Electrifying Progress.

August 4th, 2022

Re: Draft Royal Decree on Packaging and Packaging Waste

Pyrowave is a pioneer in the electrification of chemical processes based on low carbon footprint microwaves. Pyrowave is also a Canadian leader in the plastics circular economy and chemical recycling to regenerate post-consumer and post-industrial plastics into new plastics, reclaiming these resources' full value. Its patented 100% electric microwave catalytic depolymerization technology platform is the most advanced in the world and is now at the forefront of the next generation of plastics. By restoring plastics to their molecular state (plastic to monomer) identical to virgin materials, Pyrowave technology enables infinite recycling of plastics and provides a circular economy solution to meet the global plastics recycling challenge. Our high-value monomer, at 99.8% purity and virgin quality, can be used for new packaging but also synthetic rubber and other activity sectors, such as electronics, automotive and construction.

As an equipment manufacturer, we have a demonstration plant and an R&D center in operation in Canada and we partnered with the Michelin Group in 2020 to deploy our technology in Europe by 2023. We are also developing in the Asian market. This goes to show that our technology is commercially ready and operational. The accelerated growth Pyrowave has seen in the last few years is partly due to the evolution of a favorable regulatory framework in Europe aiming at incentivising the circular economy and innovation to achieve ambitious sustainability goals. This is why Pyrowave salutes the Spanish Secretary of State for the Environment for the extension of provisions mandated by the European Single Use Plastics directive.

Because recycling is an issue for the entire value chain, Pyrowave supports the Royal Decree's provisions for financing and streamlining waste collection and sorting. These activities are crucial for high-quality and consistent feedstock and thus crucial for high-quality and consistent recycled materials. We also believe that the provisions for stricter extended producer responsibility (EPR) are a step in the right direction to accelerate the deployment of recycling technologies.

1. **Terminology**

> *v) Recyclability of packaging: effective recycling capacity of packaging waste, which is determined on the basis of the following criteria:*
>
> *1st. They are collected separately efficiently, through access by users to nearby collection points;*
>
> *2nd. They do not exhibit characteristics, elements or substances that prevent their classification and separation, their recycling or limit the subsequent use of recycled material;*
>
> *3rd. They are recycled on an industrial scale with commercial processes ensuring sufficient quality of recycled material for subsequent uses, and in more than 50% of the mass of waste collected from that type of packaging;*

Pyrowave supports the Royal Decree's definition of recyclability in that it ensures that feedstock is able to meet the specifications for effective recycling. However, there should also be an added definition in the text of what constitutes recycling. This definition should also include chemical recycling, which is defined by Chemical Recycling Europe as:

"…*any reprocessing technology that directly affects either the formulation of the polymeric waste or the polymer itself and converts them into chemical substances and/or products whether for the original or other purposes, excluding energy recovery*."

Chemical recycling processes hard-to-recycle plastics and produces key raw materials from them. Our technology integrates recycled content in products that would otherwise be manufactured from virgin materials. It is crucial for the chemical recycling terminology to be integrated in the Royal Decree in order to increase confidence of the market in the regulatory environment around our technology. It is also important to exclude energy recovery or plastic to fuel applications as recycling because these remove the value from waste and do not constitute truly circular solutions.

Furthermore, Pyrowave supports the hierarchy of recycling approaches and its environmental footprint. Chemical recycling technologies can complement the portfolio of solutions to plastic waste end-of-life, particularly for hard-to-recycle plastics. In addition, mechanical recycling can collaborate with chemical recycling to prepare hard-to-recycle plastic waste feedstock and ensure all plastic waste is recycled.

PYROWAVE'S RECOMMENDATION: To explicitly recognize chemical recycling as a technology that contributes to plastics circularity in the legislative text.

2. Recycled content

Pyrowave supports Royal Decree's establishment of ambitious recycled content targets on many product groups. Pyrowave wishes ambitious targets to create demand for recycling technology and recycled products. More ambitious recycled content targets will stimulate more innovation and development for recycling technologies. The Pyrowave technology is capable of supplying 100% recycled content products and we believe that this should also be the ambition for a fully circular economy. The hurdles for a circular economy are no longer technological – the issue remains in the shifting of the value chains into a circular model. Ambitious recycled content targets will provide the stimulus necessary for this shift.

> *For the purposes of this provision, the amount of recycled plastic contained in the products shall be certified by an entity accredited to issue certification under standard UNE-EN 15343:2008 'Plastics. Recycled plastics. Traceability and conformity assessment of recycling of plastics and recycling content' or the rules replacing them. In the case of chemically recycled plastic, that quantity shall be attested by the certificate issued by the relevant body accredited or qualified for that purpose.*

While Pyrowave supports the inclusion of a provision covering chemically recycled plastics, we believe that the UNE-EN 15343:2008 *'Plastics. Recycled plastics. Traceability and conformity assessment of recycling of plastics and recycling content'* standard is not strict enough for reporting on recycled content. In order to instill trust and transparency in reporting on traceability, there is a hierarchy in the chain of custody of recycled content and hence

there should be clear reporting on whether the recycled content has been physically segregated or whether it was calculated through a mass balance approach.

There are many ways to calculate recycled content in a Chain of Custody model which ISO standards are based upon. As such, not all recycled content is equal, as the various ways to calculate recycled content offer a spectrum from a physical traceability (segregation) to an accounting rule (book and claim), which we do not support. This diagram from ISO Standard on Chain of Custody illustrates the level of physical traceability of each approach (Source : ISO 22095)[1] :

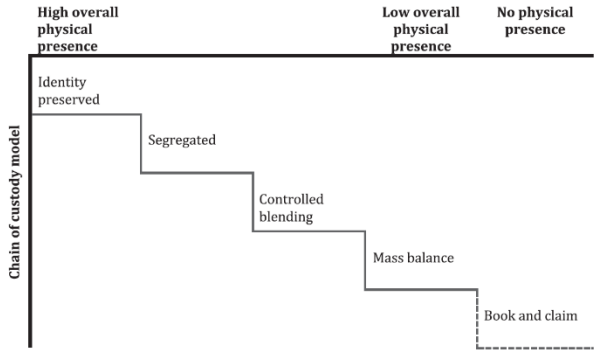

Figure 1 — Indicative illustration of chain of custody models ranked according to the physical presence of specified characteristics

The mass balance approach includes various degrees of traceability, from batch segregation, where a specific batch can be located, to a book and claim approach, which refers to an accounting rule where there is no actual recycled content in a specific product or packaging but content accounted for and attributed to this specific product or packaging.

While in some cases, a mass balance approach is required for certain hard-to-recycle plastics, we believe the recycled content that is claimed should reflect the physical recycled content of the product **in priority**. This is an important element of trust for consumers. There is a need to distinguish physically traceable recycled content in order to instill trust among consumers and allow clients to use the resin of their choice based on transparent and complete information.

To further support this sustainability objective and in a spirit of transparency and clarity, the WWF has issued principles on chemical recycling that highlight some of these key elements, namely[2]:

Its purpose to establish clear implementation principles, aimed at protecting people and nature,…and…that these principles inform decision-making and help actors make choices which result in transformative change to the global plastic system to build sustainable, circular plastic use, and support WWF's vision of No Plastic in Nature.

PYROWAVE'S RECOMMENDATIONS: To set standards for recycled content accounting that are the most transparent and verifiable as possible.

[1] ISO 22095 Chain of Custody - https://www.iso.org/standard/72532.html

[2] WWF: chemical recycling implementation principles: https://www.worldwildlife.org/press-releases/wwf-releases-new-position-chemical-recycling-implementation-principles

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In conclusion, Pyrowave supports the Royal Decree for packaging and packaging waste. We are aligned with the objectives of the regulation and our technology is fully ready to help propel the European circular economy. The Pyrowave technology is low-energy and emits less greenhouse gas emissions compared to virgin materials. It is commercially ready to help ensure a circular economy of products in the European economy. We believe that the Royal Decree can successfully tackle product sustainability and streamline the transition towards a low-carbon, circular economy.

We are at your disposal for any further information on this matter.

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