

BIO-BASED COATINGS & FINISHES



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FR additives right from your plate

The textile industry is engaged to convert half of its products into bio-based ones by 2030. This is a real challenge, because next to about 70% polymers, fibres and yarns also contain additives to improve properties, such as plasticizers, flame retardants, dyes, stabilizers, adhesives and nucleating agents, that are mostly still petroleum based.

In line with our previous research projects, such as the Interreg Vlaanderen-Nederland projects: "BB100: Pure Nature 100% Biobased" and "De Blauwe Keten" we are focusing our R&D projects on the development of **bio-based Flame-retardants** and **bio-based antibacterial additives** to create fully bio-based products.

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Every year, there are at least 5,000 daily fire incidents in the EU. About 70,000 people are hospitalised with fire-related injuries. At the same time, European regulations are prohibiting the use of some flame retardants (FR) due to their hazardous nature. In addition to the fact that the industry must reckon with increasing ecological demands of its customers, environmental guidelines and regulations prescribe a reduction of CO₂-emission.

So sustainable and performant fire-retardant products are an economic, environmental and human necessity.

An important strategy is to replace petrochemical resources by CO₂-neutral and non-toxic alternative products such as biopolymers.

The BioFRLeTex project assesses the FR properties of bio-based raw materials from animal and vegetal origin.

We have developed bio-based FR formulations complying with EN-597, ISO 15025, NFPA 701 and M1 classification for both cellulosic and synthetic fabrics.

We made FR formulations from ingredients that may be part of your diet and that are completely non-toxic.

The formulations are free from halogens and metals. Research demonstrated the synergistical action of combinations of different bio-based raw materials.



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BioFRLeTex is a Cornet project funded by Flanders Innovation and Entrepreneurship (HBC.2018.0266) and AIF in Germany.

Antibacterial by nature

Duratex is an Interreg V France-Wallonie-Flanders project looking for ecofriendly repellents and biobased antimicrobials for textiles. The bio-based antimicrobial products are metal-free and from animal, vegetal or marine origins. The antimicrobial additives were incorporated in the yarn during extrusion, in the fabric via diffusion or applied on the surface of the fabrics by padding and coating techniques. The antibacterial activity (A) of treated samples was evaluated according to ISO 20743.

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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 biobased polyurethane (PU) coating was assessed. They showed strong antibacterial properties, even after washing at 40°C. The graph below represents 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 biobased additives to produce antimicrobial textiles without using silver or any other metal.

Project website:

<https://interreg-duratex.eu>



Interreg
France-Wallonie-Vlaanderen



The Duratex project was financed by the Interreg V program France-Wallonia-Flanders, 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.
<https://www.interreg-fwvl.eu>



WATER-BASED PLA AND PHA DISPERSIONS FOR COATINGS AND INKS

More and more (partly) bio-based materials are finding their way to the market, from bio-based additives such as flame retardants to binders such as PU dispersions. One of the most attractive bio-based binders is PLA (polylactic acid). It is not only one of the cheapest bio-based materials, it also has a low carbon footprint and it is "industrially compostable". An interesting alternative to PLA is polyhydroxyalkanoate (PHA), a thermoplastic biopolymer of bacterial origin. PHA even has the advantage of being "home compostable".

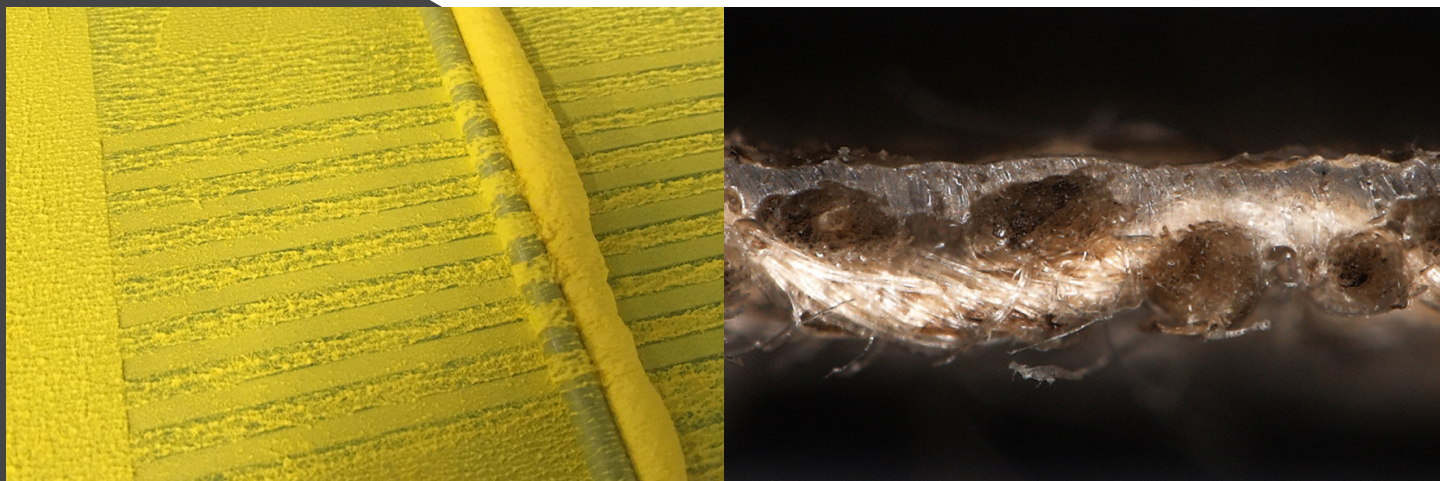
Innovative formulation

Despite their outspoken ecological advantages, PLA and PHA are seldomly used in textile coatings, as they are very stiff and brittle materials. However, this problem can easily be solved by adding a plasticizer. In recent years, Centexbel has been working on the development of a PLA-based coating formulation and succeeded in developing an innovative, water-based formulation with bio-based additives, suitable for both coating and printing.

The formulation is similar to a PVC plastisol in its use of powders. A limiting factor is that PLA cannot be obtained in the form of a powder like PVC during synthesis. Making PLA powders is quite an expertise and only available through a few producers.

Despite the extra cost of starting from PLA powders, we still managed to keep the price of the coating pastes down.

As an alternative we can use PHA, a thermoplastic polymer that is produced on an industrial scale by bacterial fermentation. This product is not only available as a very fine powder, smaller than $1\mu\text{m}$, it is also "home compostable". Unfortunately, PHA is rather expensive and difficult to obtain due to a high demand.



The formulation also contains a plasticizer to improve the flexibility. Because of the tendency of plasticizers to migrate, we searched for plasticizers with little or no migration. This resulted in the current formulation that shows no migration even at elevated temperatures in the indicative tests.

Plasticizers also have an impact on compostability and fire behaviour. Certain plasticizers allow coatings to degrade completely in a soil burial test (BS 6085-2, 28 days). This gives a strong indication that the coatings can obtain a "home compostable" certificate. However, adding plasticizers has the disadvantage that the fire behaviour of PLA strongly deteriorates. To counteract this phenomenon, we added a bio-based fire retardant and first test results (ISO 15025) indicated that this is working very well.

Applications

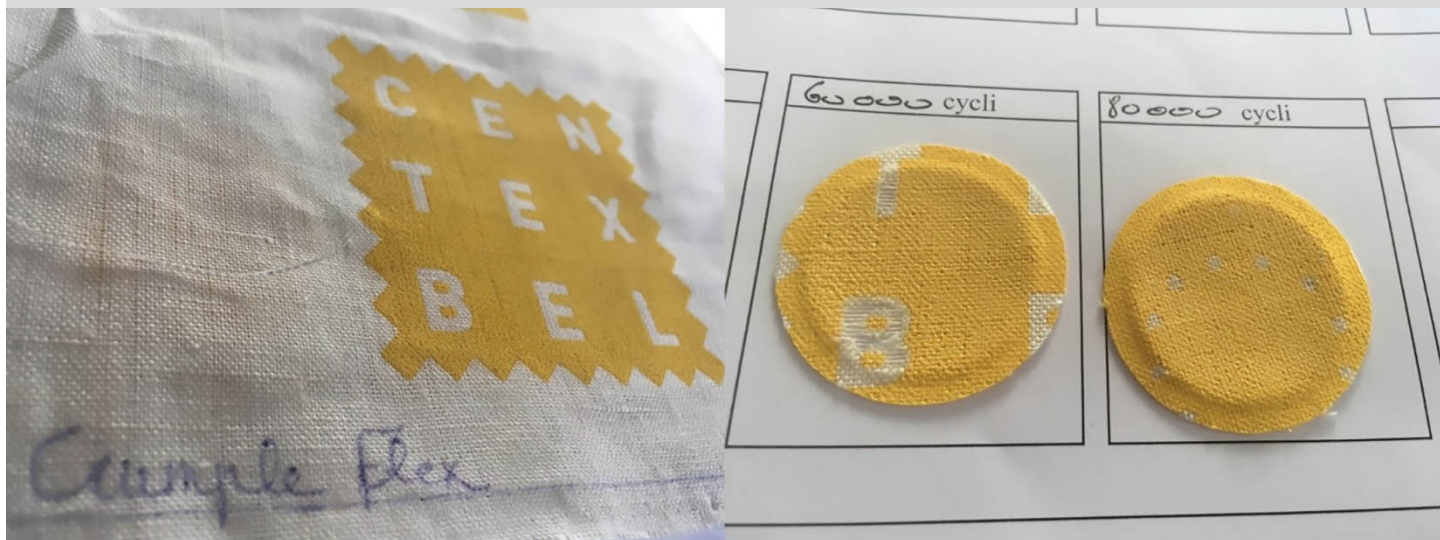
These formulations can easily be adapted to the needs of a specific application, can easily be mixed with different additives and can be applied with coating thicknesses from 30µm to 1mm.

Within the framework of the BB100 pure nature project, we have mixed various bio-based dyes. Since it concerns thermoplastic polymers, it is also possible to emboss them by lab scale pressing against a matt or glossy transfer paper.



After some optimizations, the formulations were used in the screen printing process of different substrates. The Martindale test shows that these printed textiles have an excellent abrasion resistance.

After having been submitted to 60.000 cycles with wool as an abrasive, the yellow print was still intact, whereas the textile started to degrade.



Patent pending

Centexbel has filed a patent application for this formulation development.

Centexbel is open to consultation on the use of these formulations and will be happy to advise you on their optimisation in view of the desired application.

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<https://sway.office.com/tcEIU9lPaVBNbDXC?ref=Link>

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Puur Natuur: 100% biobased

This project was financed within the Interreg V programme Flanders-Netherlands, the cross-border cooperation programme with financial support from the European Fund for Regional Development (www.grensregio.eu) and made possible by the financial support of the provinces of East Flanders, West Flanders and the Flemish region.

For more information about this project: <https://www.bb100.eu/>



This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 837761.

For more information about this project: <https://biontop.eu/>

Bio PU

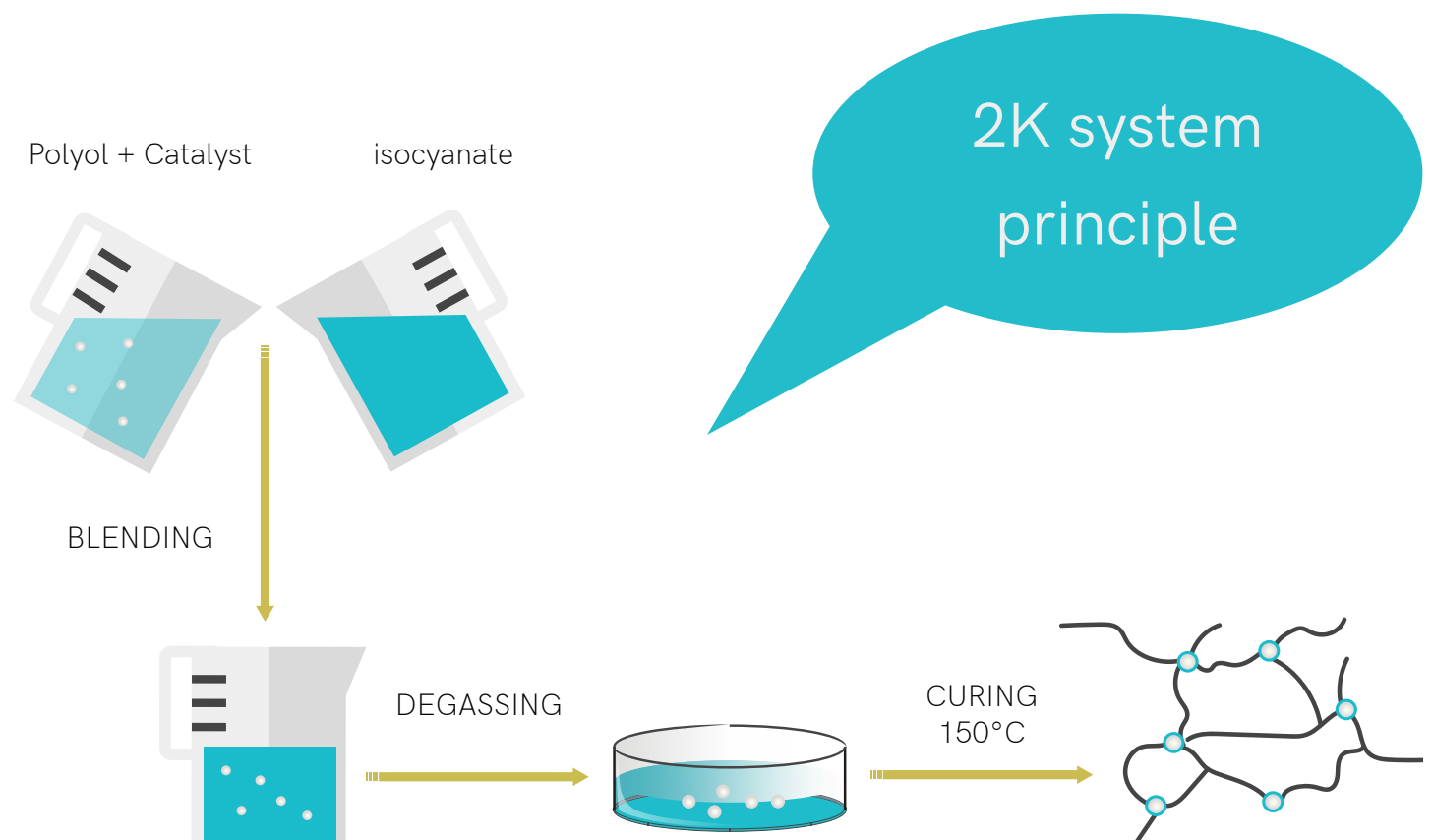
biobased PU for textile coating

solvent- & water-free bio-based polyurethanes

The PU coating industry faces many challenges. Besides the European REACH regulation which limits the use of solvents such as DMF, there is the increasing pressure to obtain labels such as OEKO-TEX® as well as end-user requirements for organic and ecological products. In response to these challenges, Centexbel started the BioPU project to develop a bio-based 2-component (2K) PU for coating applications.

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The developed 2K system is a viscous mixture of a bio-based polyol, bio-based isocyanate and a non-toxic catalyst which - after application - will cure into a PU. This formulation can then be applied both by direct and transfer coating. As the formulation does not contain solvent or water, there is no need for a drying step, which is positive in terms of energy savings as well as of the extraction and processing of released vapours. However, since this is a thermoset material, the coatings cannot be welded and their elasticity is lower than of most commercial solvent-based PUs.



Results

The coatings obtained were evaluated for their washing resistance at different temperatures, hydrolysis resistance at 75°C and 95% relative humidity (jungle test) and QUV resistance (500 hours). The characterisation was done by determining the water column of the coatings before and after the performed test.

product	coating thickness	watercolumn					
		initial	washing 20x at 40°C	washing 20x at 60°C	washing 20x at 92°C	hydrolysis (3 weeks)	QUV (500h)
polyol mix 1	2x 50µm	>1000	>1000	>1000	>1000	-	0
polyol mix 2	2x 50µm	>1000	>1000	>1000	0	>1000	-
polyol 3	2x 50µm	>1000	>1000	>1000	-	>1000	-
polyol 4	2x 50µm	>1000	0	0	-	>1000	>1000

Depending on the type of polyol, different properties can be obtained. With polyol mix 1, a maximum water column of 1000mbar can be reached even after boiling, however, the adjustments required for this caused a poor resistance to artificial weathering. This formulation is therefore more suitable for interior applications. By adjusting the polyols and additives the properties can be adjusted.

A higher degree of cross-linking, for example, ensures that coatings with a resistance to both wax and hydrolysis are obtained. A further increase in the degree of cross-linking gives the coatings UV resistance, but due to the increased stiffness they can no longer be washed without losing their water barrier properties.

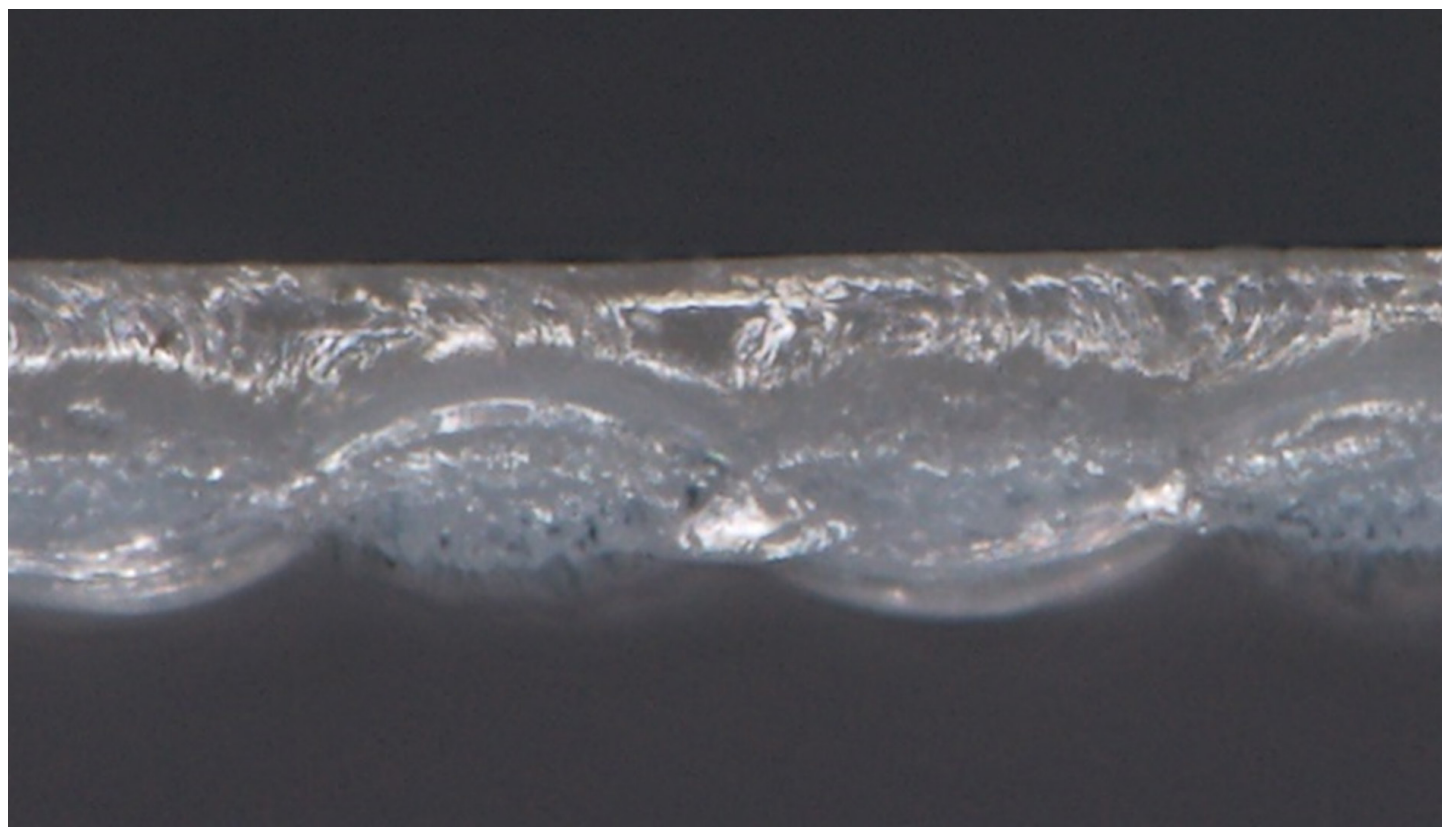
Besides wash and hydrolysis resistance, the abrasion resistance tested on the Martindale of these coatings is excellent: after 1000 cycles with sandpaper, the weight loss was limited to an average of 0.02g, and the water column had not been affected either by the abrasion test. In addition, the coatings are also airtight (<1L /m²s) and compatible with antimicrobial products, after adding a bio-based antimicrobial product a strong antibacterial activity was observed against *Klebsiella pneumoniae* and *Staphylococcus aureus*.

BioPU is a Cornet project funded by Flanders Innovation and Entrepreneurship (HBC.2017.0646) and AIF in Germany.



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BIOBASED PRODUCTS and INDUSTRIES

Edited by
Charis M. Galanakis



Chapter 10 bio-based textile coatings and composites

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<https://www.elsevier.com/books/biobased-products-and-industries/galanakis/978-0-12-818493-6>

Before the industrial revolution and the discovery of fossil fuels, the European and other economies were essentially bio-based. The production of food, feed, fuel and fiber and hence biomass has always been instrumental for economic growth and development. The rapid adoption of fossil resources as inputs for the energy sector, for a wide range of chemicals and for other value-added products, has accelerated development and led to a restructuring of economies and societies across the globe over the past century. With growing knowledge and awareness of the finite nature of fossil resources and the growing climate, environmental, socio-economic and geopolitical impacts of their exploitation and use and the associated risks, the EU and many individual European and other countries have and are developing bioeconomy strategies.

By 2030, the European Union wants 30% of petrochemical-derived chemicals and materials to be replaced by bio-based and biodegradable alternatives. Because the textile market covers a broad range of materials, it has a significant impact on the environment. Therefore, extensive research in the field of bio-based, biodegradable, or even recyclable textiles is carried out to reduce the environmental impact of textiles.

Nowadays, there is a need for a new reference highlighting principally the biobased products and industries beyond the biochemical processes. Following these efforts and considerations, the current book aims to cover all kind of biobased products and respective industries. Its ultimate goal is to support the scientific community, professionals, and enterprises who aspire to develop industrial and commercialized applications of biobased products.

Chapter 10 of this book is devoted to Centexbel's research in the field of bio-based textile coatings and composites.



EN ISO 14063 standard for green communication

In the race to meet our global climate goals, organizations everywhere are increasingly expected to communicate their environmental policies and commitments as well as the implications of what they do. Reporting their actions effectively can be a powerful catalyst for change. The International Standard for environmental communication has just been updated to help.

From sharing ideas to restoring faith in your green commitments, clear and compelling communication about environmental issues and activities is essential to getting anything useful done. When handled well, organizations can foster trust, improve their reputation and raise awareness of important environmental challenges in a way that can lead to real and lasting change. What's more, it helps when demonstrating compliance to national and international regulations and in environmental reporting.

EN ISO 14063, *Environmental management – Environmental communication – Guidelines and examples*, gives guidance on the principles, strategies and activities related to environmental communication using internationally agreed best practices. It has just been updated to harmonize with other International Standards in the field, offering additional guidance and new features.

Dr John Shideler, Chair of the ISO committee of experts that developed the standard, said environmental communication is not just about sharing information. It should reflect an organization's values and can have a powerful influence over how it is perceived and what gets done.

"There is an increasing need for organizations to be transparent about their environmental impact, demonstrate that they are committed to the cause and engage with their stakeholders about that," he said.

"EN ISO 14063 provides a solid basis for developing environmental communications strategies and policies so that organizations can talk about their activities and facilitate dialogue in a clear and effective way."

Source: <https://www.iso.org/news/>

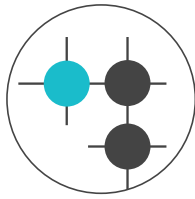
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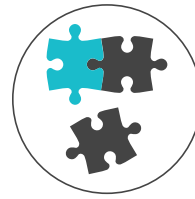
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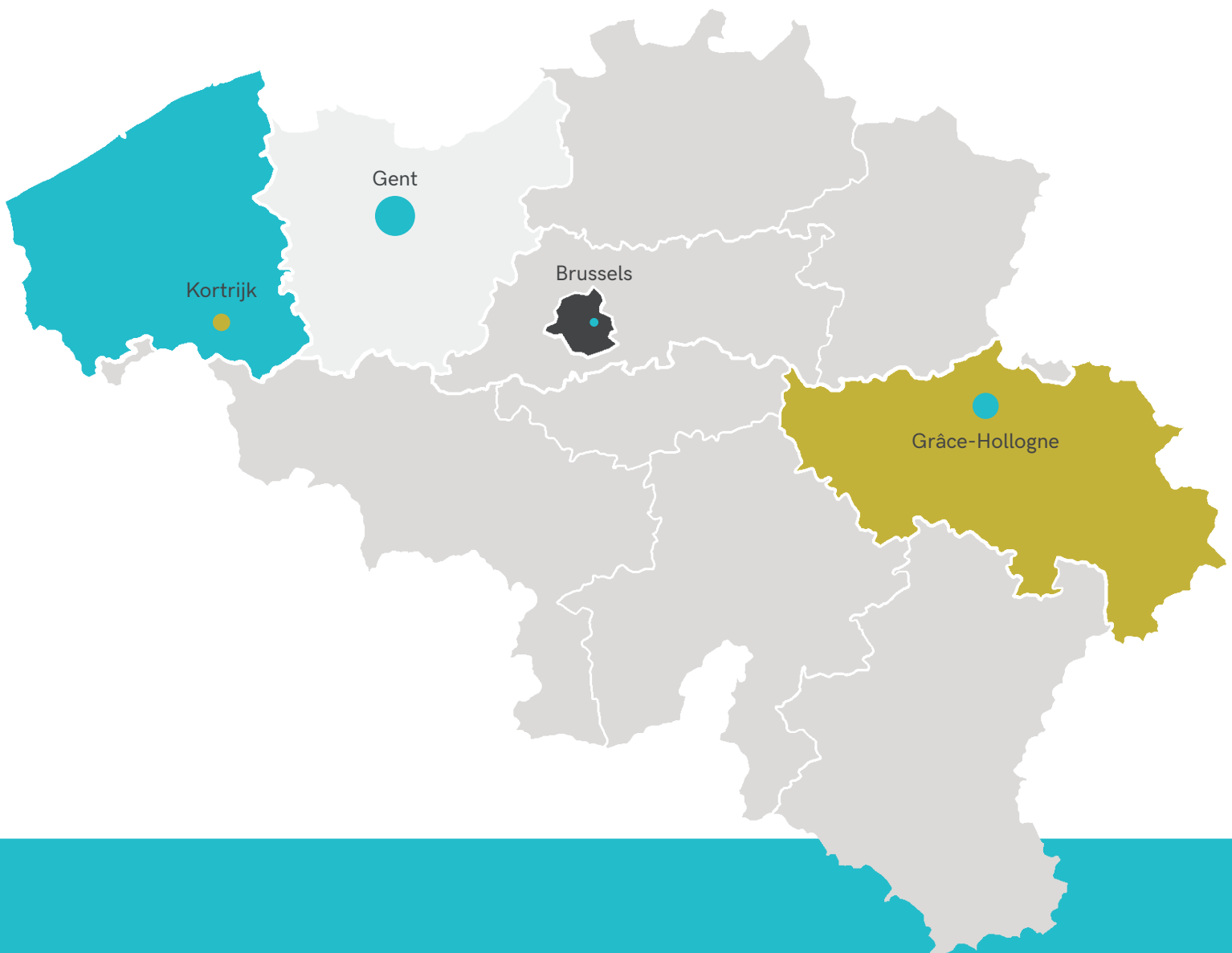
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