INTELLIGENT LABELS AS A BASIS FOR AUTO-SORTING OF PLASTIC PACKAGING

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NEXTEK Ltd - What we do

- New Recycling plant design for plastics and technical/economic Feasibility studies
- Research and development of novel materials and processes for all plastics and bioplastics
- Existing recycling plant optimization (higher quality more throughput)
- Strategic advice to Multi-National Packaging and Recycling Co’s
- New Circular Economy Technologies include
  - Intelligent labels for sorting packaging (PRISM)
  - Coffee Cup recycling process and products
  - Low Odour recycled plastics,
Recycling of plastics boost to 50% recovery in Europe

Europe could see 300 more recycling plants by 2025

By PRW Staff
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German-based consultancy ecoprog has claimed that the demand for plastic recycling plants in Europe will increase significantly by 2025, with capacity set to rise by a quarter.

The market study, 'The European Market for Plastic Sorting and Recycling', predicted recycling plants with an estimated capacity of 5.2 million tonnes would be commissioned during the next decade, while the number of plants would increase by about 300.

The report said the 1,200 active plastic sorting and recycling plants in Europe were not enough for projected capacity, with the European Union (EU) Waste Framework, which requires member states to re-use or recycle at least 50% of certain household wastes, including paper, metal, plastic and glass, by 2020 cited as a key factor in driving plastics recycling.

Marcel Siebertz of ecoprog GmbH 17 September 2015
Price development for waste plastics in Germany 2015

HDPE natural

PP homopolymer nat

Source: Euwid
RECYCLING OF PLASTICS

THE BIG CHALLENGE is….

SORTING

at high speed to high purity….and

(MAKING MONEY)
How we sort Plastics NOW!
By detecting Infrared signal (plastics type) and colour

• Sorting Efficiency is ~95% but Food Grade recycled plastics should be close to 100% (99-99.9% Purity)
Current sorting technology - Visible / NIR sorting

• Broad band excitation with halogen lamps

• Detection of the visible (to define colour) or Near Infra-red spectrum (to define polymer) when excited with EMR

Excitation energy
Broad spectrum

Emission of EMR in Vis/NIR spectrum

Color detection with in VIS
Material detection within NIR
Sorting Plastic bottles can be difficult
What if bottles could talk to the auto detectors!

I am actually a clear PET bottle (or a multilayer bottle or a bioplastic)

I am a food grade HDPE bottle

I am not food grade HDPE bottle

I am actually a black HDPE bottle
New sorting technology - Fluorescence Markers

- Organic or inorganic compounds

- Emit light (fluorescence) in the visible or Near Infra-red spectrum when excited with UV laser
PRISM
Plastic Packaging Rapid Intelligent Sorting System for Materials

• PRISM is a new way of

• rapidly sorting packaging based on intelligent labels with invisible markers

• that can be detected and sorted using existing high-speed optical sorting systems used in MRFs with minor modifications.

• Markers are removed during recycling leaving no traces for the next cycle of use.
HOW DOES IT WORK? by Luminescence

• These markers are not visible with normal lighting and so do not detract from the package aesthetics.

• under specific light sources, they emit visible light that automated sorting units can identify on individual packages and sort them into separate recycling streams.

• The labels and markers are removed during the normal recycling processes along with the label.

Under specific lighting

• No label

• With PRISM label
Intelligent labels – UV excitation of pots tubs and trays
Intelligent label sorting - RESULTS

• A single pass gave yield of 93% and a purity of 94%.
• A double pass would achieve a purity of 99.3%
• The sorting system can be set to identify both plastic type and to read the marker simultaneously giving the capacity to identify specific sub categories of the plastic.

The performance is the SAME as existing NIR sorting equipment – but NOW the label also sets the sorting decision.
Commercialisation of PRISM labels

- Cost of pigment for each PRISM label was estimated to be 0.2p per label, (that label would cost 0.8 pence). This is approx 0.25% the cost of a label.

- The fluorescent inks can be applied as an over-lacquer using existing conventional labelling and decoration techniques.

- Labels will be coded for specific applications.

- Existing NIR based sorting equipment required retrofitting with (low cost) UV-LED lighting or new machines will be released.
Opportunities for PRISM technology.

- The use of multiple markers allows additional coding opportunities.
- The number of combinations is given by $\text{Number} = 2^n - 1$
- Four markers = 15 coding sets per type of plastic
Business Impacts

• **NOW Possible** - food grade rPP similar to food grade HDPE milk bottles where 21ktpa are recycled into virgin replacement resins valued at over £21 million.

• The rPP could be sourced from the low value pots tubs and tray stream that represents 556ktpa of largely unrecycled waste.

• Reduce costs, increase the quality and yield of the HDPE milk and PET bottle recycling process through the use of automated rather than manual sorting.

• Yields improved by recovering more of the 30,000 tonnes of PET bottles incorrectly sorted due to the full sleeve obscuring the bottle from identification.

• The PRISM technology can be used as **anti-counterfeiting measures** in food and pharmacy products.
Summary

• Packaging marked with intelligent labels or coatings can be uniquely identified and sorted with high efficiency using high-speed, high-throughput commercial equipment that is modified with UV lighting.

• This technology offers the potential to sort a range of targeted recycled materials such as food grade PP, HDPE and PET packaging, as well as other materials using a non-polymer specific process.

• It can be used for positive or negative sorting to purify or eliminate specific products.

• 143,000 tonnes of PP food packaging is utilised in the UK each year and it is estimated that 77,077 tonnes could be separated for recycling back into food applications.

• The technology could be implemented using existing labelling and decoration techniques and would be improved with purpose-designed labels, to improved detection and removal during washing and recycling.
Thank you for listening.... Any questions?