Preliminary Analysis of Improving Sorting Capacity for

Flexible Packaging Using Digital Watermarking Technology

GAPC CPT

GROUPE D'ACTION PLASTIQUES CIRCULAIRES

CIRCULAR PLASTICS TASKFORCE

Film and Flexibles Innovation Hub

Optimize the capture rate of films and flexibles in MRFs and at recyclers using different sorting technologies, working towards obtaining food grade PCR

Why in Eastern Canada?

- PE films and flexibles are already collected through most recycling programs in Canada, but technical challenges remain (estimated only 1% is recycled)
- Canada's provinces are transitioning to full responsibility (EPR) schemes, which comes with ambitious collection and recycling targets for films and flexibles
- **Ontario:** Recycling rate 25% by 2026, 40% by 2030
- **Quebec:** Recycling rate 40% by 2027, 50% by 2030
- Strong market demand for PCR, but recyclers must deal with high bale contamination (up to 30-40%), lack of consistency and major collection & sortation challenges

Objectives and Methodology

Objective: In a controlled environment, test the ability of existing equipment to sort digitally marked films and flexibles with varying print coverage from mixed materials

- Test a combination of NIR technology and watermark reader
- 16 different flexible samples from four different manufacturers were tested
- Five different tests were performed:
  - Baseline test: Samples were placed alone on conveyor to test ejection
  - Three mixing tests, to test for multiple collection systems:
    - Single Stream Collect (SSC): mostly flexibles, post-sorting at MRF
    - Dual Stream Fiber (DSF): mainly papers, newspapers and cardboards
    - Dual Stream Container (DSC): mainly bottles
  - A monolayer PE vs Multilayer PE/PET test

Partners

DIGIMARC

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WINPAK

balcan

PELLENC ST

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Ejection rates

Reference #	Packaging type	Size	Print Coverage (%)	Baseline Test	Single Stream Collect (SSC)	Dual Stream Fiber (DSF)	Dual Stream Container (DSC)	Average
1	LDPE Pouch	Large	100	100	100	96	100	99
2	LDPE Shrink Film	Large	50	100	100	100	100	100
3	LDPE Garden Bag	Large	83	100	100	100	100	100
4	LDPE Bag	Large	40	85	92	88	88	88
7	Monolayer PE Pouch	Small	90	100	96	95	100	98
8	Monolayer PE Pouch	Small	60	100	98	91	95	96
9	Monolayer PE Pouch	Small	30	96	98	91	93	95
10	Monolayer PE Pouch	Medium	90	100	99	96	100	99
11	Monolayer PE Pouch	Medium	60	95	97	98	99	97
12	Monolayer PE Pouch	Medium	30	73	76	65	64	70
13	PET/PE Pouch	Small	90	100	99	98	98	99
14	PET/PE Pouch	Small	60	98	97	95	96	97
15	PET/PE Pouch	Small	30	80	87	82	88	84
16	PET/PE Pouch	Medium	90	99	97	98	98	98
17	PET/PE Pouch	Medium	60	99	99	96	97	98
18	PET/PE Pouch	Medium	30	73	71	60	68	68
Average (all samples)				93.7	94.1	90.5	92.8	92.8
Average (over 50% print coverage)				99.1	98.3	96.6	98.4	98.1

Purity of Ejected Samples

COLLECTION SYSTEM	AVERAGE PURITY (%)
Single Stream Collect (SSC)	87.0
Dual Stream Fiber (DSF)	96.3
Dual Stream Container (DSC)	96.2
Average	93

- Ejection of flexibles remains a challenge for sorting equipment and can cause impurities (as seen for SSC)
- The 95% threshold of purity was maintained for the DSF and DSC tests

Conclusions

- **The purity rates for two of the three mixing tests were very good:** the Single Stream Collect purity rate was lower (87%) due to challenges related to ejection of films and flexibles by sorting equipment.
- **The Monolayer vs Multilayer test** further proved the ability of watermarking to sort any sample on a SKU basis.
- **The combination of NIR and watermarking** improved performance without impacting the purity.
- **The trial was successful in confirming** that the Digimarc technology works to sort films and flexibles.
- **Ejection rates of samples meeting Digimarc enhancement guidelines (particularly on watermark coverage) averaged 99%.** In general, ejection rates were excellent (98% average) when watermark coverage exceeded 50%.
- **Most of the ejection challenges were related to overlapping:** a disc spreader is usually used to avoid this issue by spreading products on the conveyor.

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