



## Paper Honeycomb 101 for Packaging Designers

### EMPHA White Paper

#### Executive Summary

Paper Honeycomb (NB: further referred to as **PH** for the purpose of this white paper) has been heralded as “Nature’s Hidden Dream Enabler for Innovative Designers of Packaging and Products ‘inspired by trees and bees’” (EMPHA, 2020).

However, what exactly is PH? What are its material characteristics and its pros and cons when it comes to sustainability? What features and benefits does this substrate hold for packaging designers? How can it be applied and where can inspirational examples in (protective) packaging already be found?

This whitepaper, put together by **EMPHA** (European Manufacturers of Paper Honeycomb Association), addresses a multitude of questions for both packaging designers who have worked with PH previously and would like to have a quick recap on its inspiring properties, as well as designers who are exploring the possibilities of working with PH for the first time.



## Introduction

PH is by no means a new innovation; neither is the use of honeycomb's **biomimetic design** for engineering purposes, which has been inspiring technologies and industries for decades. However, nowhere has there been more of an impact than in the paper board industries, where the use of the biomimetics of honeycomb has created new waves in sustainable substrates, products, and processes.

These waves are driven by the growing eco-conscious world around us and our need to take responsibility for the life cycle of packaging and its waste stream, creating a healthy and sustainable environment for all. The packaging industry has an especially critical role to play in this; its designers are a key link to ensuring global success in reducing carbon emissions.

For designers, the challenge is finding the perfect substrate that ticks all the boxes necessary to make it a viable product. From its **strength, durability, adaptability, and sustainability**, to its aesthetic quality, lifecycle, weight, and **affordability**, each factor determines whether it is a workable solution.

As an association, EMPHA proactively advocates, legislates, offers voluntary standards, and represents PH's qualities as a proven product - the creation processes and applications of which continue to be revolutionized and transformed.

**EMPHA** believes the secrets and magic of PH allows packaging designers to constantly bring fresh, lightweight, and sustainable solutions to the boardroom table, shop floor, and through the consumer's front door.

Broken up into 6 sections, our white paper covers different aspects of PH to offer a 360-degree overview of using **PH as a substrate for sustainable contemporary packaging design**.

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## 1. PH introduction and material characteristics

**Plastic-free** eco-friendly substrates are on-trend for packaging designs in the 21<sup>st</sup> century; PH has a proven track record as being a reliable, sustainable, and economical solution for packaging designers from all corners of the industrial world.

Made from **recycled paper board** fibres and pulp, PH is reusable, recyclable, biodegradable, and created from a **natural sustainable resource** (EMPHA, 2020). The lightweight, biomimetic design of PH's honeycomb cores, sandwiched between paper board layers, are held together using water-based glues, enabling PH (if left outside for just a few weeks) to simply disappear into the ground.

Its impact on the environment as a product is certainly minimal; its lifecycle is traceable and innovations in production technologies of PH have become ever more streamlined and **eco-efficient**.

Studies and data show that PH is not only a highly efficient low-carbon-emitting green solution, it is also exceptionally lightweight and has incredible load bearing properties (Xiang and Wang, 2010). This has enables designers to find innovative, lightweight, and effective solutions, especially in the area of protective packaging design and the economical and eco-conscious logistics of products (large and small) in a global market.

PH is available in **standardised formats** that enable designers to develop solutions rapidly; it can be contoured and tailor-made to exacting **bespoke designs** that bring creations to life. Plastic-based and protective packaging can easily be replaced with PH as, by design, it creates superior strength, rigidity, and a low aerial weight (EMPHA, 2020).

The hexagonal shaped cells are nested together (like bees' wax), enabling the creation of packaging that is 95% open space and giving PH an exceptional **low aerial weight per cubic metre**, "Inspired by trees and bees" (EMPHA, 2020). Using this ancient natural geometric design allows PH to be not only strong, but also an economical substrate with **infinite uses**. It is considered one of the most cost-effective sustainable resources used as a core material today.

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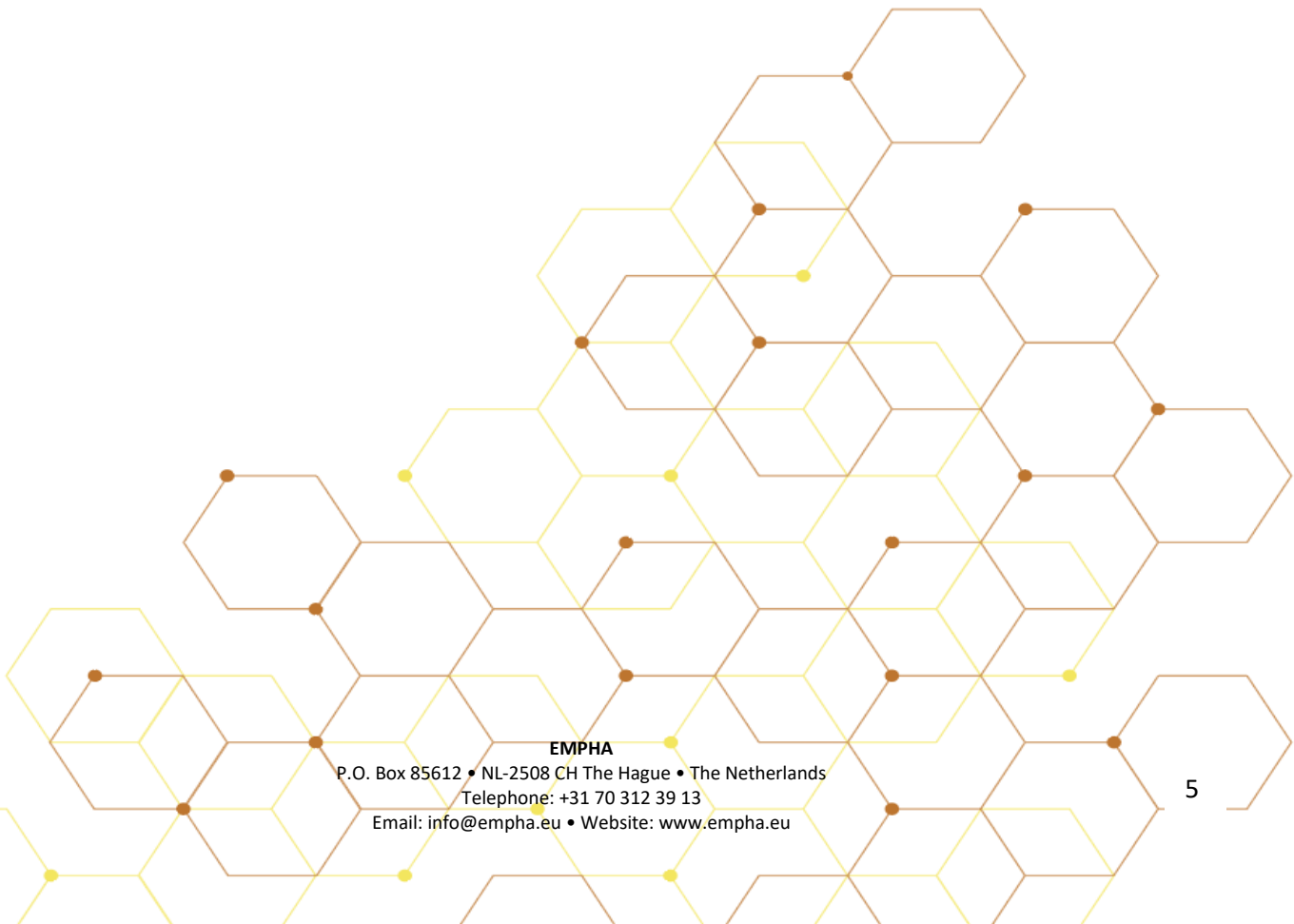
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Industries such as the **automotive, white goods, construction, and furniture** – those which deal with **protective packaging, transport and logistics, acoustics**, and more – are all able to utilize and benefit from the properties of PH. PH has huge potential; it gives packaging designers the opportunity to **innovate, create, and re-create**, as well as reduce the costs and environmental impact of packaging throughout its lifecycle.





## 2. PH pros when it comes to sustainability

We have already touched upon the sustainability of PH but let us get into the real business; the **positive environmental impact** that using PH is having and why it is an incredible, eco-conscious solution for packaging designers.

As we have established, PH is a lightweight recycled substrate which has a low material content. It is sourced from the fibres and pulp of recycled cardboard and re-engineered into a biomimetic substrate that takes on nature's ingenuity in more than one way.

PH displays strengths and innovations that only nature knows best - with a single waste stream it is not only **biodegradable**, PH can also be broken down and reused in a continuous recyclable cycle.

Recognising the need for the creation of a **holistic** approach to the handling of cardboard and paper at the end of its life has focused the **innovations in technologies** in paper board recycling and manufacturing industries - "We challenge ourselves continuously and commit to using the best available technologies and developing the **Circular Economy**" (SAICA, 2020).

This in turn has helped drive initiatives for the use of PH as a **sustainable ecological substrate** that has an enormous amount of applications, especially for packaging designers across a broad range of industries. PH is recognised and **certified by the FSC** and the majority of producers are also ISO certified and members of associations such as EMPHA, who are the "pan-European association for manufacturers of paper honeycomb core and paper honeycomb board products" (EMPHA, 2020; Honeycomb Cellpack, 2020).

Through PH's continued innovation and support as an **ecological packaging substitute** - especially for one-use-plastic - it has been proven that not only can PH help to drastically reduce carbon dioxide emissions, but it is also a **carbon storage solution** (Xiang and Wang, 2010). In fact, initiatives like the CPI's (Confederation of Paper Industries) 'Beyond the Box' campaign (Beyond the Box, 2020) could easily be adapted to PH as it is a **complimentary substrate to cardboard**.

The manufacturing of paper is constantly being innovated. Processes have streamlined over the decades and industries have created ground-breaking solutions in a bid to reduce carbon emissions (CPI, April 2020). Such solutions include abandoning the three-phase production method in favour of new production tools enabling PH to be **manufactured in one single phase**, significantly reducing the production costs and emissions during manufacturing. (L'hexagone, 2009)

When we look to the dictionary for a definition of sustainability, it says; "Sustainability - the ability to be maintained at a certain rate or level . . . avoidance of the depletion of natural resources in order to maintain an ecological balance . . . the pursuit of global environmental sustainability" (Lexico, 2020).

**Packaging designers** need a reliable, sustainable source from which their intentions and **eco-conscious goals** can be met on every level. PH, by its creation and infinite amount of applications, meets those goals and exceeds expectations in its function and form.

### 3. Features and benefits of PH for packaging designers

So far we have discussed what PH is and why it is a **sustainable product** that makes way for a **cyclical economy**, benefiting a **holistic** approach to packaging for designers.

However, PH's benefits and features go far beyond the fact that it is a **100% biodegradable** product that allows for recycling in a single waste stream. The strength and rigidity of PH, paired with its low aerial weight, make the functional biomimetic elements an attractive alternative for designers with diverse applications - especially for **protective packaging** (EMPHA, 2020).

Per cubic metre, PH has an exceptionally **low overall weight**, which makes its **strength, rigidity, flexibility**, and **durability** a surprising but exceptional aspect of its overall function as a packaging product. This can be seen even more so in protective packaging design (Pritchard, 2019), where PH can be used in both practical and innovative ways. (Ti-Vu Plast, 2020)

PH's low material content makes it an ideal substitute for plastic void fillers that clog up our oceans and add to the millions of tonnes filling our landfill sites daily. For packaging designers considering recycled paper as an e-conscious solution for protective packaging, PH is the ideal resolution. Not only do its lightweight and expansive qualities enable its assets as a protective void filling, but:

- PH has outstanding shock absorbency properties; it can provide cushioning for corners and protection against damage.
- It can stabilise heavy and awkward loads during transportation, reducing if not eliminating the amount of product shift during its logistical phases.
- PH provides high stacking strength for palletised loads, as well as a reduction in overall weight, creating a reduction in warehousing and transportation costs.

(Smurfit Kappa, 2020)





- As a sandwich core, PH not only has the highest strength-to-weight ratio, but also it carries the highest stiffness to weight ratio as a paper/board product.
  - PH can take immense pressure; it has predictable and uniform crushing strength under compression. This makes it easy for packaging designers to create further eco-conscious and cost saving solutions.
  - Easy to cut and fold, PH can be machine-manipulated to fit any shape or size.
- (EMPHA, 2020)

And more...

There is a certain magic to the qualities and **diverse applications** of PH. This **magic enabler** can be used in packaging design - and not only as a paper/board product with immense protection abilities.

PH can also be used to express the eco-awareness of a brand or product. With the use of eco-friendly inks and dyes, PH can be transformed with colour, artistic flair, logos, and ingenious designs.

Today, consumers are ever more aware of their carbon footprints. PH is an exciting, transformable, biodegradable substrate that can be used to convey a message of sustainability to people's doorsteps in a contemporary and often ground-breaking way.

Furthermore, and most ingeniously, PH is currently used as the base material for the production of **doors, interior walls, exhibition materials, advertising stands, and furniture** (EMPHA, 2020). This is to mention just a few of the innovative methods PH has been applied to across a broad range of industries and environments.

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## 4. Fields of application for PH

As we have already established, packaging designers are spoilt for choice when it comes to the applications of PH in their creations. As a product, it enables engineers and designers to develop and **create without barriers** – for anyone in any industry, PH creates **versatile, flexible, lightweight, and sustainable solutions** that can meet and match any design or engineering challenge. (SPC, 2020)

Its application in **protective packaging** for the automotive industry, large industrial products, small, fragile, or awkwardly shaped items, and transport and logistics has shaped PH into being a packaging designer’s dream. (EMPHA, 2020)

It is not only available in many standard sizes, which in turn enables fast and pro-active solutions, but PH can be easily cut and folded to meet exacting sizes and parameters. Therefore, it is simple to create **bespoke eco-conscious solutions for protective packaging designs**.

Here are just some of the useful areas of industry to which PH packaging and design can be applied:

### **Appliances**

**Household appliances** face a challenging journey from the factory floor, via storage facilities, to their final destination. PH is a **protective packaging solution** that can ensure the **safe transportation** and storage of valuable, large, or small household appliances.

As packaging designers, the ultimate objective is to **reduce logistical costs** and damage, **reduce the carbon footprint** of products, and ensure satisfaction at the customer’s door.



PH can be far more than a packaging material to be discarded; as designers PH can make itself an integrated part of the customer experience. PH offers packaging value, beyond the cost of the material. (EMPHA 2020)

## Automotive Industry

It comes as no surprise that PH and the automotive industry are a match made in heaven. For many years, honeycomb's **biomimetic design** has been used in Aviation engineering and PH (by design) is now proving to be a versatile partner for the automotive industry too. PH is providing a lightweight answer for this industry's **performance and environmental improvements**.

As PH is a substrate that can easily be shaped, collaborations between industries has led to its use as the **core material** for some automotive parts such as **car roofs** and interior trims. Its **flexibility** allows for ground-breaking and **multifunctional design** concepts to be brought to life. In addition to this, PH has the lightweight nature, strength, and durability required to be able to create **bespoke protective packaging designs** for the automotive industries. (EMPHA 2020)

## Industrial Parts

PH is a **lightweight champion** when it comes to doing the heavy-duty work. If designers need to develop packaging for industrial parts with a large volume and heavy weight. The versatility of PH allows them to engineer (almost) any shape which ultimately results in **on-demand bespoke solutions** that fit like a glove.

From **paper pallets** to **corner edges** and **full impact protection**, PH can fulfil external protective packaging requirements as well as provide **inner protection** tailored to bespoke design needs.

For packaging designers of industrial parts and transportation, the PH solution is incredibly lightweight and extremely **environmentally friendly**.



## Transportation and Logistics

Packaging in the logistics and transportation industry needs to be made from a material that is **durable, solid, and stable**. PH has been providing these essential ingredients for the successful creation of protective packaging in transport and logistics for many years.

PH has successfully contributed to resolutions of the challenges this industry faces, giving it a strong lightweight solution that reduces costs and environmental impact. Using PH for **logistical protective packaging** ensures a **secure product** and avoids any damage during the logistical chain.

## 5. Examples of PH based packaging

We have already touched on some of the extraordinary examples in PH packaging design and engineering; this paper is going to dig a little further and really get into some of the packaging **dream design solutions** with PH's properties.

**Void fillers** - Protecting products, this is a vital armour that packaging designers need to use. PH is an ideal **solution enabler** for filling the void for a product packing requirement. Not only does it have its own **expandable qualities**, PH has the ability to fit complex shapes; it can be honed or expanded to meet large or awkward product sizes and durability needs.

The density and **cushioning** of PH are unsurpassed for **lightweight protective packaging designs**; PH void fillers have been ingeniously crafted to give the customer a unique and fulfilling experience that goes beyond the packaging.

**Pallets** - Wooden pallets were used from the 1900's on, often weighing 20lbs or more. Reducing the weight of a product seemed redundant when using these for **transportation and storage**.

Since the development of PH, it has been a go-to substitute for **palletising** products - especially those that need to be shipped globally or stored for long periods of time. Its **seamless waste stream**, ability to be made **water resistant**, and versatility in creating bespoke, lightweight solutions means PH can be uniquely designed to fit any size or load. (PN Staff, 2014)

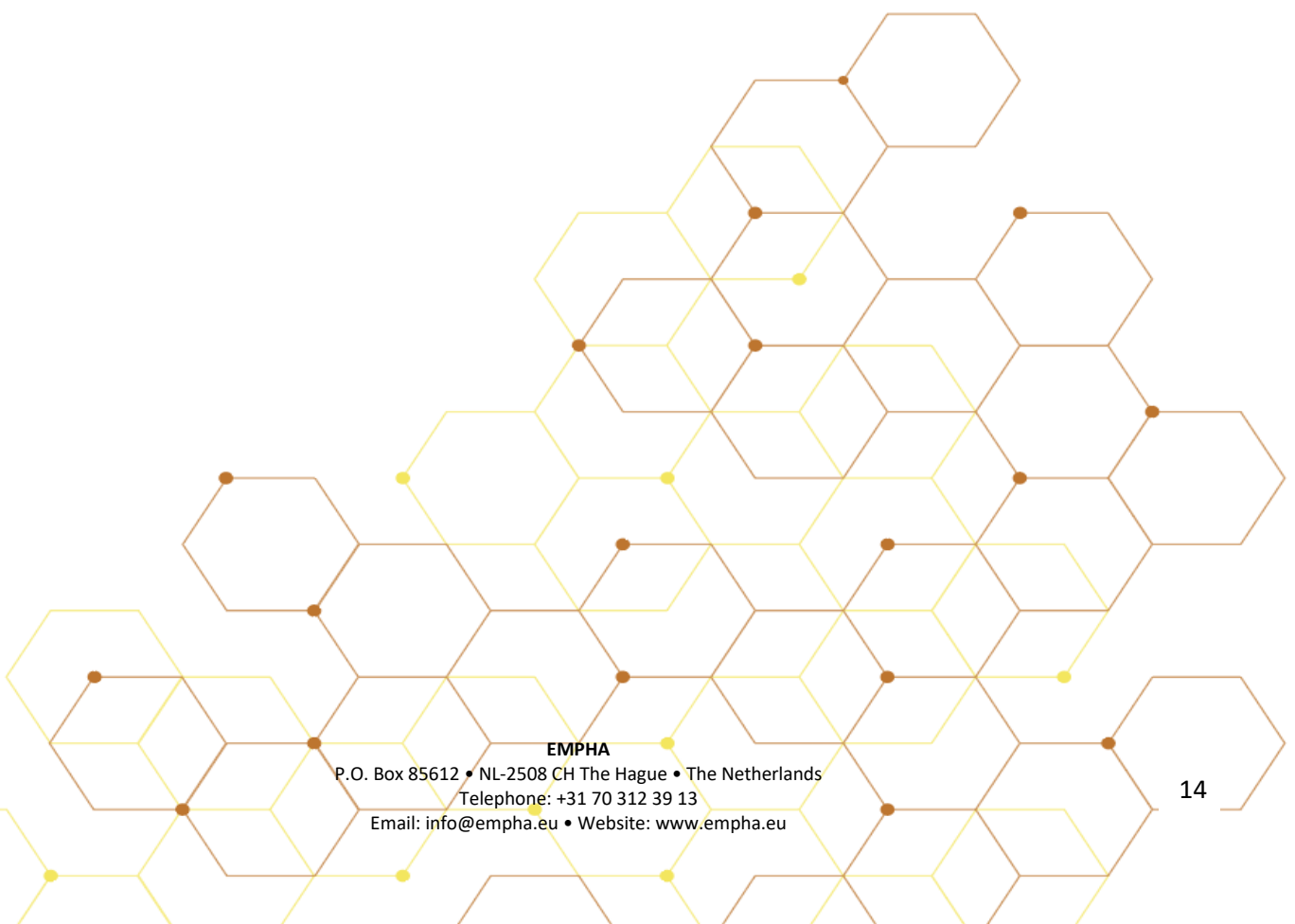
**Corner guarding** - Damaged packaging means unusable packaging and often leads to broken products and economic loss – especially if they are heavy and high-end. Corner guarding is great **protective packaging for heavy appliances, furnishings, and industrial items**.

PH is the **sustainable alternative** to one-use-plastic or metal for protective corner guarding packaging design; it has **predictability under compression** with a **uniform crushing strength** that can be measured. PH can be calculated to the exact amount of substrate required for the weight and size of products. PH, corner guard packaging, ensures protective packaging designs are lightweight and **low cost with maximum strength and durability** (Wang, Bai, and Liao, 2018).



**Glass and bottle spacers** - PH glass spacers have been uniquely designed to support and **cushion glassware** while it is on its logistical journey. PH may be compressed or formed to a certain depth and shape that fits the **bespoke** needs for a glass or bottle.

This **unique quality** of PH gives way to the enormous potential for **out-of-the-box protective packing design solutions** for the transportation, distribution, and display of glassware products. (Tivu Plast, 2020)



## 6. Trends and innovations in PH packaging design

Our global reach as industries, engineers, designers, and consumers of **paper/board products** means we need our fingers on the pulse of the contemporary and future **environmental and economic trends** that develop.

PH is a product that inspires packaging designers and their inceptions – from dream through to creation - but what does PH hold for the future of packaging design?

More than ever it is **eco-conscious consumerism** that is driving the need for packaging designers to create inspiring **ecological solutions** (Business Wire, 2016).

This is why developments in PH productions and applications have and will continue to expand - not only to **reduce production emissions and costs**, but for PH's continued use as an exceptionally viable, sustainable paper/board product for innovations in packaging design (Ti-Vu Plast, 2020).

Replacing plastic is a common goal for many packaging designers today, especially with governments across the globe setting increased importance on reducing our carbon footprints and plastic usage. PH applications continue to evolve in ground-breaking ways to solve **protective packaging design solutions**. PH is lightweight yet strong, durable yet biodegradable - like magic, not only does PH simply disappear when left to the elements, but it also has strength that is unsurpassed for a paper/board substrate of such little density (EMPHA, 2020).

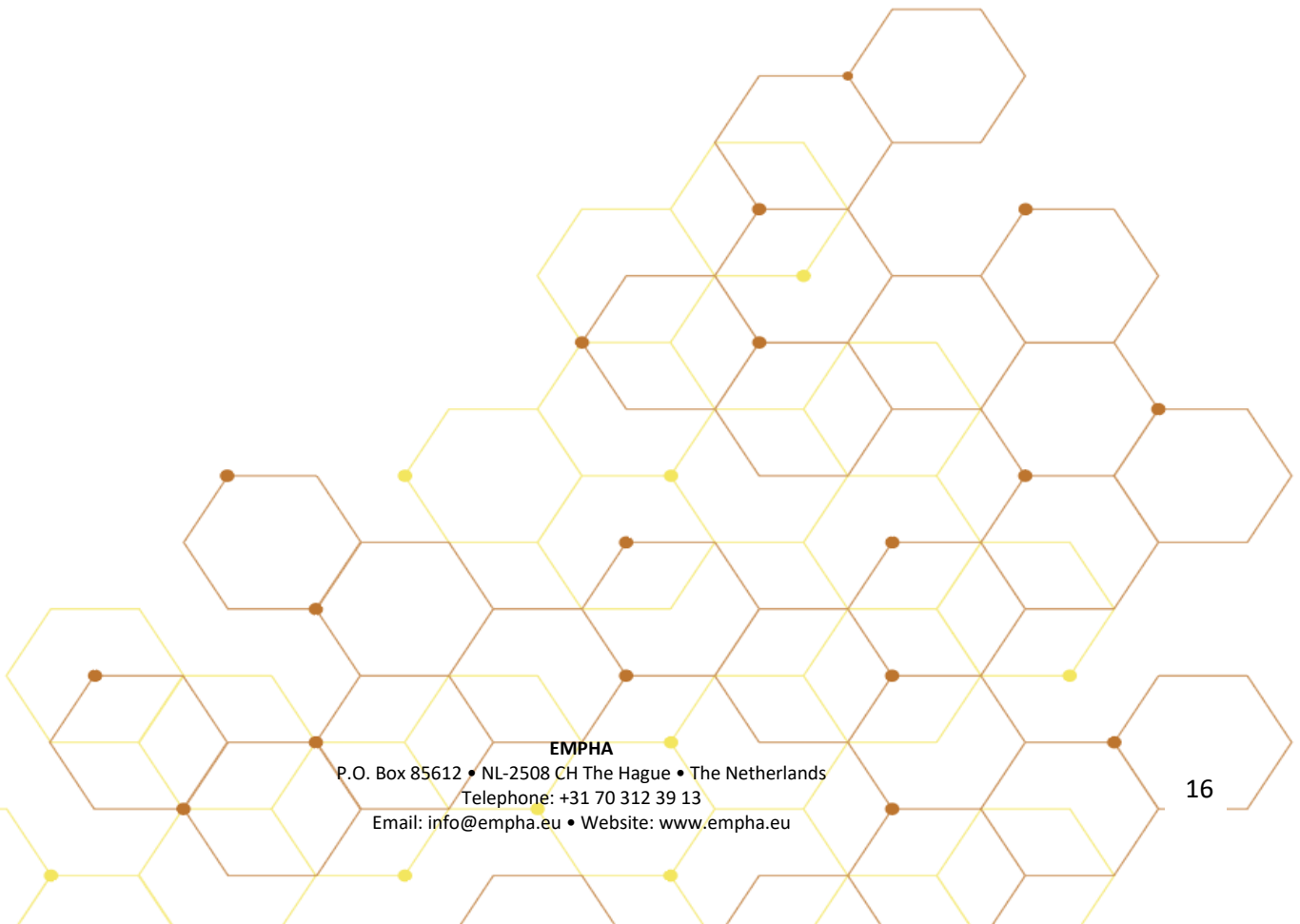
Applications in PH can be found everywhere, from **building sites** and **exhibition centres** to small **retailers** and **commercial displays**; even **artists** have used its ingenuity for their expression (Contemporist, 2010). It simply goes without saying that PH, as a product by itself, has an inexhaustible range of functions for today and the future.

Undoubtedly, PH is proving to be a lightweight product that can replace outdated and environmentally-damaging traditional packaging methods and designs. **EMPHA** and our members represent the PH industry and the immense qualities PH has as a versatile and sustainable product for today and the **future of packaging design**.

We support each other in exploring the unique opportunities PH provides for a variety of industries and individuals in packaging; design dreams enabled by nature's hidden secrets.



We believe the **magical abilities** of 'honeycomb' (EMPHA, 2020) are only just being touched upon and implore the dream weavers of packaging design's future to use the generous and unfathomable possibilities of PH's design capabilities - setting **eco-conscious packaging** trends for today while creating **sybiotic sustainability** for tomorrow.



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