PIONEERING DIGITAL WATERMARKS FOR SMART PACKAGING RECYCLING IN THE EU

Digital Watermarks Initiative HolyGrail 2.0
CIRCULAR ECONOMY

FOR PACKAGING

FACING THE NEW CIRCULAR REALITY

BY 2030
100% of plastic packaging to be reusable, easily recyclable, or compostable

BY 2030
55% of plastic packaging to be effectively recycled

BY 2030
90% of plastic beverage bottles to be collected for recycling

BY 2030
30% average recycled content across all plastic beverage bottles

Eliminate problematic or unnecessary single-use plastics

AIM

Alliance to End Plastic Waste
One of the biggest challenges is how to maximize our resources through optimal sorting and recycling.

We need to better sort our post-consumer waste in the EU waste management systems by accurately identifying (plastics) packaging, resulting in more efficient and higher-quality recycling.

How can we achieve a Circular Economy for Packaging in the EU?
Digital watermarks for smart packaging to **revolutionise the way packaging is sorted**

Opens **new possibilities** currently not feasible with existing technologies
September 2020: Under the auspices of AIM, European Brands Association, 85+ companies and organisations from the complete packaging value chain have joined forces

Objective: Prove the viability of digital watermarking technologies for accurate sorting and the business case at large scale

Website: www.aim.be/priorities/digital-watermarks
2nd iteration of the Pioneering Project HolyGrail 1.0 led by the Ellen MacArthur Foundation 2016-2019

HolyGrail 1.0 investigated **different innovations to improve post-consumer recycling** (digital watermarks & chemical tracers)

**Digital watermarks** were found to be the **most promising technology**, gathering support among the majority of stakeholders and passing a basic proof of concept on a test sorting line
Pioneering **DIGITAL WATERMARKS**
for smart packaging recycling **IN THE EU**
HOLYGRAIL 2.0 Membership
Imperceptible codes, the size of a postage stamp, covering the surface of a consumer goods packaging

Able to carry a wide range of attributes (e.g. manufacturer, SKU, type of plastics used and composition for multilayer objects, food vs. non-food usage)
Imperceptible codes, the size of a postage stamp, covering the surface of a consumer goods packaging.

Able to carry a wide range of attributes (e.g. manufacturer, SKU, type of plastics used and composition for multilayer objects, food vs. non-food usage).

WHAT ARE Digital Watermarks?

BEHAVES LIKE THIS
Digital Watermarks @work

FOR PRINT

Repeated Tile

Pieces of multiple tiles can be combined to recover a Barcode

The encoder applies the tiles to graphics in a mosaic manner

Uses existing pixels
No special inks
No special printing process

Exaggerated view for illustration purposes
Digital Watermarks @work
FOR MOLDS

01 Micro-topological variations in substrate create signal tiles

02 Works in variety of mold types
HOW DO DIGITAL WATERMARKS WORK ON A SORTING LINE?

SMART PACKAGING SORTING FOR A CIRCULAR ECONOMY

1. Packaging waste coded with digital watermarks arrives at the sorting plant.
2. Standard high resolution camera detects the digital watermarks & decodes their information.
3. Packaging waste is sorted into different streams for recycling (e.g., food vs non-food).
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3 FOCUS AREAS

01
Intelligent Sorting

02
Data Mining

03
Consumer Engagement

Reject
Add
Divide
POTENTIAL BENEFITS OF DIGITAL WATERMARKS across the package life

01 Design
- Incorporate barcode data into artwork
- Integrate codes and link to content

02 Manufacturing
- Improve in-line inspection

03 Distribution Center
- More reliable labels
- Print on corrugated packaging
- Scan readily from a distance
- Verify logistics and returns

04 Check Out
- Easily scan products & labels
- Improve first-pass read rate
- Reduce misreads and manual keying
- Improve customer experience

05 In-Aisle
- Price checks
- Manage planogram & availability (OSA)
- Data Analytics

06 Home-Use
- Instructions for use
- Brand and social content
- Point and scan to buy now & reorder

07 Recycling
- Identify material and substrates
- Improve sorting mechanisms
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Roadmap

2020

PHASE 1
Developing detection unit prototypes

Start industrial testing

PHASE 2
Brand owners and retailers are welcome to join with min. 2-3 SKUs coded with digital watermarks

Start semi-industrial testing

PhASE 3
Brand owners and retailers that are operating in the chosen test market are expected to participate with a minimum of 10 SKUs coded with digital watermarks

End Report

2021

2022
Focus on **functional add-on module for the detection sorting unit** – combined with existing NIR sorters – developed by the machine vendors **Pellenc ST** and **Tomra**, in combination with **Digimarc** (digital watermarks technology provider).

Success criteria: unit’s ability to detect and sort digitally watermarked packaging of various sizes. The Technical Project Manager overlooks and validates the prototypes.

The prototypes will be used for the (semi-)industrial testing phase.

Successful completion of Phase 1 will bring the Technical Readiness Level (TRL) to TRL 6 – technology demonstrated in relevant environment.
Software model & identification parameters are developed and tested for sorting based on digital watermarks detection.

System is tested for speed, accuracy, and detection efficiency.

2 test locations for semi-industrial trials of the detection sorting units:
- Pellenc ST/Digimarc module:
  Sep - Dec 2021 at the Amager Resource Centre, Copenhagen
- Tomra/Digimarc module:
  Q4 2021 - Q1 2022 in Germany

Successful completion of Phase 2 will bring the Technical Readiness Level (TRL) to TRL 7 – system prototype demonstration in operational environment and TRL 8 – system complete and qualified.
Phase III

Industrial tests
Q1 2022 – Q3 2022

Functional prototypes now **deployed in commercial sorting and recycling facilities under normal operational conditions on a large-scale.**

**5 locations in France and Germany,** includ. MRFs, PRF, recycling plants. Partners include e.g. SUEZ, PreZero, Indorama, Tomra/Borealis/Zimmermann, Paprec.

- Brand owners and retailers bring their enhanced products commercially to market in Denmark, France and Germany.
- Consumers can buy on-shelf products with digitally watermarked packaging, which will enter the waste stream after consumption.
- Objective: test system’s reliability to ensure optimum performance.
- Successful completion of Phase 3 will bring the TRL to TRL 9 – *actual system proven in operational environment.*
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WORK PACKAGES

WP1: Intelligent Sorting
WP2: Digital Watermarks for Print
WP3: Digital Watermarks for Molds
WP4: Business Development
WP5: Data Management
WP6: Consumer Engagement
WP7: Legal Framework
WP8: Exploitation & Dissemination
WP9: Project Management
HG2.0 Structure

MEMBERSHIP

HG2.0 Membership
Associate & Full Initiative Members

- Technical Work Packages:
  - Involvement of all members based on expertise and knowledge
  - WG leaders appointed
  - Under supervision of Technical Project Manager

- Leadership Team:
  - Core members representing each of the sectors engaged in the initiative
  - Leads, coordinates and manages the activities of the initiative
  - Ensures effective use of membership fees and involvement of member companies
  - Overlooks the activities and decides on the set-up of technical work packages
### Elected LT Chair: Gian de Belder, Procter & Gamble
HolyGrail 2.0 Structure

**MANAGEMENT**

- **Secretariat – AIM as Initiative Facilitator:**
  - Overall management of initiative
  - Contact point for members & external stakeholders
  - Ensuring regular updates / information flow to all HG2.0 members

- **Technical Project Manager – An Vossen (Plarebel):**
  - Drafting a technical test plan
  - Coordinating the different technical working groups
  - Overseeing the work on the test sorting line
  - Supporting members with technical expertise & in their work with technology suppliers

- **Legal Counsel:**
  - Present at all meetings of leadership team and HG2.0 members

HG2.0 STRUCTURE BASED ON **HOLYGRAIL 2.0 CHARTER** UNDER THE AUSPICES OF AIM, EUROPEAN BRANDS ASSOCIATION:
PARTNERSHIPS FOR HG2.0 (SEMI-) INDUSTRIAL TRIALS

- Alliance to End Plastic Waste
- City of Copenhagen

- More information in our press release here
HolyGrail 2.0 Structure

ADVICE

Advisory Group:

Panel for dialogue, exchange and input into both the operational implementation of key activities and the overall strategy of HG2.0.

Provides advice to HG2.0 Leadership Team, constituting the public and policy complement to the cross-value chain initiative HolyGrail 2.0.

Comprised of key stakeholders in the Circular Economy debate, including representatives from NGOs, Media, European and national public agencies, European and national policy-makers, other key stakeholders.
Innovation, sustainability and digital are the 3 key ingredients we are combining with smart packaging through digital watermarks to achieve the objective of the Green Deal towards a clean, circular and climate neutral economy.

MICHELLE GIBBONS
DIRECTOR GENERAL, AIM
Digital Watermarks Initiative HolyGrail 2.0

The Digital Watermarks Initiative HolyGrail 2.0 – driven by AIM, the European Brands Association and powered by the Alliance to End Plastic Waste – is a pilot project with the objective to prove the technical viability of digital watermarks for accurate sorting of packaging waste as well as the economic viability of the business case at large scale.

Digital watermarks are imperceptible codes, the size of a postage stamp, covering the surface of a consumer goods packaging and carrying a wide range of attributes. The aim is that once the packaging has entered into a waste sorting facility, the digital watermark can be detected and decoded by a standard high resolution camera on the sorting line, which then – based on the transferred attributes (e.g. food vs. non-food) – is able to sort the packaging in corresponding streams. This would result in better and more accurate sorting streams, thus consequently in higher-quality recyclates benefiting the complete packaging value chain.
Digital Watermarks Initiative HolyGrail 2.0

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