NSSN
NSW Smart Sensing Network

FACT SHEET

LABEL CONTAMINANT SENSING AND IMPACT DELAMINATION BREAKTHROUGH

2021

RESEARCH UNDERTAKEN BY THE UNIVERSITY OF SYDNEY AS PART OF THE CRC-P: INCREASED RECYCLING OF PLASTICS BY SENSING AND TREATING LABEL CONTAMINATION

THE UNIVERSITY OF SYDNEY

LEAD PARTNER

PEGRAS

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Label Contaminant Sensing and Impact Delamination Breakthrough

Key Centre for Polymers and Colloids (KCPC), School of Chemistry, the University of Sydney

Recycling companies today have problems in recycling HDPE because label adhesive contaminates the feedstock. The source of this very strong sticky adhesive is the milk label (see Figures 1.a and b.). HDPE is a high quality material in demand for re-use but under 2% of used HDPE is now recycled as PCR (Post Consumer Recyclate) in Australia. The current process of HDPE recycling is consistently limited to ~ 25% of re-manufactured rHDPE material, due to the current wash process not removing 100% of the contaminating adhesive.

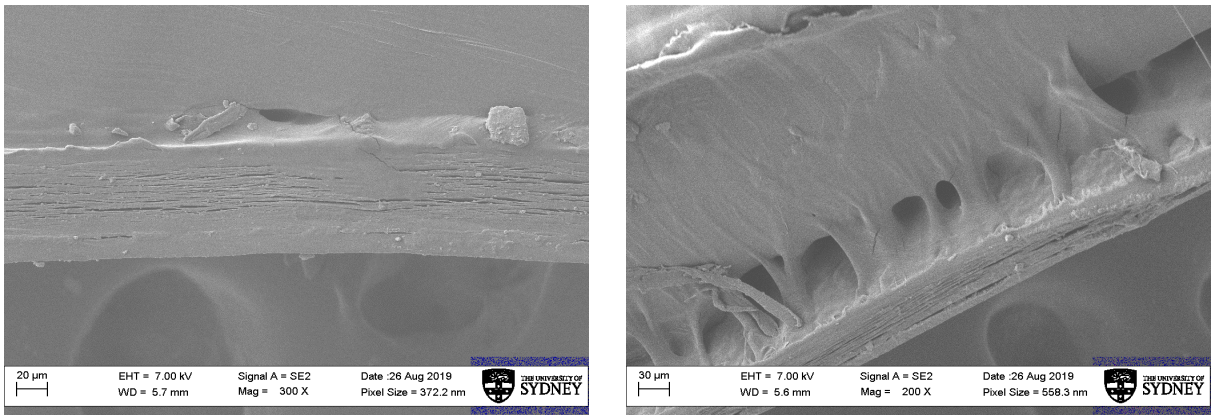


Figure 1: SEM (Scanning Electron Microscope) images showing the label (top layer) is very well adhered to the HDPE substrate (bottom layer) (a. left), even after normal efforts to remove it (b. right).

How will the success for the sub-project be measured?

Success is being defined by the progress against the agreed milestones. To date milestones 1 and 2 have been completed, with significant progress on milestone 3.

How will you attain the outcomes?

The Key Centre for Polymers and Colloids with Assoc. Prof. Hawkett as the director have a well established team of chemists who have worked extensively with industry partners for many decades.

How is the project relevant to the recycling challenge?

A clean feedstock of recycled plastic is vital to achieve the APCO 2025 PCR targets for HDPE. The adhesive must be fully removed to match the performance of virgin resin. This project will enable improvements in current recycling processes to achieve this result.

Project impact

To achieve 100% recycled rHDPE results the Univesity of Sydney Univesity is contributing to the project in the following ways;

- Analysing the contaminants to determine the chemistry and chararistics
- Develop chemistry to fully remove the adhesive from the HDPE
- Develop a Quality Control process to measure the adhesive level in production
- Optimise the new processes for commercial introduction

Project achievements

To date the project has made significant progress in fully characterising and quantifying the adhesive contaminant levels in factory samples. The researchers have developed new chemical and sensing analytic techniques to measure residual adhesives of factory samples. This has formed the basis for reporting on future progress.

- New wash chemistry has been formulated with very successful results in acheiving 100% removal. Future work is focused on optimising the chemistry and process conditions.
- An innovative impact delamination technique has also been discovered that can act as a pre-process step to almost fully remove the adhesive from the HDPE prior to washing (Figure 2.)
- Close collaboration with all the project partners, led by PEGRAS has enabled rapid progress in spite of the COVID-19 impact.

Figure 2: Perfectly clean HDPE flakes after applying the University of Sydney removal processes.

Key take away

This applied chemistry research has enabled a deeper understanding of the impediments in the current industry standard recycling process that has limited the level of recycled rHDPE in milk bottles to 25%.

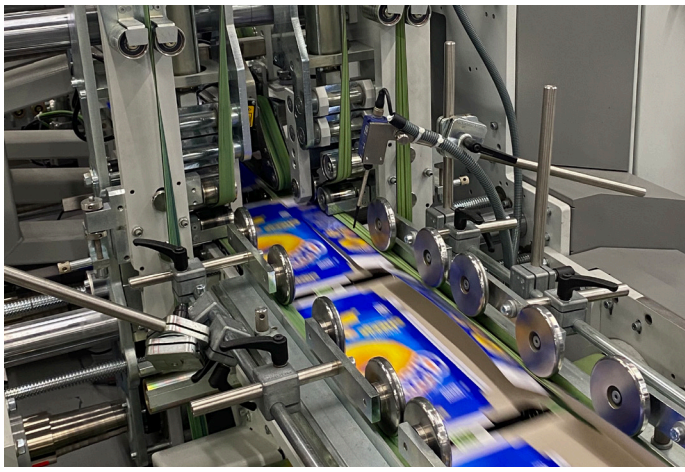
This is leading to world first chemical and impact delaminaton techniques that can be applied within the recycling industry. The ability to remove the contaminant adhesive via these methods, and then ‘measure’ the success of this process with newly developed analytic methods that are ‘process ready’ to implant within the factory QC environment are considered commercially viable solutions.

Ultimately this project is developing new knowledge for the recycling industry that can be deployed to enhance the successful implementation of the Circular Economy for plastics.

Industry Partners

The project's industry partners are making an investment in the future by funding this research to the tune of nearly $1.5 Million.

Labelmakers started back in 1987 printing self-adhesive labels, and grew to become Australasia's largest and most innovative label supplier. Packaging has changed considerably over the last three decades and they have developed solutions that have responded to the changing needs of our customers. Self-adhesive labels are now just one of six core labelling products. Labelmakers are supporting this project as part of their commitment to exploring opportunities that expand our business to continue to grow our offerings to our customers while remaining competitive in a global market and looking at ways to further reduce our carbon footprint.



PEGRAS Asia Pacific, is a technical solution consulting company based in NSW. For seneral years they have been collaborating with the NSSN and many industry partners to solve real world problems.

With a network of consultants in Australia, Europe and Asia, PEGRAS has provided solutions for various companies, including Audi, BioOil, Continental, Siemens, and TOYO.

Building on immense background knowledge of print and packaging, their business focus includes developing solutions for the Circular Economy needs of plastic recycling. PEGRAS developed the initial proof of concept chemistry that has evolved into this CRC-P project and provides a chemical and engineering lead.

To find more about the project out how the NSSN can help solve your challenges in other areas, please contact Dr Don McCallum at 0433 496 778 or don.mccallum@nssn.org.au

This is a Cooperative Research Centre Project (CRC-P) supported by:

Australian Government
Department of Industry, Science, Energy and Resources

NSW GOVERNMENT Office of the Chief Scientist & Engineer