrophobic or oleophobic finishes that have been developed during the project can be applied via padding or spray.

It is well-known that rough hydrophobic surfaces display an increased hydrophobicity compared to smooth surfaces. Since fabrics have an intrinsic surface roughness, due to their weave pattern and the packing of fibers in filaments, Duratex focused on possible correlations between the surface roughness of fabrics and their water-repellency. More particularly, experimental methods were developed for the characterization of the roughness of fabrics, and mathematical models for the prediction of water contact and roll-off angles on fabric surfaces modified by a range of hydrophobic formulations.

These models and related experiments show that is possible to obtain properties close to superhydrophobicity from fabrics with tailored roughness, coated by fluor-free formulations[1].

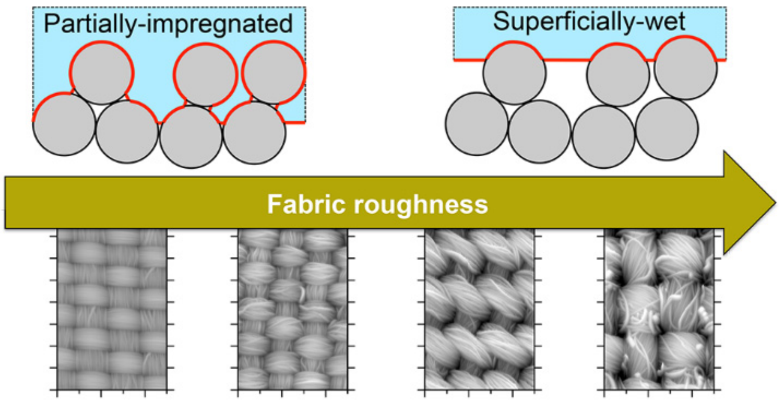
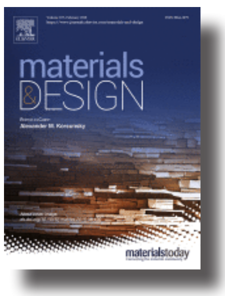


Figure 1: The weaving of fabrics results in increased roughness, leading to an augmented water-repellency without the addition of fluorinated compounds.



1 The above results were published in open access in a scientific journal
How roughness controls the water repellency of woven fabrics,
Materials & Design 2020, 187, 108389,
https://doi.org/10.1016/j.matdes.2019.108389

The roughness can also be modified by spraying silica particles onto the fabrics, thereby increasing the surface roughness of the fibers, leading to superhydrophobic textiles even without the addition of fluorinated compounds. A strong oleophobicity can also be obtained by using C4 rather than C6 or C8 fluorinated compounds[2].

These results demonstrate that it is possible to rationally design fabric surfaces to obtain a high water-repellency without fluorocarbons, either by selecting fabrics of proper intrinsic roughness, or by boosting fabric roughness by tailoring the roughness of fiber surfaces.

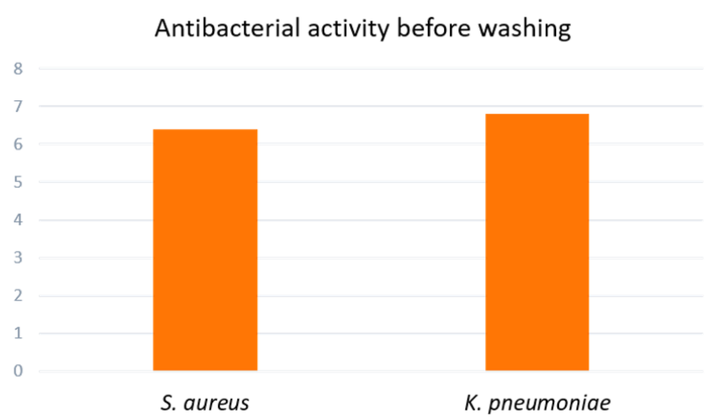
The selected bio-based antimicrobial products were metal-free and from animal, vegetal or marine resources. The antimicrobial additives were incorporated in the yarn during extrusion, in the fabric via diffusion or applied on the surface of the fabrics via padding and coating.

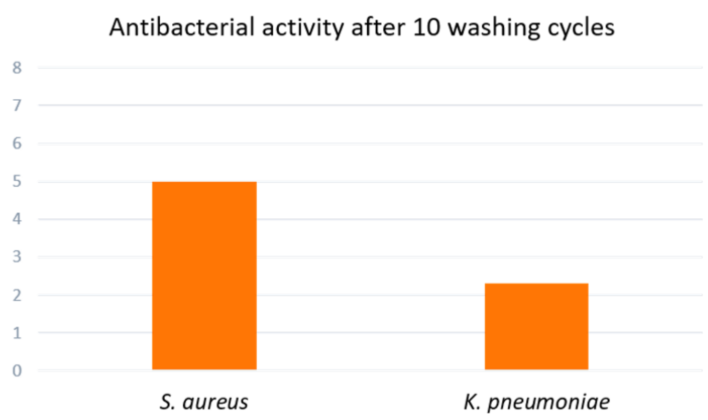
The antibacterial activity (A) of treated samples was evaluated according to **ISO 20743 Textiles - Determination of antibacterial activity of textile products.** The antibacterial activity is classified as follows:

A >3	**strong antibacterial activity**
2 < A <3	**significant antibacterial activity**
A <2	**insufficient antibacterial activity**

Monolaurin is found in coconut oil and known to have antimicrobial effects in vitro. The antibacterial effect of monolaurin in bio-based polyurethane (PU) coating was assessed. They showed strong antibacterial properties, even after washing at 40°C. The following graphs represent the antibacterial efficiency of the coated samples against gram-negative (*Klebsiella pneumoniae*) and gram-positive (*Staphylococcus aureus*) bacteria before and after washing.

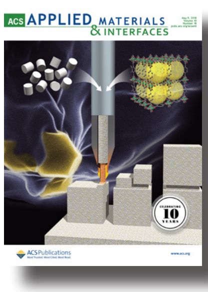
These results indicate the possibility to use bio-based additives to produce antimicrobial textiles without using silver or any other metal.





2 The above studies were published in open access in two scientific journals:

Environmentally Friendly Super-Water-Repellent Fabrics Prepared from Water-Based Suspensions
ACS Appl. Mater. Interfaces 2018, 10, 18
https://doi.org/10.1021/acsami.8b02707
One-Step Aqueous Spraying Process for the Fabrication of Omniphobic Fabrics Free of Long Perfluoroalkyl Chains
ACS Omega 2019, 4, 16660
https://doi.org/10.1021/acsomega.9b02583



For more information about the project and the presentations of the final events: https://interreg-duratex.eu

Interreg
France-Wallonie-Vlaanderen

UNION EUROPÉENNE
EUROPESE UNIE

Wallonie

met de steun van west-vlaanderen de gedreven provincie

GoToS3
DURATEX

Duratex was financed by the Interreg V program France-Wallonia-Flanders (http://www.interreg-fwvl.eu/nl), a crossborder collaboration program with financial support of the European Fund for Regional Development and cofinanced by the province West Flanders and the Walloon Region.

BIO-BASED FIBRE REINFORCED PLASTICS

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BREPLA intends to accelerate the transition to the production and application of bio-based composites by expanding our knowledge of bio-composites and by stimulating and activating their industrial implementation. Cooperation with companies is the key to such a successful transition. The project focuses on 3 sectors with the greatest potential: the furniture industry, the transport sector and the consumer goods sector.

BREPLA WILL TAKE THE USE OF BIO-COMPOSITES TO THE NEXT LEVEL: FROM DEMONSTRATOR TO COMMERCIAL PRODUCT!

By means of collective actions and a broad and easily accessible awareness raising, we involve the entire value chain in the transition to bio-composites:

- technological training for frontrunners
- hands-on workshops for innovation followers
- composite demonstrators
- a project website, blogs, etc. will inform companies about the feasibility of a quick implementation of this technology

BREPLA webpage for all information: https://www.centexbelpresents.be/en/brepla

Join the kick-off meeting which will take place on February 9 from 10.00 to 11.30 Free of charge, but registration is mandatory.

Programme and registration: https://www.centexbelpresents.be/en/events/brepla-kick

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

BREPLA project is a COOCK project of Centexbel in cooperation with Sirris and receives funding from the Flanders Innovation & Entrepreneurship Agency (VLAIO HBC.2020.2567)

New plasma treatment device for semi-industrial and R&D trials

PLASMALINE®

ATMOSPHERIC PLASMA SYSTEM FOR A HOMOGENEOUS TREATMENT OF ALL SURFACES

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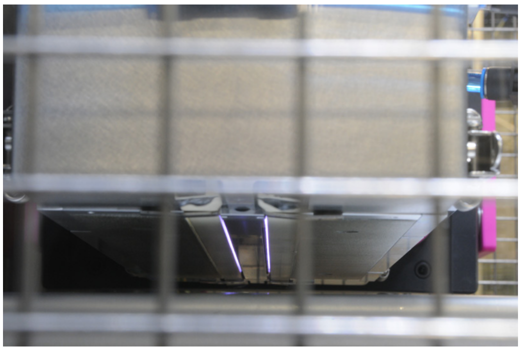

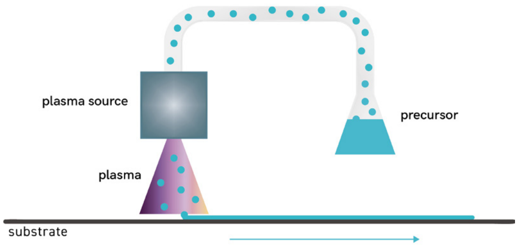

Since September 2020, Centexbel is the proud owner of a PlasmaLine® device from Molecular Plasma Group. With this R&D plasma device, surfaces of any material can be treated in a semi-industrial setting as it is designed to be used inline. By generating an atmospheric pressure plasma in 2 lines of 30cm, the PlasmaLine® can deposit coating layers with thicknesses of a few 10-100nm for a wide range of chemicals/precursors.

During the plasma treatment, a substrate is moved through a plasma zone, which is generated by means of a power source. This plasma zone consists of a gaseous mixture of energetic and active particles (electrons, ions, radicals, photons). Plasma treatment of a substrate can be performed as is (plasma activation) or by adding a precursor (plasma coating). The goal of the treatment is to change the surface chemistry of the substrate.

Typical applications include amongst others: changing a surface's hydrophilicity/hydrophobicity, adhesion improvement, deposition of antimicrobial/antibacterial/antifouling coatings, and increasing the affinity to dyeing, printing, and sterilization.

Compared to traditional surface treatment techniques, plasma treatment has no need for water or solvents and modifies the surface chemistry without altering the bulk properties (tensile strength, tear resistance, flexibility, etc.). **In short, plasma treatment is a highly eco-friendly and efficient technique**.

Centexbel's platforms at your service:

https://www.centexbel.be/en/pilot-platforms

NEW LAB EQUIPMENT

TO DETERMINE THE SUN PROTECTION FACTOR OF COATINGS

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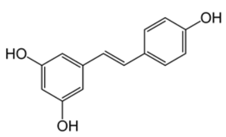
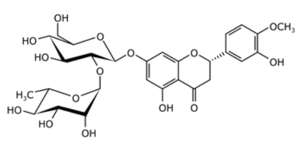
The small fraction of the solar spectrum that reaches the surface of the earth includes visible light, infrared, and highly energetic UV-B and UV-A light (between 280nm and 400nm). Ultraviolet light has harmful effects on materials and are a major cause of skin cancers. Textiles may protect the human skin against the sun, but not all textiles are offering a full protection.

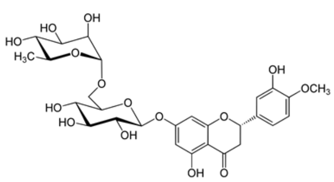
Centexbel is now equipped to quantitatively measure the sun protection factors (SPF) or ultraviolet protection factors (UPF) according to EN 13758-1, AS/NZS 4399, and AATCC TM 183



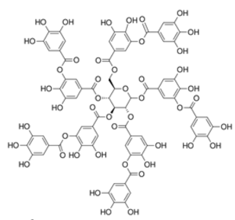
Resveratrol
Abundant in grape skins



neohesperidin
Abundant in orange peels



hesperidin
Abundant in orange peels



Tannin
Floctan, Ajinomoto Omnichem

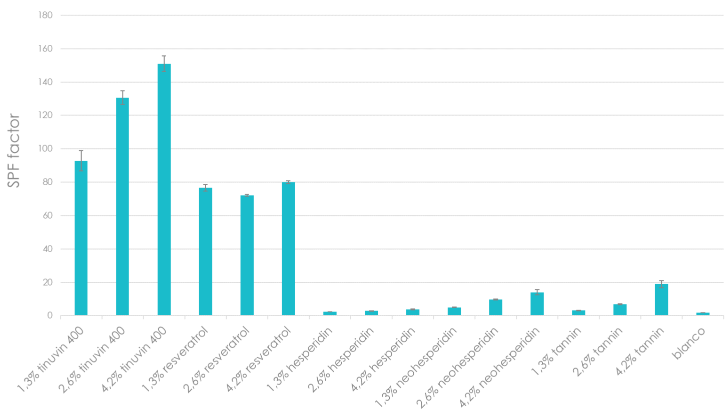
Overview of natural aromatic molecules from agricultural waste streams that are colorless, light-absorbing within the UV-A and UV-B range and easy to disperse in coatings.

A sun protection factor is not to be interpreted as a linear scale: whereas SPF 0 indicates no protection, SPF 10 signifies that one tenth of the harmful irradiation is still reaching the skin. The higher the SPF the better the protection level.

We have examined several bio-based molecules capable of absorbing UV irradiance when added to coating formulations in low concentrations. These molecules were carefully selected on colorlessness, capability of absorbing UV irradiance within the correct wavelengths, and they had to made from agricultural waste streams. We selected **resveratrol**, a molecule derived from skin grapes, **tannins from pits**, **hesperidin** and **neohesperidin** that are extracted from the peels of oranges and other citrus fruits.

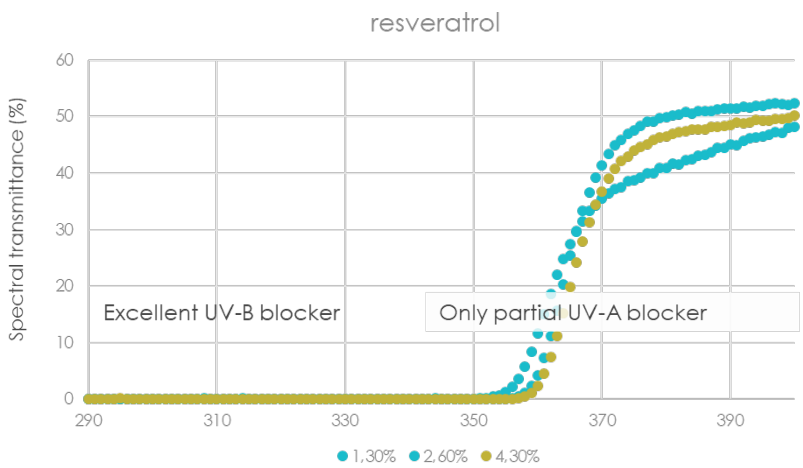
We added them in low concentrations (between 1 and 4.5%) to a thin transparent PU coating of 55µm thick and then determined the SPF of the coatings, using a commercial product (Tinuvin, BASF) as a reference.

The tests were performed on the Solar Light's Ultraviolet Protection Factor (UPF) Analyzer, SPF-290AS



SPF factors of thin polyurethane coatings with low concentrations of protective molecules in them. From the bio-based molecules, especially promising results were obtained with resveratrol. The commercially available product Tinuvin 400 (BASF) was used as reference

Resveratrol resulted in a good SPF even in low concentrations. However, increasing its concentration did not result in an improved sun protection factor, because resveratrol blocks only part of the UV spectrum (between 290 and 360, UV-B) without blocking the spectrum at higher wavelengths.



The spectral transmittance shows that the coatings are blocking nearly all UV between wavelength 290 and 350nm, indicating resveratrol is an excellent UV-B blocker.

However, it still allows the transmittance of the UV-A spectrum.

The calculation of SPF is rather complex, covering the blocking of both UV-A and UV-B. Therefore, to boost the protection level against the sun, resveratrol must be combined with other additives that also block the UV-A spectrum.

The ULTRAVIOLET PROTECTION FACTOR (UPF) ANALYZER that we have recently installed in our physical lab is a great tool not only to determine the SPF or UPF factors of commercial garments, but also to develop novel UV-protective coatings, to determine working concentrations and to acquire knowlegde of the spectral transmittance of different additives.

CONTACT

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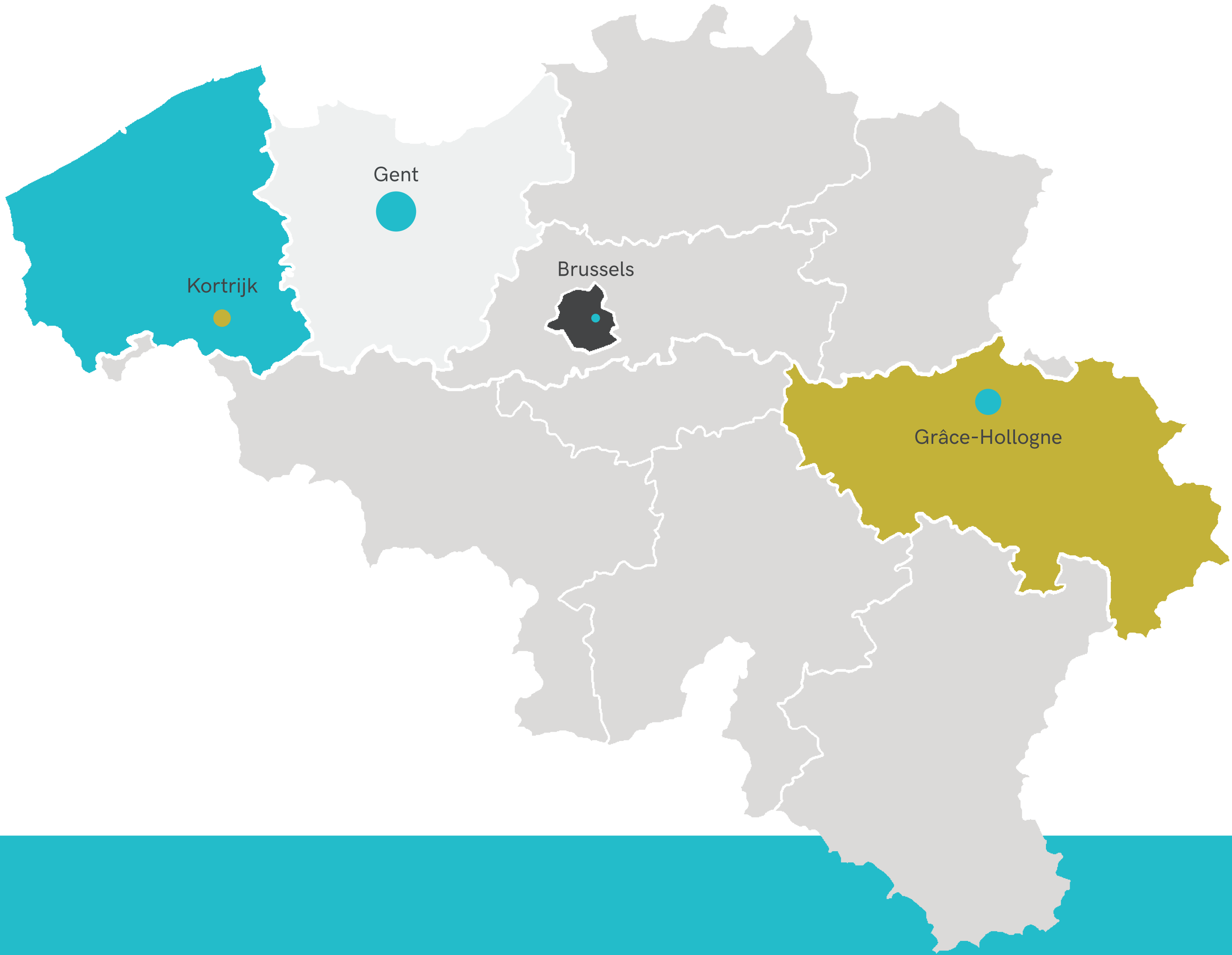
CREATE

CONNECT

INSPIRE



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