Material change for a better environment

Trial report

Post-consumer film recycling: Film separation at Biffa Waste Services Ltd

Report of film separation trial at Biffa Trafford Park MRF

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Front cover photography: Post-consumer film product – Biffa Waste Services Ltd Trafford Park

Executive summary

This trial report forms part of a suite of reports demonstrating the technical feasibility of using fully comingled post-consumer film packaging to manufacture products that the retail sector can adopt for use within their store networks and as part of their product ranges for customers. The overall project involves a number of upstream recyclers and downstream manufacturers manufacturing a number of different products from post-consumer films. There are a number of individual trial reports available, in addition to a summary report for the whole project:

- Film separation at Biffa Waste Services Limited;
- Processing of LDPE film at Ecoplast;
- CeDo manufacturing trial;
- Agglomeration trial at Hanbury Recycling;
- Centriforce manufacturing trial;
- Protomax manufacturing trial; and
- Post-consumer film recycling (overall summary report).

The film separation trial at Biffa Waste Services' Materials Recovery Facility (MRF) at Trafford Park, Greater Manchester was the first stage of the CeDo refuse sacks manufacturing trial. The trial required collection of post-consumer comingled film from mixed household dry recyclables as feedstock material for recycling at Ecoplast and subsequent manufacturing by CeDo of refuse sacks.

Whilst collection of typical 'Class C' post-consumer comingled film was possible via normal operation of the Biffa MRF, the contamination levels within this material was considered to be too high for the CeDo manufacturing trial. As such, the settings for the Near Infrared (NIR) film sorter were adjusted (with the assistance of TITECH) in order to produce a product with lower levels of contamination, specifically for this trial.

In total, 5.9 tonnes of low level contamination post-consumer film packaging was produced from the trial for further processing at Ecoplast.

As there was concern that the 5.9 tonnes of post-consumer film may not be enough material for processing at Ecoplast due to an expected low yield, an additional 1.5 tonnes of standard 'oversize' film and 3 tonnes of standard 'Class C' film were also baled and dispatched from the Biffa MRF. This additional material was dispatched as contingency product, only to be used if the 5.9 tonnes of trial product was not a large enough amount to process at Ecoplast. In total 10.4 tonnes of baled film was sent for reprocessing at Ecoplast.

Content

List of figures

List of tables

Acknowledgements

Axion Consulting and WRAP wishes to thank all the staff at Biffa's Trafford Park MRF for their time and cooperation with this trial. We would also like to thank to the staff at TITECH UK for their commitment and effort to support the trial.

1.0 Background

WRAP has commissioned Axion Consulting to demonstrate the technical feasibility of using fully comingled post-consumer film packaging in economically and environmentally viable products. The project involves Axion working with a number of manufacturing companies to trial the manufacture of products using post-consumer films.

The manufacturing trial partners and products being trialled are:

- CeDo: refuse sacks;
- Centriforce: rigid panels with a variety of end use applications including hoardings; and
- Protomax: rigid panels with a variety of end use applications including hoardings.

There is a suite of individual trial reports available, in addition to a summary report for the whole project:

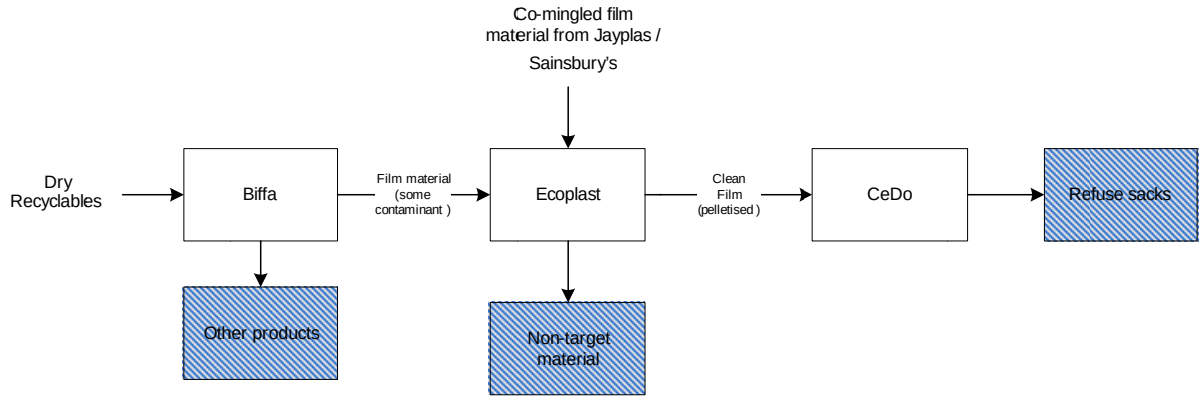
- Film separation at Biffa Waste Services Limited;
- Processing of LDPE film at Ecoplast;
- CeDo manufacturing trial;
- Agglomeration trial at Hanbury Recycling;
- Centriforce manufacturing trial;
- Protomax manufacturing trial; and
- Post-consumer film recycling (overall summary report).

The trials are using two feedstock materials; plastic films collected through Sainsbury's front of store and back of store collection network and comingled films collected from domestic kerbside recycling schemes.

The film separation trial at Biffa Waste Services' Materials Recovery Facility (MRF) at Trafford Park, Greater Manchester was the first stage of the CeDo manufacturing trial. The objective of the trial was to obtain post-consumer comingled film from mixed household dry recyclables as feedstock material for recycling at Ecoplast and subsequent manufacturing by CeDo of refuse sacks.

The flow diagram shown in **Figure 1** shows the various stages and companies involved in the production of refuse sacks from post-consumer comingled film.

Figure 1 CeDo trial overview



2.0 Trial information

Trial host: Biffa Waste Services Ltd, Trafford Park MRF, Greater Manchester

Trial date: 1st February 2011

2.1 Description of trial host/equipment

The Biffa MRF at Trafford Park was selected as a trial host due to its state of the art recycling equipment coupled with the high volume of post-consumer kerbside collected household dry recyclable material that it processes. The plant consists of waste screens, trommels and ballistic separators each used to segregate the post-consumer waste feed into well controlled size fractions. A number of eddy current separators, magnets and Near Infrared (NIR) optical sorters are used to segregate the material into a range of pure product streams. Any unsorted material is either recycled or manually hand sorted and diverted to the relevant product bay.

The final NIR sorter in the process is dedicated to separating the film fraction from other dry recyclable materials (paper, cardboard, plastic bottles and cans and tins) that have been missed in the upstream separation stages. Under normal operation, this NIR sorter is set to give a high yield in order to maximise the tonnage of film separated.

2.2 Objectives of the trial

The objectives of the trial were to:

- Collect a minimum of 12 tonnes of post-consumer comingled film (lower contamination level film) for the next stage of the trials (recycling at Ecoplast); and
- Produce high quality post-consumer comingled film by optimising the NIR sorter settings for purity and undertaking additional hand sorting on the film material to ensure viability of the feedstock for the subsequent stages of the trial at Ecoplast and CeDo.

2.3 Trial feed material

The new Biffa MRF at Trafford Park handles 200,000 tonnes per annum of comingled dry recyclables collected from both commercial and industrial sources and domestic kerbside recycling schemes throughout the UK.

For this trial, it was agreed that Biffa would stockpile post-consumer dry recyclables on the evening prior to the trial (31st January 2011) in order to provide sufficient feed to obtain 12 tonnes of lower contamination level product, for further processing at Ecoplast.

2.4 Trial methodology

Axion Consulting and CeDo representatives visited the Biffa MRF on the 28th January 2011 in order to assess the suitability of the comingled film stream for the refuse sack manufacturing trial with CeDo. It was established that paper and metallised film fractions would be the most problematic materials for processing during the downstream recycling and manufacturing stages. Samples of these materials were taken and were used to make display instruction boards to train the hand pickers that this material needed to be removed during the trial.

In order to remove as much of the contamination as possible, the detection settings on the film NIR sorter were to be modified to produce a 'purer' film fraction with a lower level of contamination rather than the standard high yield (higher contamination level) material normally produced. An engineer from the equipment suppliers (TITECH) was on site to provide technical assistance optimising the NIR sorter on the day of the trial. A trial plan was produced.

The approach was for the stockpiled waste to be processed through the plant as normal, with the optimised NIR film sorter set up to produce a post-consumer film with low levels of contamination that could be further improved by using hand pickers to remove any residual non-target material. Display instruction boards were installed in the hand picking area in order to provide guidance as to what should be removed as 'contamination'.

The collected material would be baled and dispatched to Ecoplast for recycling.

3.0 Results and discussion

3.1 Photographs

The photographs in this section show the equipment utilised in the trial and the processed film.

Figure 2 NIR sorting equipment similar to that at the Biffa MRF Trafford Park

Figure 3 Example label on bales of trial material

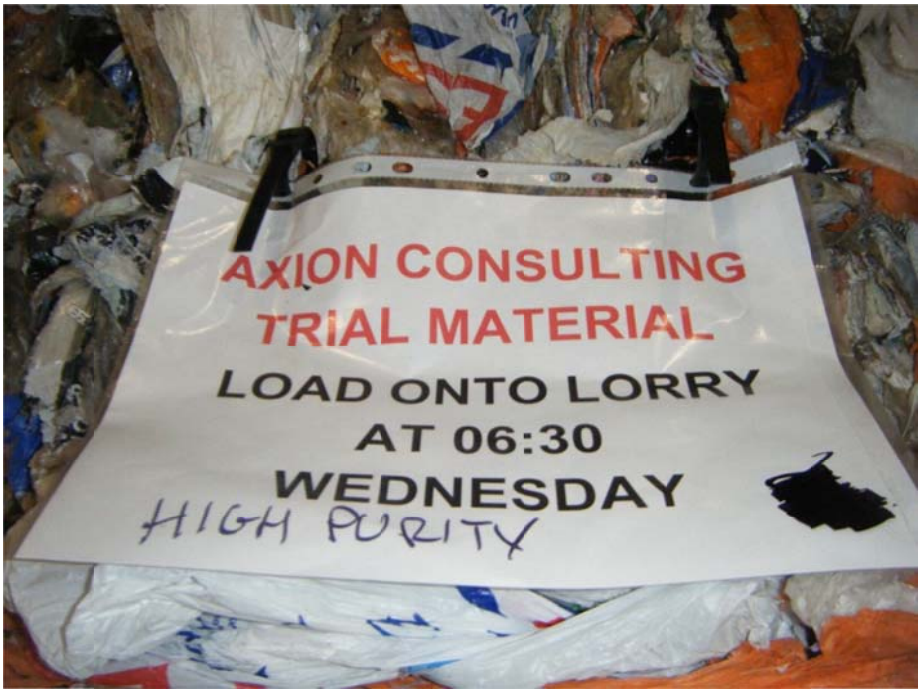
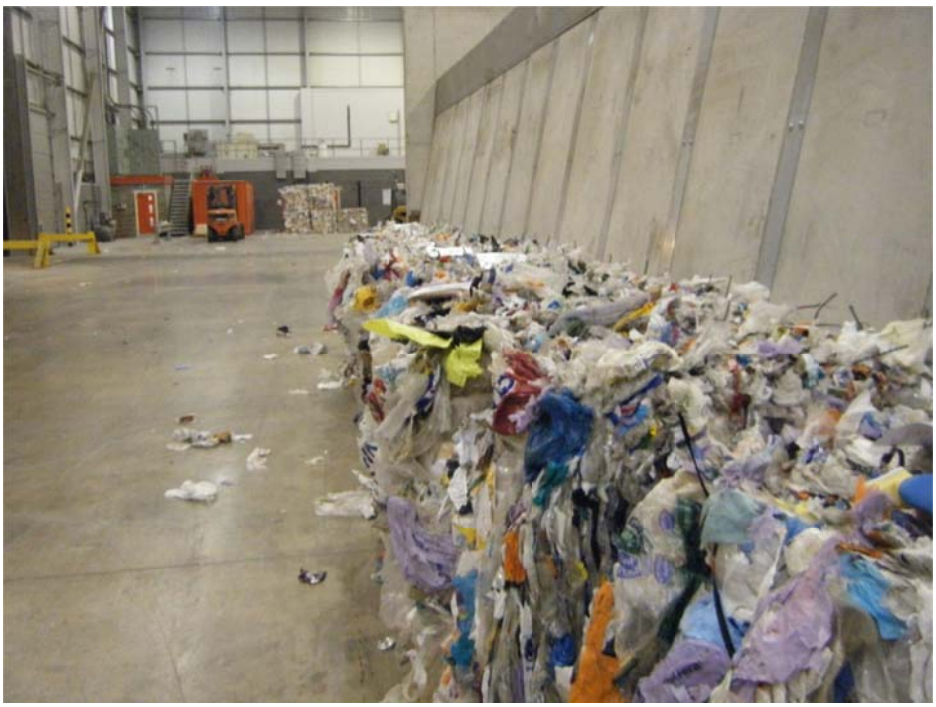


Figure 4 Bales of separated film material



3.2 Data

It was not possible to collect 12.0 tonnes of low level contamination film as initially planned. This can be attributed to unforeseen (and unrelated) mechanical problems that occurred at the plant on the day of the trial.

By the end of the trial 5.9 tonnes of low level contamination film was produced.

As there was concern that this may not be enough material for processing at Ecoplast, an additional 1.5t of standard 'oversize' film and 3t of standard Class C film[1] were also baled for distribution to Ecoplast. Whilst not directly related to the trial, this material was dispatched as contingency product, only to be used if the 5.9t of trial product was not a large enough amount to process at Ecoplast.

Table 1 shows the material dispatched to Ecoplast.

Table 1 Mass balance of trial material

Material	**Mass (t)**
Low level contamination film (from trial)	5.9
Oversize film (contingency product)	1.5
Class C film (contingency product)	3.0
Total sent to Ecoplast	**10.4**

[1] *'Class C' film is the standard film product Biffa produce. It can be sourced from both household waste and commercial and industrial waste streams. The priority is to produce a high yield product, with purity levels being sacrificed to some extent to achieve this and also to product a high purity paper stream. Key contaminants include paper, polypropylene film, polyethylene terephthalate packaging and metallised films.*

3.3 Discussion

The film NIR sorter needed to be operational in order for its settings to be adjusted from high yield (higher film production rate, high levels of contamination) to higher purity (lower production rate, lower levels of contamination). Therefore, at the start of the trial, the machine was started on the standard plant sorting settings, producing a high yield of material, with high levels of contamination. The downstream hand pickers removed as much of the high level contamination as possible. The higher purity settings required were then established and fine-tuned over a period of approximately two hours. Approximately 0.5 tonnes of film was produced during this initial set up period. In total 1 tonne of film was produced from using the optimised NIR settings and the hand sorting. A further 4.9 tonnes of film was produced using the optimised NIR settings, without any additional hand sorting.

In total, the trial produced 5.9 tonnes of post-consumer trial film for further processing at Ecoplast. Whilst the trial material produced contained a lower level of contamination than a standard film produced by Biffa (known as Class C film), relatively low yields (less than 50%) were still expected through the Ecoplast separation and cleaning plant.

As discussed above, there was some concern that 5.9 tonnes of material would not be a sufficient final quantity of material for conversion into refuse sacks. As a contingency, other standard post-consumer film material was sourced from Biffa and dispatched with the trial material. This consisted of 1.5 tonnes of 'oversize' post-consumer film and 3.0 tonnes of standard 'Class C' film.

4.0 Conclusions

In total, the trial produced 5.9 tonnes of post-consumer comingled film for separation trials at Ecoplast and subsequent recycling into refuse sacks at CeDo.

Due to the low recycling yields expected at Ecoplast, there was concern that this was not enough material to successfully complete all the trials. An additional 4.5 tonnes of contingency material was sourced from standard Biffa production operations. This consisted of 1.5 tonnes of film sourced from the oversize line and 3.0 tonnes of standard class C film.

In total, 10.4 tonnes of film was dispatched to Ecoplast for further separation and washing trials.

It was not possible to make an accurate measurement of yield of film material from the bulk feed to the Biffa plant. However the plant management team commented that the yield was very much lower than normal during the first part of the run, when several hand pickers were used in combination with enhanced NIR separation machine settings. During the second part of the run when the plant was operated at night with enhanced NIR separation settings but no hand pickers on the film product line, the yield was less than when running with Biffa's normal settings but not significantly.

The subsequent trials at Ecoplast[2] and CeDo[3] managed to produce useful product from the material produced in this trial. There is therefore a good prospect that operators with advanced MRFs like Biffa should be able to produce a mixed film product that will be a commercially viable feedstock for recyclers like Ecoplast or other operators who may develop in the UK in future.

[2] *See separate trial report 'Post-consumer film recycling: Processing of LDPE film at Ecoplast'*

[3] *See separate trial report 'Post-consumer film recycling: CeDo manufacturing trial'*

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