

# Determining the Feasibility of Using Optical Sort Technologies to Separate PET Non-bottle Rigid Plastics

By:



And:



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## 1.0 Background

Most material recovery facilities (MRF's) routinely separate PET and HDPE bottles from their plastic streams. While bottles and tubs comprise about 60% of the rigid plastics found in the household, there remains a mixture of rigid plastics that are neither bottles nor tubs, which are manufactured from a variety of resins. These materials are in the form of clam shells, trays, cookie liners, egg trays, etc. The fraction of these materials that is PET has the potential to become a revenue stream for a recycling program if it can be separated from the other resins. The purpose of the experiment described below was to determine the capability of an optical sorting device used to remove PET bottles as a tool to efficiently remove PET thermoformed packaging.

## 2.0 Methodology of Audit

The waste audit was conducted over one day with the helpful support of Canada Fibres Ltd. and the City of Toronto; three independent samples were collected from both the PET positive-sort bunker, and the residue bunker. The samples were collected immediately after running through the optical sorter, and with the absence of quality control on the post-feed lines. Each sample consisted of 90 seconds worth of material from both the PET and residue bunkers. The quantity of material feeding the optical sorter was consistent throughout each sample test. It should also be noted that the City of Toronto currently does not accept polystyrene and non-bottle PET packaging, however these materials do routinely show up on the curb side.

Each sample was sorted for PET bottles (#1 resin), PET non-bottle other packaging (#1 resin) and polystyrene packaging (#6 resin). All other items were categorized as All Categories Not Identified. While the resin type of other thermoform materials including PVC, PLA, composite polyethylene mixtures and polypropylene was noted these materials were not individually recorded and were included in All Categories Not Identified.

## 3.0 Data

The data were collected by AET Consultants led by Larry Freiburger and are summarized in Table 3.1 below.

**Table 3.1 – Raw data from three samples of waste audit**

Facility/Address:	35 Vanley Cres	35 Vanley Cres	35 Vanley Cres	35 Vanley Cres	35 Vanley Cres	35 Vanley Cres
Date (day/month/yr):	08.10.2008	08.10.2008	08.10.2008	08.10.2008	08.10.2008	08.10.2008
Conveyor:	PET	Residue	PET	Residue	PET	Residue
Sample Number:	1	1	2	2	3	3
Material Category	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)
<b>PLASTICS</b>						
1. PET Bottles (#1) .....	13.06	2.67	12.75	1.66	9.78	1.74
2. PET Other Packaging (#1) ...	1.64	0.32	1.50	0.44	1.04	0.35
3. Polystyrene Packaging (#6) .	0.00	0.33	0.03	0.27	0.01	0.15
<b>OTHER MATERIALS</b>						
All Categories Not Identified .....	1.34	48.98	2.70	43.68	1.48	35.20

## 4.0 Results

To analyze the data, three tables are required. Table 4.1 shows the percent composition of each material in the PET bunker and the residue bunker. Approximately 9.3% of total material found in the PET bunker after passing through the optical sorter is thermoform packaging. Conversely, approximately 1.4% of the total material found in the residue bunker is thermoformed packaging which is not being recognized by the optical sorter.

Of the total packaging found in the PET bunker and the residue, approximately 9.2% and 0.82% respectively are PET thermoformed plastics.

**Table 4.1 – Percent composition of PET bottles and thermoform packaging**

Material Category	PET Positive Sort Bunker		Residue Bunker	
	Average Weight (kg)	Percent Composition	Average Weight (kg)	Percent Composition
<b>PLASTICS</b>				
1. PET Bottles (#1 resin) .....	11.86	78.49%	2.02	4.46%
2. PET Other Packaging (#1 resin) .....	1.39	9.20%	0.37	0.82%
3. Polystyrene Packaging (#6 resin) .....	0.01	0.07%	0.25	0.55%
<b>4. Total Thermoform Packaging (2+3)</b>	<b>1.40</b>	<b>9.27%</b>	<b>0.62</b>	<b>1.37%</b>
<b>OTHER MATERIALS</b>				
5. All Categories Not Identified .....	1.84	12.18%	42.62	94.17%
<b>TOTALS</b>				
<b>6. Grand Total .....</b>	<b>15.11</b>	<b>100.00%</b>	<b>45.26</b>	<b>100.00%</b>

*\*\*Percentages may not add to 100% because of rounding\*\**

Table 4.2 below, summarizes the recovery rate of PET bottles, PET other packaging and polystyrene packaging. The data suggest that approximately 79% of PET other packaging (non bottle) is being recovered through the use of an optical sorter. Moreover, the optical sorter is successfully rejecting polystyrene (#6 resin) as contaminant. Only 3.85% of the total polystyrene Handled ended up in the positive sort bunker. The optical sorter was commissioned at a recovery rate of 91.8% for PET bottles. This test suggests that PET bottles are being recovered at a rate of 85.5% which differs with the commissioning rate because of the absence of quality control both before and after the optical sorter.

**Table 4.2 – Recovery rates of PET bottles and thermoform packaging**

Material Category	PET Positive Sort Bunker	
	Average Weight (kg)	Recovery Rate (%)
<b>PLASTICS</b>		
1. PET Bottles (#1 resin) .....	11.86	85.45%
2. PET Other Packaging (#1 resin) .....	1.39	78.98%
<b>CONTAMINANTS</b>		
3. Polystyrene Packaging (#6 resin) .....	0.01	3.85%
4. All Categories not Identified .....	1.84	4.14%

*\*\*Data is significant to 2 decimal places\*\**

Table 4.3 shows the amount of PET other packaging as a proportion of all PET materials found in the PET bunker and the residue stream. The three trials indicate that approximately 11% of total PET (in the positive sort bunker and the residue stream) is thermoform.

**Table 4.3 – PET bottles and PET thermoform as a percentage of total PET**

Material Category	First Trial		Second Trial		Third Trial		Average	
	Weight (kg)	(%)	Weight (kg)	(%)	Weight (kg)	(%)	Weight (kg)	(%)
<b>PLASTICS</b>								
PET Bottles (#1) .....	15.73	88.9%	14.41	88.1%	11.52	89.2%	13.89	88.7%
PET Other Packaging (#1) ..	1.96	11.1%	1.94	11.9%	1.39	10.8%	1.76	11.3%
<b>Total PET Materials .....</b>	<b>17.69</b>		<b>16.35</b>		<b>12.91</b>		<b>15.65</b>	

*\*\*Percentages may not add to 100% because of rounding\*\**

## **5.0 Conclusion**

The purpose of the experiment was to determine the capability of an optical sorting device used to remove PET bottles as a tool to efficiently remove PET thermoformed packaging. This test found that with the use of optical sorting technology, 79% of PET rigid plastics are being positively sorted. Furthermore, if we limit our scope to only look at PET materials, Table 4.3 suggests that approximately 11% of all PET material in the current stream is non-bottle rigid plastics. Polystyrene accounted for 0.62% of the three trials being examined and was successfully being rejected by the optical sorter at a rate of approximately 96%. In future tests it is recommended that data be recorded for other forms of thermoform materials such as PVC, PLA, polypropylene and polyethylene mixtures which currently have been classified as “All Categories Not Identified”.