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Surrey Uni leads research to replace plastic with paper for liquids

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A multimillion-pound research project, called SustaPack, aims to overcome manufacturing challenges for the next generation of sustainable, paper-based packaging for liquids. Backed by a £1 million grant from the Engineering and Physical Sciences Research Council (EPSRC) as part of UKRI's co-investing programme, packaging technology company Pulpex Ltd has joined forces with the University of Surrey to refine its manufacturing processes to provide a viable solution to plastic pollution.

Contributing matching support towards the project, Pulpex has already made significant strides in the development of its patented technology, which produces degradable bottles made from natural wood fibres. The packaging offers a sustainable alternative to traditional plastic materials and can be recycled in existing paper waste streams.

However, designing the next generation of production technology and materials requires novel and fundamental research to address current limitations, including new analytical techniques to improve product quality, optimising performance and reducing in-process imperfections.

Scott Winston, CEO at Pulpex, said:

"We're excited to strengthen our existing collaboration with the University of Surrey to enhance our technologies and processes. Our SustaPack partnership will help us advance safe, sustainable packaging solutions, enabling brand owners to meet Net-Zero targets. It gives consumers sustainable choices, delivers answers for brand owners, and enables supply chains and retailers to deliver their carbon footprint reduction goals – a priority for all."

A key feature of the packaging is its multi-layered barrier coating, which prevents contained liquid from leaking, as well as inward oxygen permeation, maintaining high-quality products for consumers. To create a step-change in the energy usage in methods used to apply these coatings, the researchers plan to develop innovative processes that consume less energy and water while increasing the shelf life of packaged goods.

Professor Joseph Keddie, from the University of Surrey's School of Mathematics and Physics, and Fellow of the Institute for Sustainability, said:

"Over the past couple of years, I have forged a close relationship with Pulpex as a Royal Society Industry Fellow, and I am enthusiastic about strengthening our ties through our SustaPack Partnership.

"Our aim here is to combine novel coating processes, mechanistic modelling, computer vision and artificial intelligence (AI) to establish a 'dry' spray coating process that deposits food-safe, degradable coatings. This technology, which isn't yet commercially available, will not only drive the next generation of packaging technology but will also contribute to a significant reduction in plastic pollution and lower carbon emissions from manufacturing."

A multi-disciplinary team of researchers will explore the feasibility of using thermal imaging to detect defects in wet coatings as they occur, enabling immediate corrections using AI. Multi-scale mechanistic models of the coating process will be employed to identify the sources of imperfections and non-uniformities and then eliminate them to ensure optimal packaging performance.

By applying innovative computer vision techniques powered by AI, the project aims to identify production defects in real-time, optimise materials and processes, and achieve 100% reliability in the manufactured products.

The outcomes of the project could set new standards for environmentally friendly packaging, helping brand owners reduce their environmental impact amidst ever-increasing environmental regulations – while offering consumers eco-friendly options to help fight against plastic pollution.

From left to right: Dr Hui Luo and Professor Robert Dorey (University of Surrey's School of Engineering); Professor Joseph Keddie (University of Surrey's School of Mathematics and Physics); Scott Winston, CEO at Pulpex; Barrie Harvey, COO at Pulpex; Dr Simon Hadfield (University of Surrey's Centre for Vision, Speech and Signal Processing); Professor Charley Wu (University of Surrey's School of Chemistry and Chemical Engineering).