PE(r)Fect Pack: Advancing Circular Pharmaceutical Packaging

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Priority Topic Area: **Waste Valorisation and Circular Economy**

Addressing Medical Blister Packaging Waste

The medical sector produces one of the largest single-use plastic waste streams, and blister-pack waste stands out with having **no established circular pathway**. These packs cannot be recycled in households due to their mixed plastic-aluminium composition - a design optimised for sterility and shelf-life, but not sustainability.

Because medical plastics are exempt from the **EU's 2030 recycling targets**, there is little incentive to redesign blister packs or invest in recycling solutions.

This project aims to establish a blister pack that meets medical standards and integrates into existing waste streams, addressing major gaps in sustainable pharmaceutical packaging and **SDG 12 compliance**.

Annual blister-pack waste weighs as much as 10 Eiffel Towers

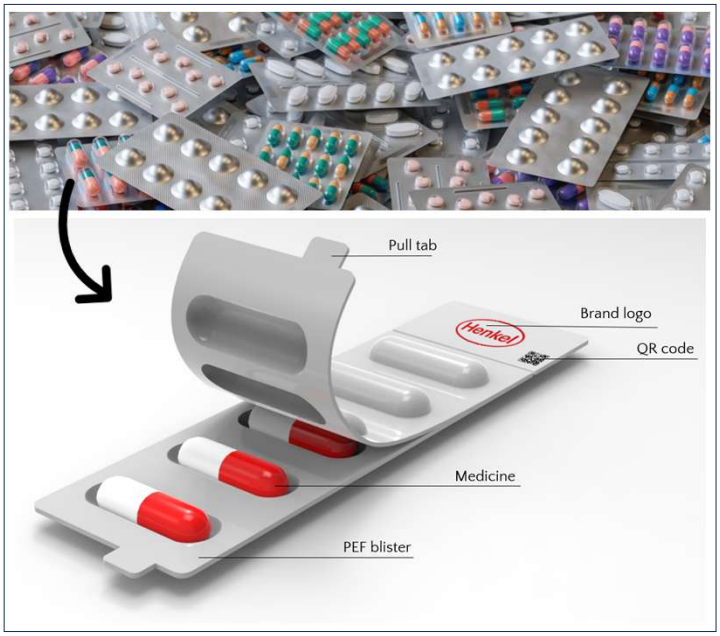
100,000 tonnes of blister-pack waste per year [1]

Methodology: Creating a Circular Blister Pack

1) Literature review: Identified mono-material formats as the most effective route for recyclability. Defined criteria for medical-grade polymers with required barrier performance, stability, regulatory compliance, and low-carbon footprints

2) Design development: Developed a mono-material blister design using a single polymer and a pharmaceutical-compliant adhesive.

3) CAD modelling: Evaluated peel-apart opening mechanisms and seal layouts to ensure product protection and address accessibility limitations of conventional push-through packs.



Findings: PEF Performance and Design Development

Literature review identified **bio-sourced PEF**, a low-emission polymer with **medical-grade barrier performance**, as the most suitable material for the design. This would allow the packs to be produced from a single material, increasing ease of recycling. One of the main benefits of PEF is its **compatibility with PET** recycling streams in small quantities (up to 10%)[2], minimising the need for new waste-handling systems, particularly during early prototyping. Research also highlighted that PEF offers great oxygen and CO_2 barrier performance, supporting its feasibility for pharmaceutical protection requirements.

Design and additional features

The traditional blister pack was redesigned as a peel-apart format to remove the need for aluminium foil and enable **mono-material construction**. Accessibility research also suggests that peel-apart mechanisms reduce the dexterity demands associated with push-through packs, particularly for seniors [3]. **CAD modelling** confirmed that the cavities and seals needed can be made consistently using thermoforming processes.

A **QR code** may be attached to the packet to provide a space for medical information and tracking.

Challenges and how they can be addressed in early testing

- **Limited PEF availability**: Prioritise small scale prototyping and early market engagement
- **Possible weaker adhesion without aluminium**: Conduct targeted lab-scale testing
- **Strict barrier regulations**: Engage with regulators early

Benefits of a PEF Blister Pack (Aligned with SDG 12)

Reduced environmental impact (PET-compatible and no mixed waste)

Potential for automation and material cuts

Automated dispensing reduces material use and improves pharmacy efficiency

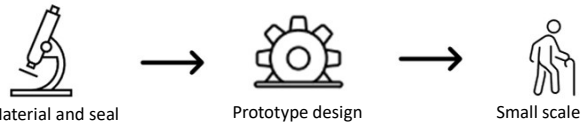
Improved patient accessibility

Peel-apart opening reduces grip strength and dexterity demands and supports independence

Lower carbon footprint (bio-sourced PEF)

Testing and Development Plan

Further work will involve small-scale research to assess **PEF seal integrity**, and how the design could be manufactured, such as through thermoforming or injection moulding. Broader considerations such as **PET-stream behaviour** will be reviewed at later stages.



Acknowledgements

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References

1) Society of Chemical Industry (2021) *Blistering waste: the problem with pharmaceutical blister packs*. Available at: https://www.soci.org/chemistry-and-industry/cni-data/2021/11/blistering-waste (soci.org in Bing) (Accessed: 27 February 2026).
2) Jedvert, K. (2025) Polyethylene furanoate (PEF): a biobased alternative to PET. Chalmers Industriteknik, Bio+ Programme. Version 1.3, January 2025. Available at: https://chalmersindustriteknik.se/app/uploads/Polyethylene-furanoate-PEF-a-biobased-alternative-to-PET_copyright-images.pdf (Accessed: 27 February 2026)
3) Swiftpak (2023) Inclusive pharmaceutical packaging for the elderly. Available at: https://www.swiftpak.co.uk/insights/inclusive-pharmaceutical-packaging-elderly (Accessed: 27 February 2026)