WRAP MDD018/23 WEEE separation techniques

Alvan Blanch particle size distribution trial report

This report describes a trial on a destoner, sometimes referred to an air-table, held at Alvan Blanch, Wiltshire. The purpose of the trial was to monitor the effect particle size distribution has on the efficiency of separating chipboard wood from plastic. The desire to separate these two fractions from one another is commonly encountered in WEEE recycling.

The separation is possible due to the differing density and shape of each type of material. Lighter, smaller particles are generally fluidised by the air flow and hence are separated from the heavier, larger particles.

The objective of the trial was to test the technique for separating wood and plastic whilst investigating the effect particle size had on the separation efficiency.

Plastic (Axion grade PS04) and chipboard wood formed the two sample materials for the trial. Both sample materials were granulated and size classified into two fractions 0-3mm and 3-8mm. The corresponding fractions of wood and plastic were then mixed in a ratio of 10:90 respectively. Samples of 100% of each size fraction were tested along with samples of 3-8mm containing differing percentages of fines (0-3mm) , from 10% to 50%.

The results of the trials were fairly conclusive. With the uniform samples, either 100% 0-3mm or 100% 3-8mm, the separation of the wood and plastic was very efficient separation. As the percentage of fines increased, a high purity plastic fraction was produced, always with a plastic content above 98%. However the efficiency of the separation in terms of the plastic recovery decreased dramatically, from 85% with 10% fines to 39% with 50% fines. The recovery of wood to the light fraction remained relatively high, even with the introduction of fines. At 10% fines 79% of the wood was recovered and at 50% fines 88% of the wood was recovered, so it appeared the introduction of fines did not affect the separation efficiency in terms of the wood fraction. The increase in fines also results in an increase in the loss of plastic to the light fraction.

The conclusions which can be drawn from the trial are that either the 0-3mm or 3-8mm fractions of wood and plastic could be separated using a destoner. The introduction of fines which is an increase in the particle size distribution resulted in the separation efficiency decreasing. Therefore the technique should be avoided if a high percentage of fines, above approximately 20%, are present or if the particle sizes are widely distributed.

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1.0 Information about the trial

Trial host: Alvan Blanch Development Company Ltd, Chelworth, Malmesbury, Wiltshire, SN16 9SG

Trial equipment: Alvan Blanch – DS2 Destoner (Pressure Type)

Trial date: 26th March 2009

1.1 Description of trial equipment

The Alvan Blanch destoner (sometimes referred to as an air table) is designed to accurately remove stones and metal from various feed materials. It can however be used to remove a wide range of unwanted contaminants. Examples of materials which have been processed on a destoner include cereals, peas, beans, lentils and coffee beans. The destoner has not previously been trialled in plastics recycling.

Particle size distribution can have an effect on many different pieces of separation equipment, such as destoners/air tables and gravity separators. For this project, the degree of variables associated with a gravity separator was considered unnecessary and hence the destoner was preferable.

Figure 1 shows a photograph of a DS2 destoner.

Figure 1: DS2 Destoner

The process variables for the destoner include:

- Air-flow;
- Inverter frequency;
- Bed elevation;
- Pitch; and
- Inclination.

To achieve the desired products one or more of the process variables will require manipulation. The settings are simple to adjust though and are lockable which ensures consistency in the results.

The maximum throughput for the destoner is approximately 1500 kg hr^{-1}.

The mesh of the vibrating bed can be changed to accommodate differing feed materials.

Figure 2 is a depiction of the principle of the operation for the destoner.

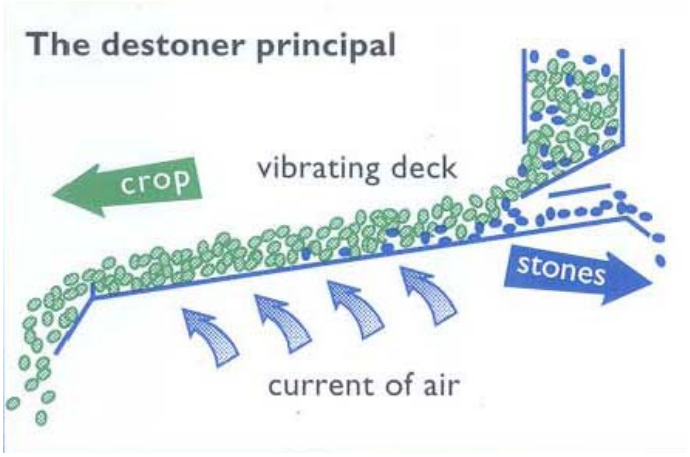

Figure 2: Depiction of the Destoner principle

The principle of operation for the destoner is very similar to that of an air-table, which separates based on density and shape differences. Using a vibrating bed the feed material is stratified through a combination of the vibrations and the pressurised air flow from beneath the bed. The stratification process causes the lighter smaller particles to become fluidised and rise to the upper levels whilst the heavier larger particles sink to the lower levels. The bottom strata is in contact with the bed resulting in an uphill throw motion which causes the heavier particles to climb up the deck until they are discharged. The effect of gravity causes the light particles to travel down the vibrating bed.

In terms of the material tested in this trial the plastics acts like the stones whilst the wood is like the crop.

Particle size distribution is an important factor in obtaining a good separation, as larger, less dense particles struggle to become fluidised and so tend to be captured in the heavy fraction. Meanwhile smaller dense particles can become fluidised and tend towards the light fraction. In the trial the scenario may arise where the small plastic particles tend toward the light fraction rather than the heavy fraction.

Particle-particle interactions also play an important role in the separation. For material with a compact particle size distribution the particle-particle interactions phenomenon has less of an effect on the overall separation.

1.2 Photographs of trial equipment

Figure 3: Bed of Material

Figure 4: Destoner showing Light Output on left and Heavy Output on right

Figure 5: Light Output End of Destoner

1.3 Trial objectives

The objective of the trial was to test the destoner as a technique for removing wood from plastic in material fractions generated from WEEE recycling. A second objective was to investigate the effect that particle size distribution has on the separation performance of the destoner. Using varying mixtures of plastic and wood the aim was to remove all the wood and create as pure a plastic fraction as possible.

1.4 Sample material

The sample material for the trial involved specially made fractions of wood and plastic. Chipboard wood was granulated using two screens; 4mm and 8mm, to provide a wide range of particle sizes. The material was then separated into two categories; 0-3mm and 3-8mm.

The plastic fraction was Axion grade polystyrene known as PS04, which is produced in a wide range of particle size. The PS04 was separated and size classified in the same way as the chipboard wood to produce two categories; 0-3mm and 3-8mm.

The corresponding size fractions of wood and plastic then mixed in an approximate ratio of 90:10 plastic to wood based on volume.

The samples for the individual trials were then made up on site using the pre-prepared fractions.

In total seven samples were tested:

- 100% 0-3mm material;
- 100% 3-8mm material;
- 90% 3-8mm and 10% 0-3mm;
- 80% 3-8mm and 20% 0-3mm;
- 70% 3-8mm and 30% 0-3mm;
- 60% 3-8mm and 40% 0-3mm; and
- 50% 3-8mm and 50% 0-3mm.

1.5 Trial methodology

Seven individual trials were conducted on the destoner.

The first two trials tested the 100% 0-3mm and 100% 3-8mm.

There was no specific weight of feed material required for each of the trials, simply enough material to provide results and give an indication of separating ability of the destoner.

The mixing of the 0-3mm and 3-8mm fractions was conducted by hand carefully and thoroughly to produce well mixed samples. The samples were weighed and checked to ensure the correct mix ratio. The percentage of fines was increased by 10% for each trial, until a ratio of 50:50 was achieved.

The light and heavy fractions were collected and weighed after each trial. Samples were taken from each of the fractions in preparation for the post trial analysis.

The product samples were hand sorted and separated into individual material components, i.e. plastic, wood, rubber, wires etc. The individual material fractions were then weighed and compositional graphs of the products were plotted.

The Q and R convention was used to assess the efficiency of the separations.

In this case, Q, the product separation efficiency, is the probability that the product (plastic) was correctly sorted into the heavy fraction.

R, the reject separation efficiency, is the probability that the reject (wood) was correctly sorted into the light fraction.

2.0 Trial 1 – 100% 0-3mm

2.1 Feed material

The feed material for trial 1 was the 0-3mm size fraction of the 90:10 ratio of PS04 plastic and wood chipboard.

Compositional analysis of the feed, by hand sorting, showed that the wood was only 2.8% by mass which is less than expected. The aim had been to have 90:10 ratio of plastic to wood. Figure 7 shows the composition of the feed material for trial 1.

Figure 6: Photograph of trial 1 feed material, 0-3mm

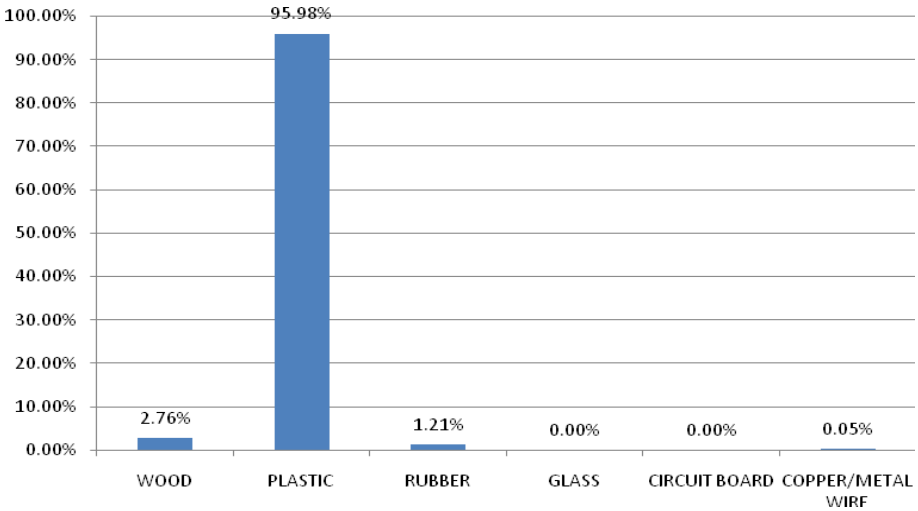

Figure 7: Compositional Analysis of 0-3mm Feed

2.2 Results

After successfully adjusting the settings of the destoner, a very efficient separation was achieved. A slight problem developed in which the light chipboard blew off the bed into the surrounding air by the air-stream. This was not a major problem but from an operational point of view the air stream was obviously too powerful for the light particles in the sample of material.

Visual assessment of the samples indicated that the separation appeared efficient as there was almost no wood in the heavy fraction and very little plastic in the light fraction.

Figure 8: Photograph of trial 1 light fraction

Figure 9: Photograph of trial 1 heavy fraction

2.3 Analysis of results samples

Figure 10 and Figure 11 show the results of the compositional analysis of the two product fractions.

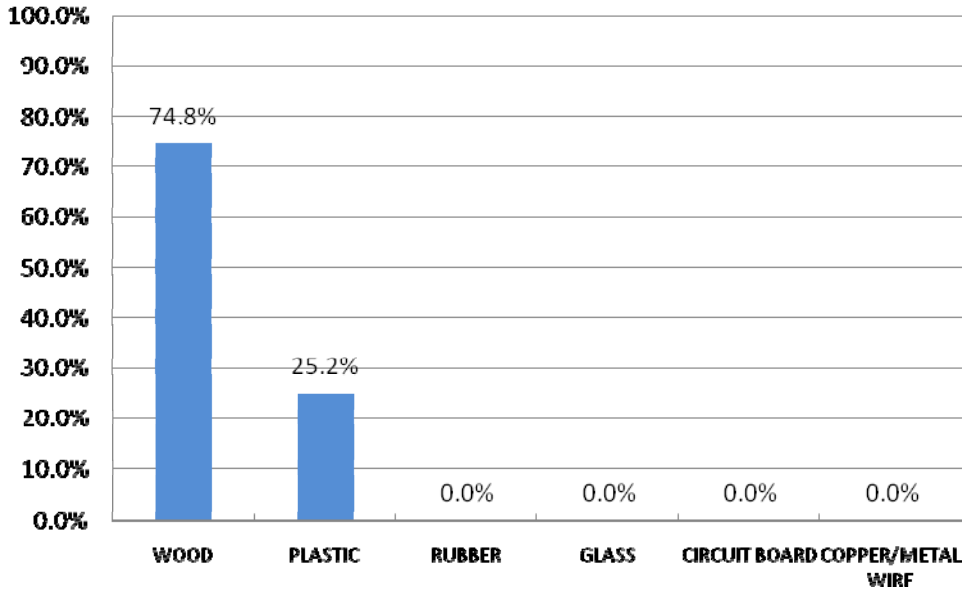

Figure 10: Trial 1 Light Output Composition

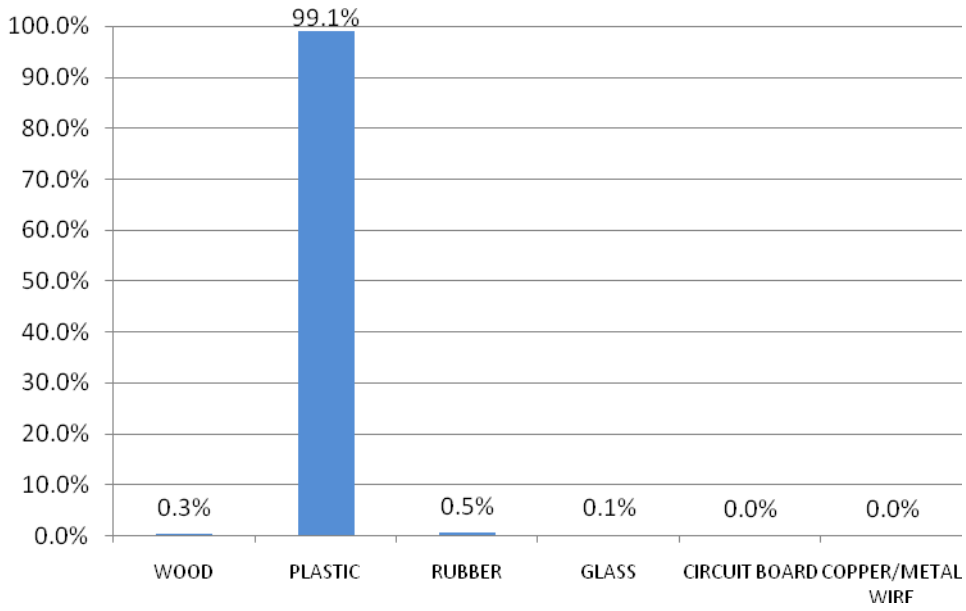

Figure 11: Trial 1 Heavy Output Composition

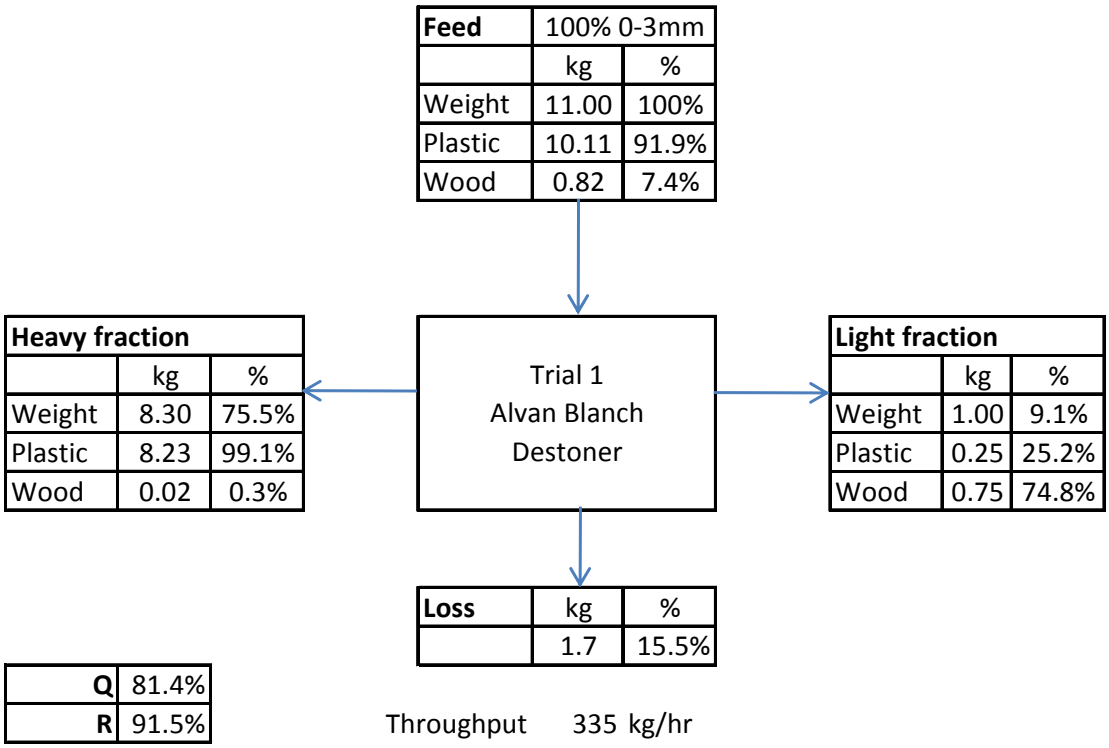

Figure 12: Diagram for trial 1 results

2.4 Discussion of results

Figure 12 is a diagram of the trial 1 results. The feed sample for the trial had a measured composition of 96% plastic, 3% wood and 1% rubber. The back-calculated feed composition, as seen in Figure 12, was 92% plastic and 8% wood. There is some disparity between the two results. It may be due to the difficulty in hand sorting material which has such a small particle size or possibly the sample sorted was not representative of the full sample.

The heavy fraction was 76% of the feed amount with a composition of 99% plastic and only 0.3% wood. The high percentage of plastic in the heavy fraction shows that most of the wood was removed during the separation.

The light fraction was 9% of the feed amount with a composition of 75% wood and 25% plastic. There was a small loss of plastic from the feed to the light fraction but it was not significant. Figure 10 shows there were no impurities in the light fraction.

The loss of material during the trial was 16%, which is relatively high.

The product separation efficiency, which is the probability that the plastic will be correctly sorted into the heavy fraction, was 81% which is good but could be better. The reject separation efficiency, which is the probability that the wood was correctly sorted into the light fraction, was 92%.

The throughput was measured at 334 kg/hr.

2.5 Conclusions from trial

The destoner handled the 0-3mm fine material very well and a good separation of materials was achieved. The plastics fraction had a purity of 99% and product separation efficiency of 81%. The reject separation efficiency was 92%.

Although the particle size of the feed material was small, less than 3mm, the particles size distribution was also small and the results from the trial indicate that the destoner could be used to separate wood and plastic mixtures generated from WEEE at relatively high separation efficiencies.

3.0 Trial 2 – 100% 3-8mm

3.1 Feed material

The feed material for trial 2 was only the 3-8mm size fraction of PS04 plastic and wood chipboard.

Figure 13: Photograph of trial 2 feed material, 3-8mm fraction

Compositional analysis of the feed is shown in Figure 14.

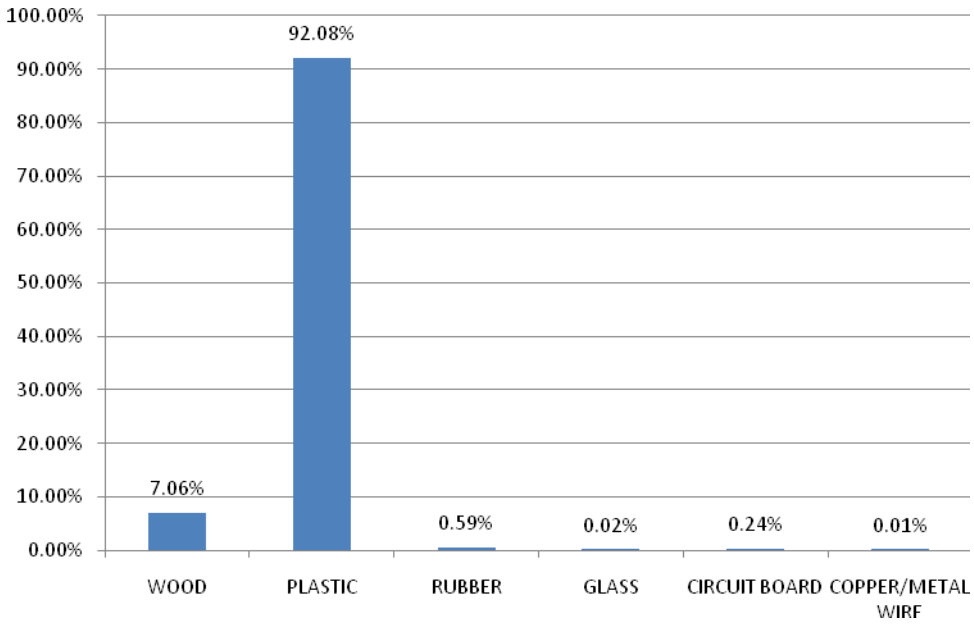

Figure 14: Compositional Analysis of 3-8mm Feed

3.2 Results

Again the separation was successful and there appeared to be almost no wood in the heavy fraction but there was some plastic present in the light fraction.

Figure 15: Photograph of trial 2 light fraction

Figure 16: Photograph of trial 2 heavy fraction

3.3 Analysis of results samples

The heavy and light product samples were analysed, by hand sorting, to determine the compositions. Figure 17 and Figure 18 show the respective results.

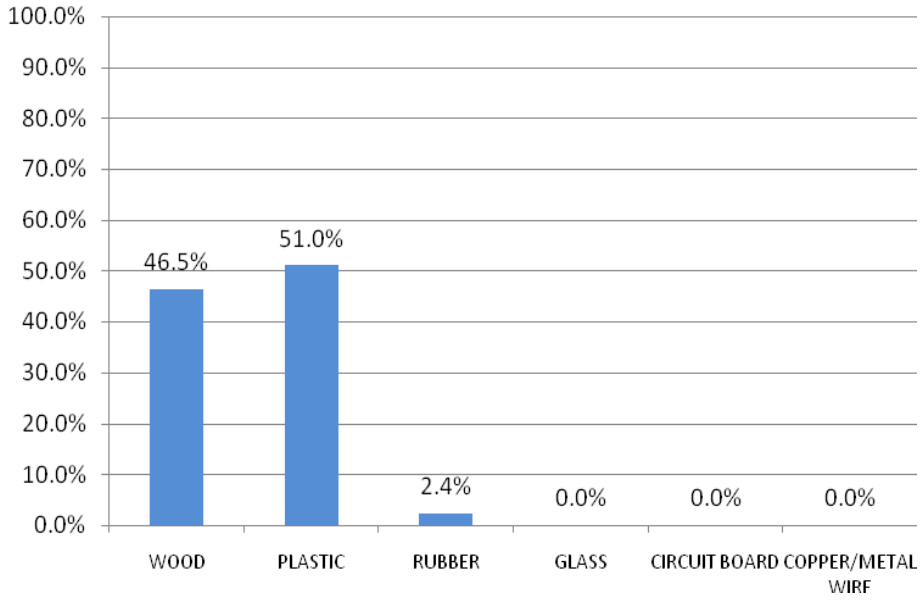

Figure 17: Trial 2 Light Output Composition

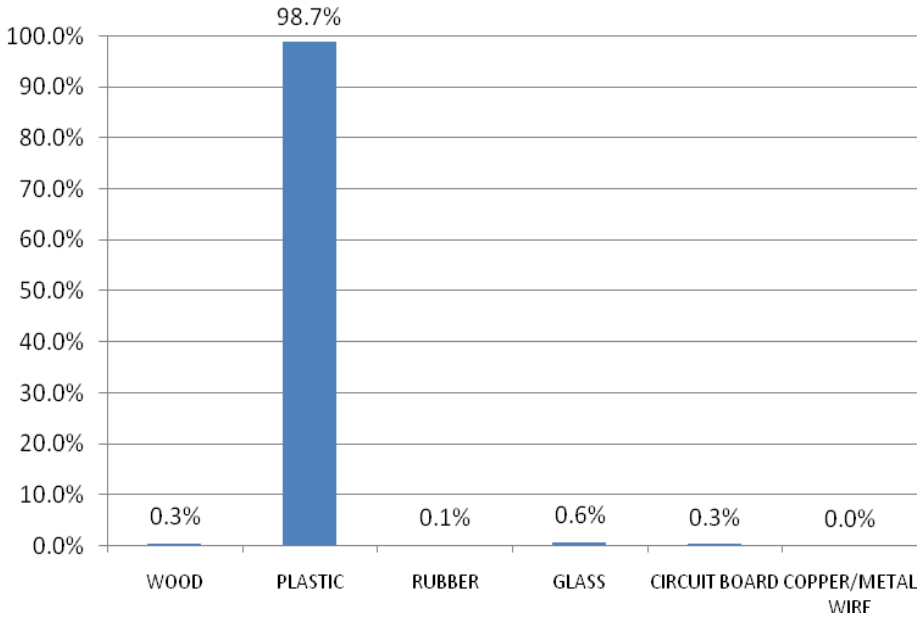

Figure 18: Trial 2 Heavy Output Composition

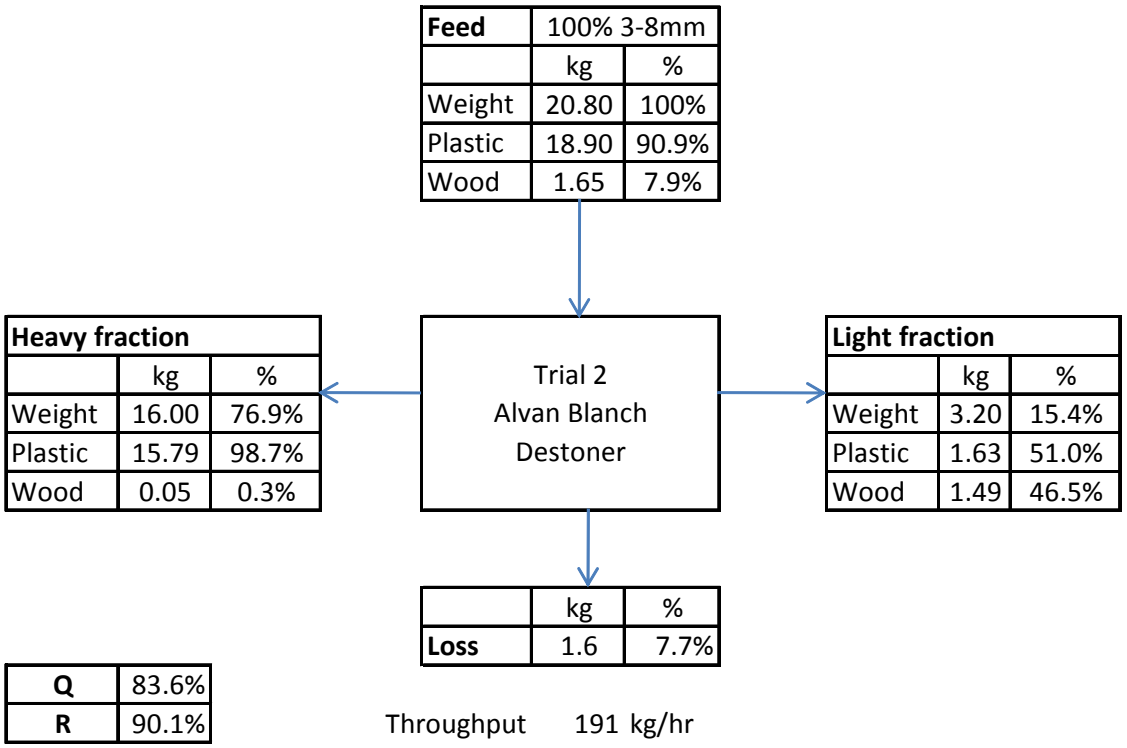

Figure 19: Diagram of trial 2 results

3.4 Discussion of results

Figure 19 is a diagram of the results for trial 2. The feed sample for the trial had an analysed composition of 92% plastic, 7% wood with the remainder being contaminants. The composition of the feed, back-calculated from the output fractions, gave a result of 91% plastic and 8% wood which means there is a good correlation between the two results.

The heavy fraction was 77% of the feed with a composition of 99% plastic and only 0.3% wood. The separation removed the majority of the wood from the feed leaving a high purity plastic fraction.

The light fraction was 15% of the feed with a composition of 47% wood and 51% plastic. The plastic makes up more of the light fraction than the wood does and the loss of plastic from the feed to the light fraction is 9%. During the trial it was observed that it was difficult to stop the plastic entering the light product fraction.

The loss of material for the trial was 8%.

The product separation efficiency, which is the probability of the plastic being correctly separated into the heavy fraction, was 84%. The reject separation efficiency, which is the probability of the wood being sorted into the light fraction, was slightly higher at 90%. Both these efficiencies are good for this type of separation.

The throughput was measured at 191 kg/hr.

3.5 Conclusions from trial

The destoner handled the 3-8mm very well and a good separation of the wood and plastic was achieved. The problem which occurred during trial 1, where the wood chips were blown around, did not exist with the 3-8mm material as the wood chips were obviously larger and heavier so that the air flow was not enough to blow them off the table.

The plastic fraction had a composition of 99% plastic and the product separation efficiency was 84%, whilst the reject separation efficiency was 90%.

Based on the trial results it would be possible to scale up using a destoner for separating WEEE derived materials of plastic and wood in the size range 3-8mm.

4.0 Trial 3 – 90% 3-8mm and 10% 0-3mm

4.1 Feed material

The feed material for trial 3 was a combination of 90% of the 3-8mm plastic and chipboard wood fraction and 10% of the 0-3mm plastic and chipboard wood fraction (fines).

4.2 Results

A relatively good separation was achieved with the material, the majority of the light fraction was wood and in turn the majority of the heavy fraction was plastic.

Figure 20: Photograph of trial 3 light fraction

Figure 21: Photograph of trial 3 heavy fraction

4.3 Analysis of results samples

The product samples were analysed by hand sorting into the different material categories and the results are shown in the following two figures.

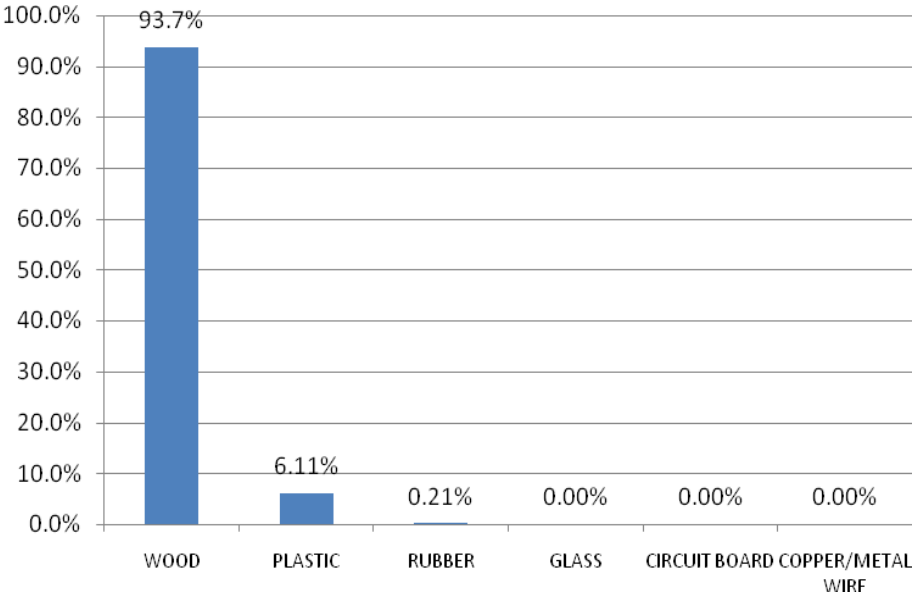

Figure 22: Trial 3 Light Output Composition

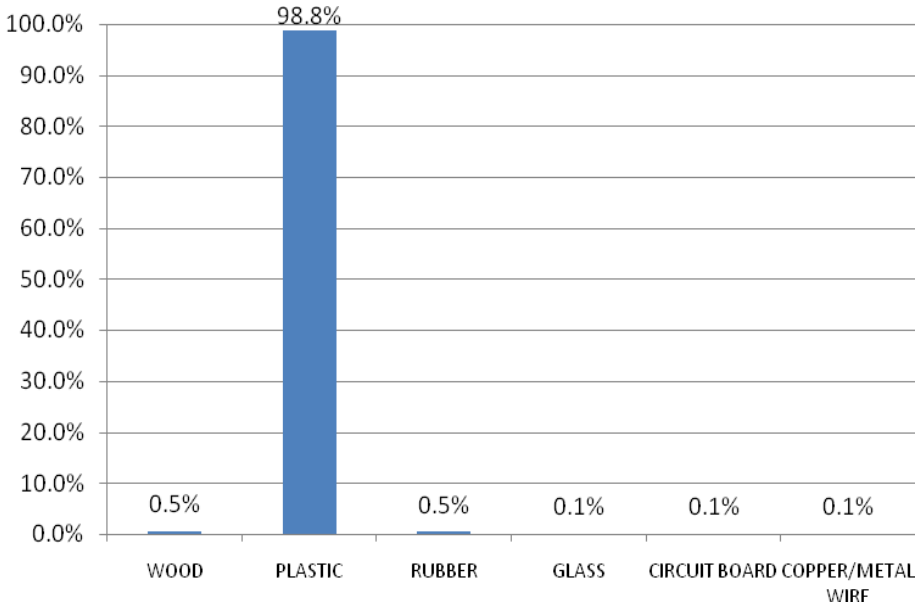

Figure 23: Trial 3 Heavy Output Composition

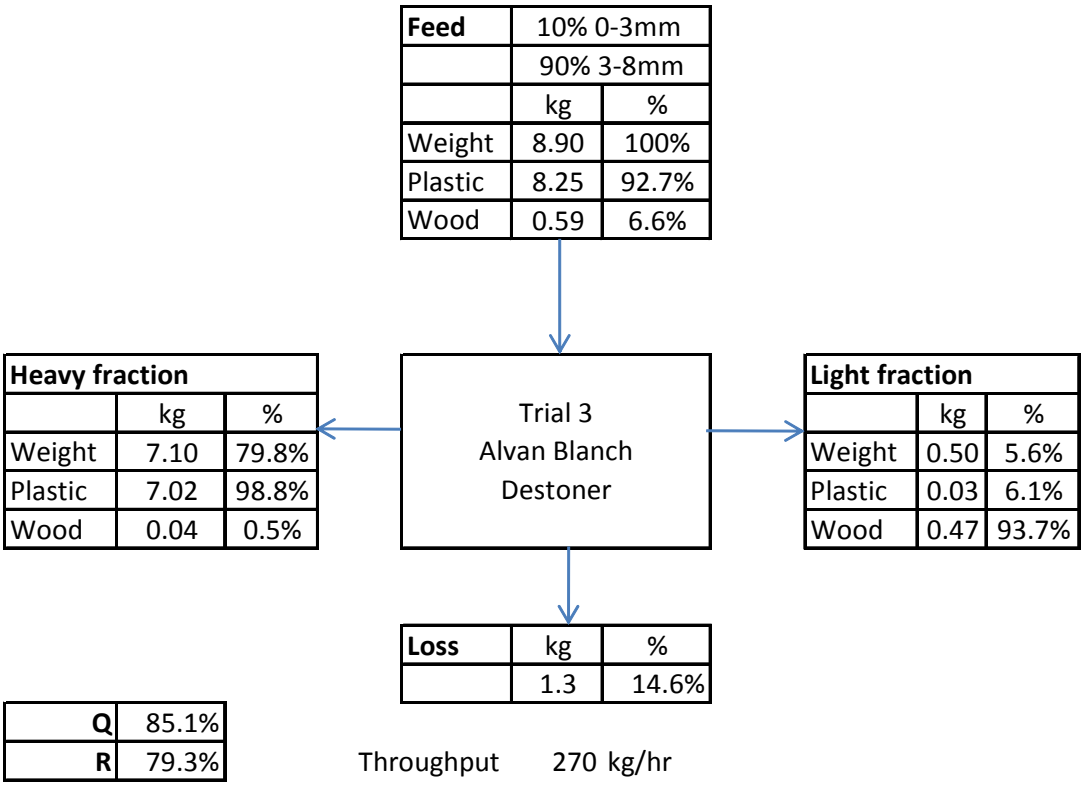

Figure 24: Diagram of trial 3 results

4.4 Discussion of results

Figure 24 is a diagram of the trial 3 results. The composition of the feed was back-calculated from the output fractions, which gave a composition of 93% plastic and 7% wood.

The heavy fraction was 80% of the feed with a composition of 99% plastic and 0.5% wood. The separation did a good job of removing the wood and producing a high purity plastic fraction.

The light fraction was 6% of the feed with a composition of 94% wood and 6% plastic. The loss of plastic from the feed to the light fraction is very low for this trial.

There was a loss of 15% of the material, which is double the previous trial loss.

The product separation efficiency, which is the probability of the plastic being correctly separated into the heavy fraction, was 85%. The reject separation efficiency, which is the probability of the wood being sorted into the light fraction, was slightly higher at 80%.

Therefore most of the wood has been recovered from the feed resulting in a high purity plastic fraction and with only a small loss of plastic to the light fraction.

The throughput was measured at 270kg/hr.

4.5 Conclusions from trial

A relatively good separation was achieved with the material. The product separation efficiency was similar to trial 2 which indicates the introduction of 10% fines has not had a significant detrimental effect on the separation. The composition of the light fraction actually improves in this separation, compared to trial 2, as less plastic is present and therefore the loss of plastic is also lower.

The trial did involve finding a compromise between the settings required to separate the 0-3mm and 3-8mm material, however from the results an acceptable compromise was achieved.

Although the separation was successful it was evident that the destoner did find it more difficult to separate this mixture.

5.0 Trial 4 – 80% 3-8mm and 20% 0-3mm

5.1 Feed material

The feed material for trial 4 was a mix of 80% of the 3-8mm plastic and chipboard wood and 20% of the 0-3mm plastic and chipboard wood. The two samples were mixed thoroughly to ensure a well distributed sample.

5.2 Results

A separation was achieved with the material however from visual observations of the results it was clear that it was not a successful as the previous trials. The amount of plastic in the light fraction appeared to be significantly higher however the heavy fraction still appeared very pure.

Figure 25: Photograph of trial 4 light fraction

Figure 26: Photograph of trial 4 heavy fraction

5.3 Analysis of results samples

Samples of the heavy and lights fractions were hand sorted and the compositional results are shown in Figure 27 and Figure 28.

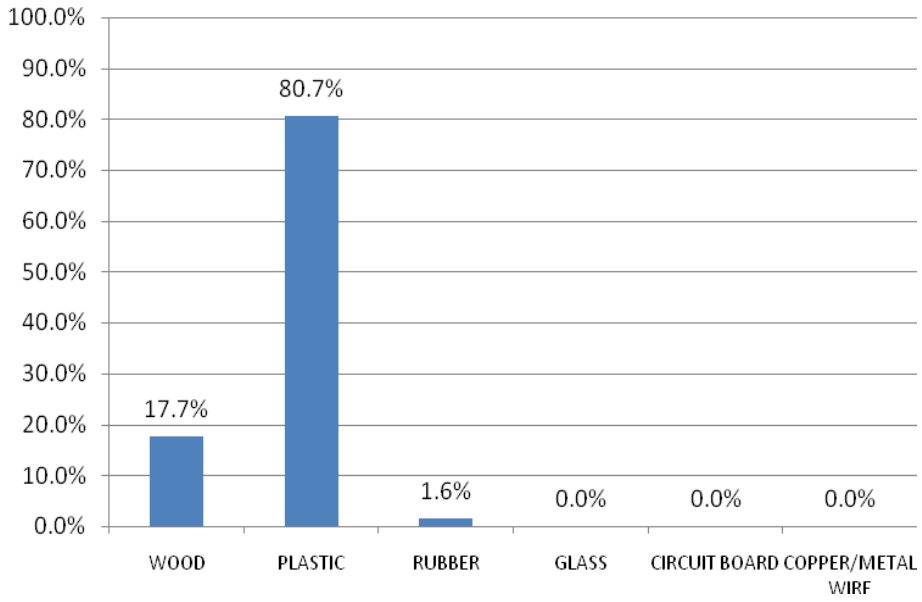

Figure 27: Trial 4 Light Output Composition

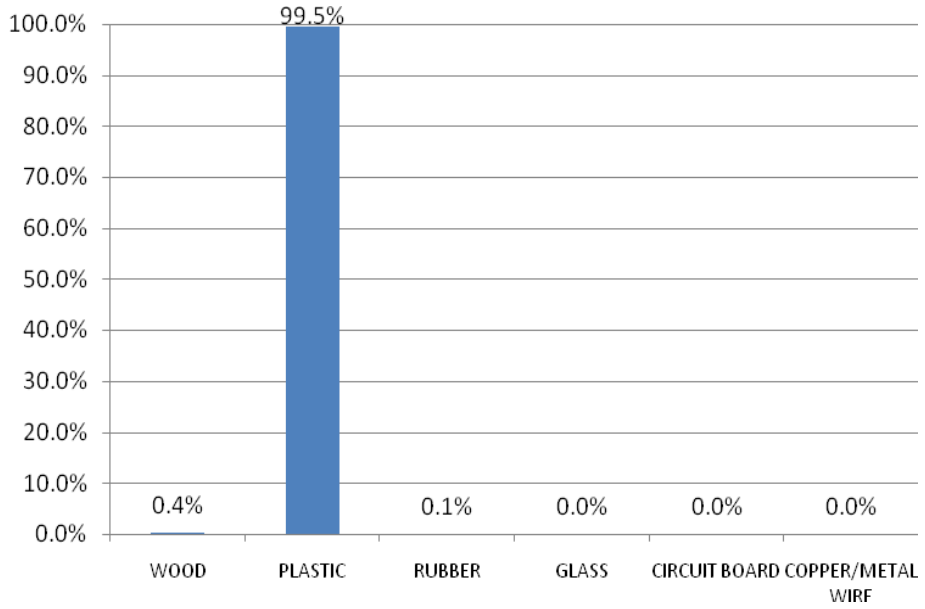

Figure 28: Trial 4 Heavy Output Composition

Feed	20% 0-3mm	
	80% 3-8mm	
	kg	%
Weight	9.40	100%
Plastic	8.56	91.0%
Wood	0.58	6.2%

Heavy fraction		
	kg	%
Weight	4.70	50.0%
Plastic	4.68	99.5%
Wood	0.02	0.4%

Trial 4
Alvan Blanch
Destoner

Light fraction		
	kg	%
Weight	2.40	25.5%
Plastic	1.94	80.7%
Wood	0.42	17.7%

Loss	kg	%
	2.3	24.5%

Q	54.6%
R	73.2%

Throughput 202 kg/hr

Figure 29: Diagram of trial 4 results

5.4 Discussion of results

Figure 29 is a diagram of the trial 4 results. The composition of the feed was back-calculated from the output fractions which gave a composition of 91% plastic and 6% wood.

The heavy fraction was 50% of the feed with a composition of 99.5% plastic and 0.4% wood. A high purity plastic fraction was produced.

The light fraction was 26% of the feed with a composition of 18% wood and 81% plastic. The amount of plastic in the light fraction is fairly significant and equates to a loss of 24% from the feed. It was observed during the trial that it was difficult to find a system setting which prevented the plastics entering the light fraction.

There was a loss of 25% of the feed material during the trial which is very significant. In order to try and achieve a separation the material was actually processed three times which may be the reason behind the high loss.

The product separation efficiency, which is the probability of the plastic being correctly separated into the heavy fraction, was 55%. The low Q value is due to two factors: the high quantity of plastic which ended up in the light fraction and the high loss of material during the trial. The combination of these two fractions accounts for nearly 50% of the feed material, therefore a high Q value would never be possible. The reject separation efficiency, which is the probability of the wood being sorted into the light fraction, was slightly higher at 73%.

The throughput was measured at 202kg/hr.

5.5 Conclusions from trial

The results from the trial show a rapid decrease in the success of the separation, with the product separation efficiency only 55%. Too much plastic was lost into the light fraction to make the separation viable on a larger scale. However most of the wood was removed from the feed and a heavy fraction with a very high plastic content was produced.

The increase in the fines content of the feed had a significant negative impact on the ability of the destoner to effectively separate the materials.

6.0 Trial 5 – 70% 3-8mm and 30% 0-3mm

6.1 Feed material

The feed material for trial 5 comprised of 70% of the 3-8mm plastic and chipboard wood and 30% of the 0-3mm plastic and chipboard wood. The weights of each of the fractions were carefully measured to ensure the correct ratio of material. The two samples were thoroughly mixed by hand prior to processing.

6.2 Results

A separation was completed however it was clear from the visual observations during the trial that the efficiency had decreased again and the light fraction contained even more plastic.

Figure 30: Photograph of trial 5 light fraction

Figure 31: Photograph of trial 5 heavy fraction

6.3 Analysis of results samples

Both the light and heavy fraction samples were hand sorted to determine the composition. The results are shown below.

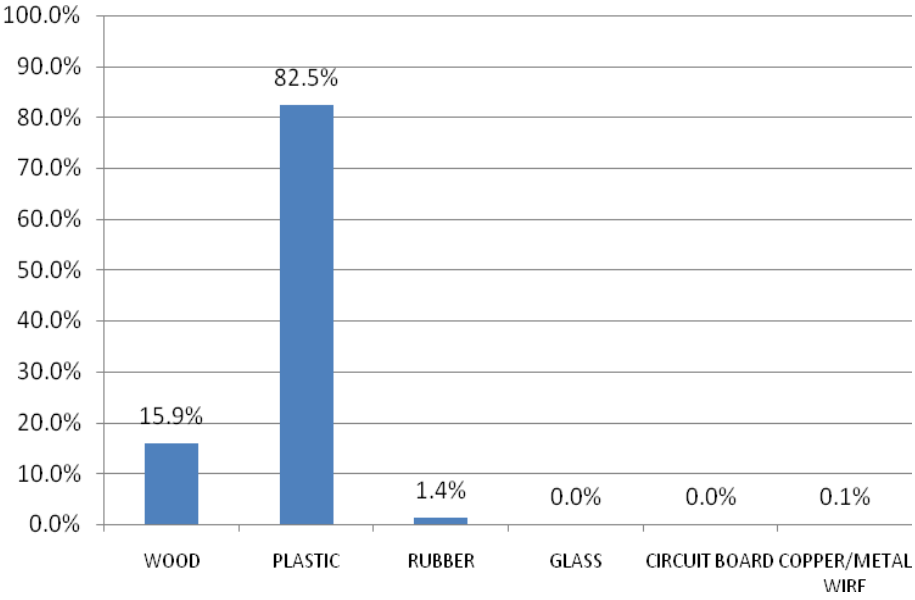

Figure 32: Trial 5 Light Output Composition

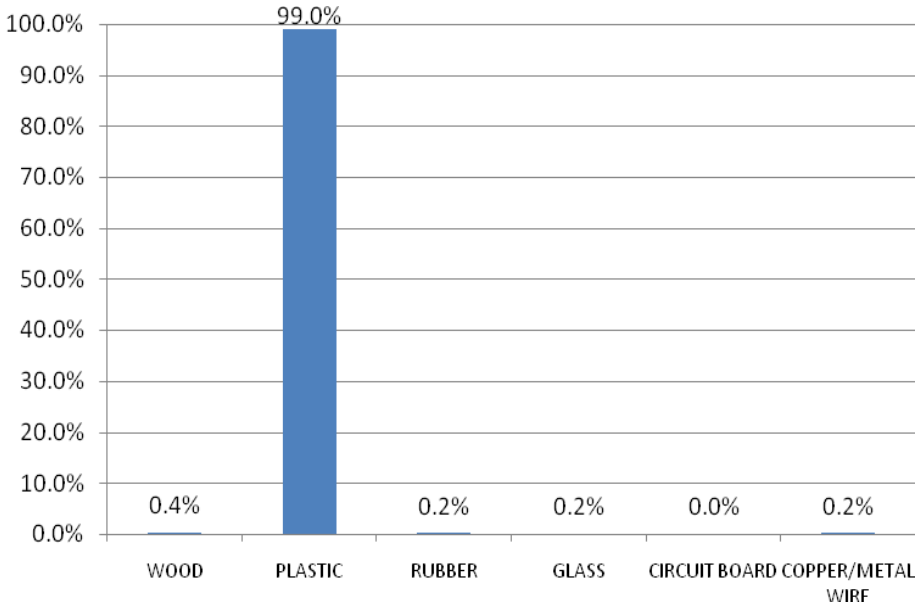

Figure 33: Trial 5 Heavy Output Composition

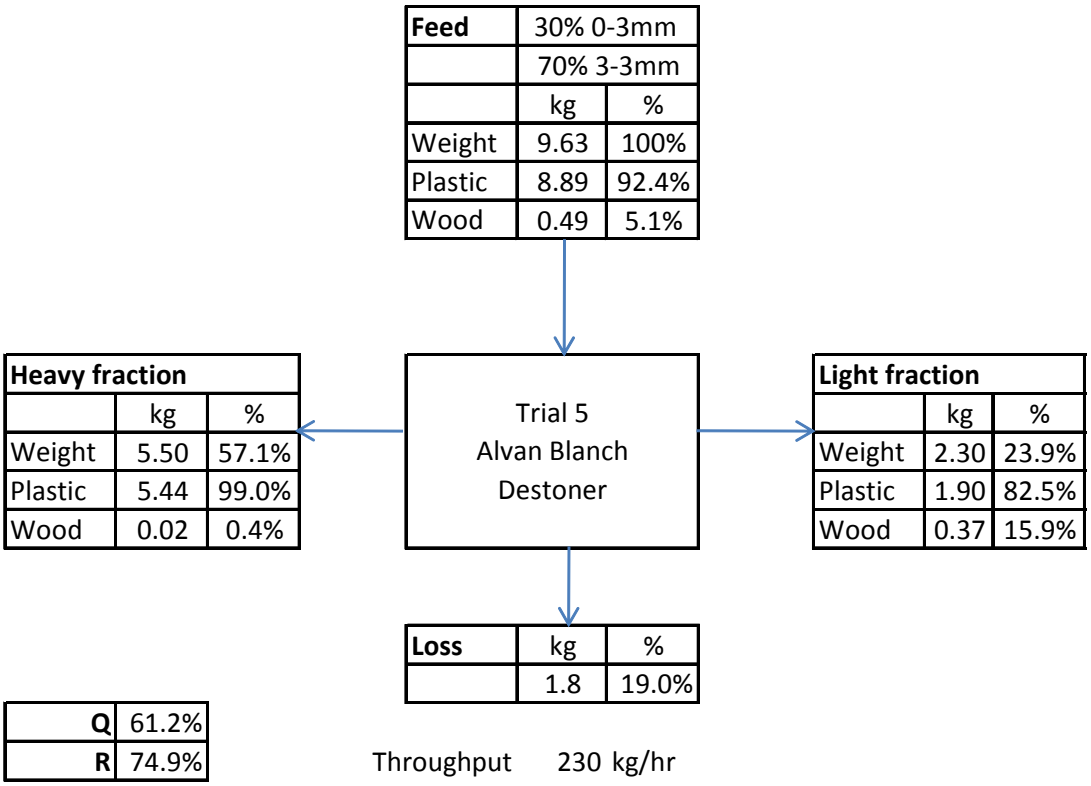

Figure 34: Diagram of trial 5 results

6.4 Discussion of results

Figure 34 is a diagram of the trial 5 results. The composition of the feed for the trial was back-calculated from the output fractions, which gave a composition of 92% plastic and 5% wood.

The heavy fraction was 57% of the feed with a composition of 99% plastic and 0.4% wood. Again a heavy fraction had a high plastics content, with very little wood present.

The light fraction was 24% of the feed with a composition of 16% wood and 83% plastic. The amount of plastic in the light fraction is fairly significant and equates to a loss of 21% from the feed to the fraction.

There was a loss of 19% of the material, which is less than trial 4 but still significant.

The product separation efficiency, which is the probability of the plastic being correctly separated into the heavy fraction, was 61%. The reject separation efficiency which is the probability of the wood being sorted into the light fraction was slightly higher at 75%.

The throughput was measured at 230kg/hr.

6.5 Conclusions from trial

Overall the separation was very poor and it is clear that an increase in the amount of fines present has had a negative effect on the separation efficiency of the process. Although the heavy fraction is very pure the loss of plastic and low separation efficiency is unacceptable.

If the level of fines present in the feed material existed in a real life situation it would not be viable to use a destoner for the separation of wood from plastic.

7.0 Trial 6 – 60% 3-8mm and 40% 0-3mm

7.1 Feed material

The feed material for trial 6 was 60% of the 3-8mm plastic and chipboard wood and 40% of the 0-3mm plastic and chipboard wood. The two fractions of material were weighed prior to mixing to ensure the correct ratio was used. The samples were then mixed thoroughly before the trial commenced.

7.2 Results

A full separation of the plastic from the chipboard was not achieved. Again the plastic content of the light fraction was very high and hence the separation was poor.

Figure 35: Photograph of trial 6 light fraction

Figure 36: Photograph of trial 6 heavy fraction

7.3 Analysis of results samples

The light and heavy samples fractions were hand sorted to determine the compositions. The results are shown in Figure 37 and Figure 38.

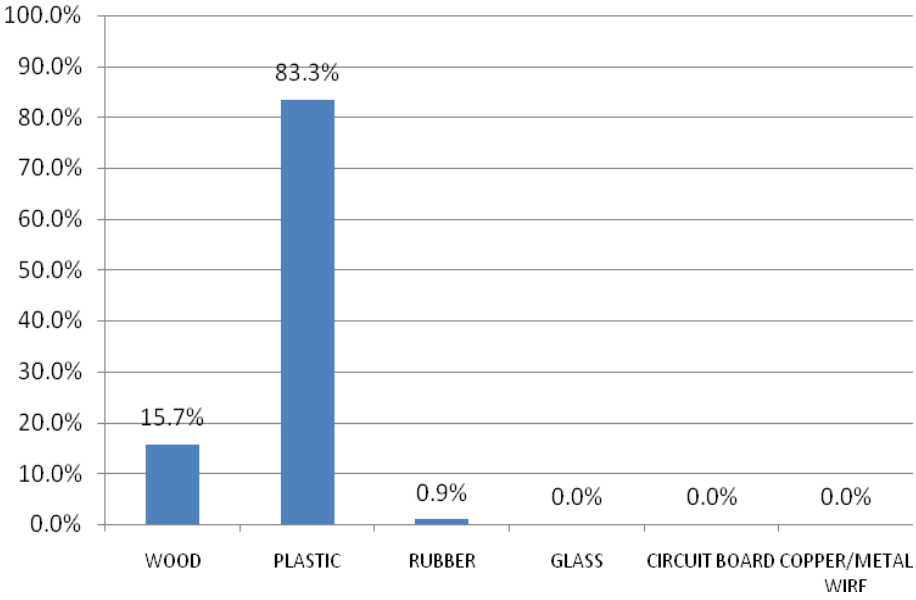

Figure 37: Trial 6 Light Output Composition

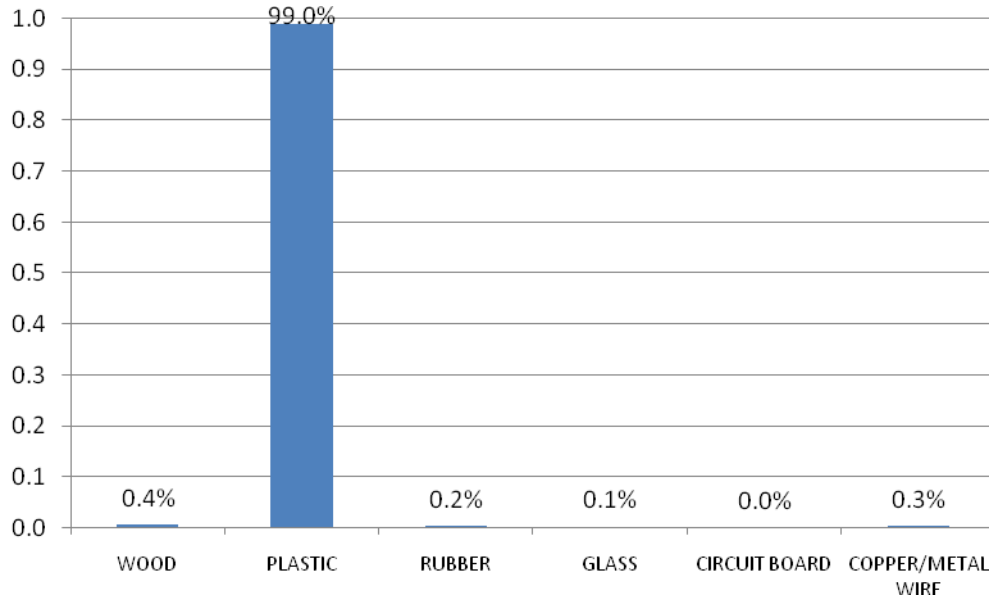

Figure 38: Trial 6 Heavy Output Composition

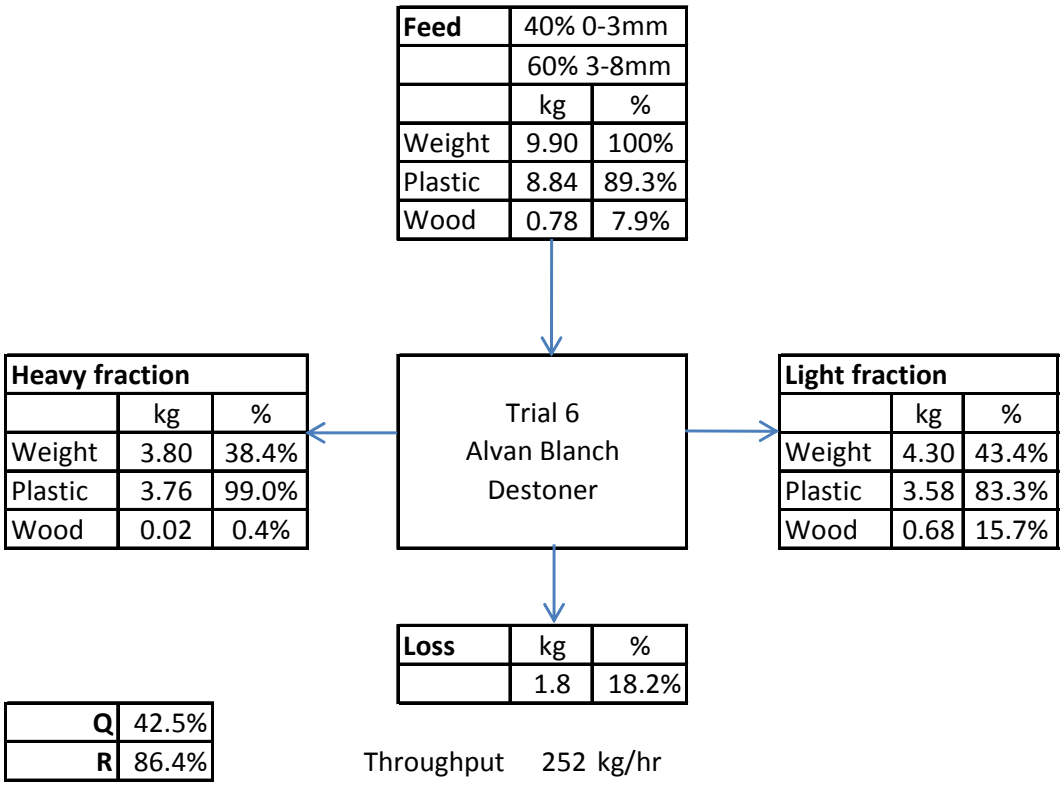

Figure 39: Diagram of trial 6 results

7.4 Discussion of results

Figure 39 is a diagram of the trial 6 results. The composition of the feed for the trial was back-calculated from the output fractions, which gave a composition of 90% plastic and 8% wood.

The heavy fraction was 34% of the feed with a composition of 99% plastic and 0.4% wood. The heavy fraction is still dominated by the plastic and is still pure as there is very little wood present.

The light fraction was 43% of the feed with a composition of 16% wood and 83% plastic. The amount of plastic in the light fraction is very substantial and equates to a loss of 40% from the feed to the fraction.

There was a loss of 18% of the material, which is lower than some of the other trials but is still significant.

The product separation efficiency, which is the probability of the plastic being correctly separated into the heavy fraction, was 43% which is very poor. The reject separation efficiency which is the probability of the wood being sorted into the light fraction was much higher at 86%.

The throughput was measured at 252kg/hr.

7.5 Conclusions from trial

The quantity of fines present is obviously too much for the destoner to handle resulting in the very poor separation results. To try and combat the high amount of plastic in the light fraction changes to the system settings could be made. However this would have a negative effect on the heavy output stream so it is necessary to find a compromise between the two; although this is very difficult achieve. Although a high purity plastic fraction is produced, the product separation efficiency is far too low for the separation to be considered economically viable.

8.0 Trial 7 – 50% 3-8mm and 50% 0-3mm

8.1 Feed material

The feed material for trial 7 was a 50:50 mix of the 3-8mm material and the 0-3mm material.

8.2 Results

The results of the separation were very poor. The light fraction was completely dominated by plastic but the heavy fraction contained very little wood.

Figure 40: Photograph of trial 7 light fraction

Figure 41: Photograph of trial 7 heavy fraction

8.3 Analysis of results samples

Samples of the light and heavy fractions were hand sorted to determine the composition and the results are shown in Figure 42 and Figure 43.

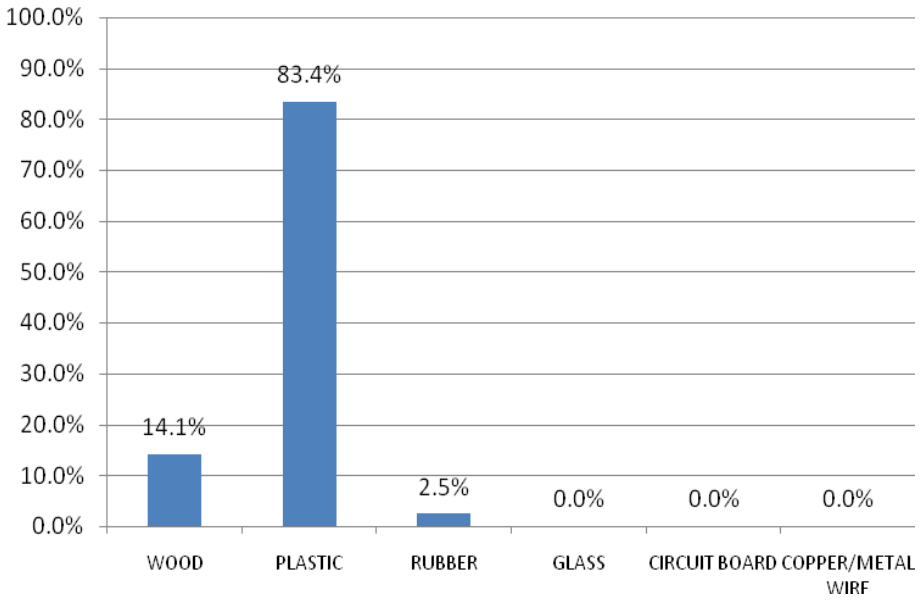

Figure 42: Trial 7 Light Output Composition

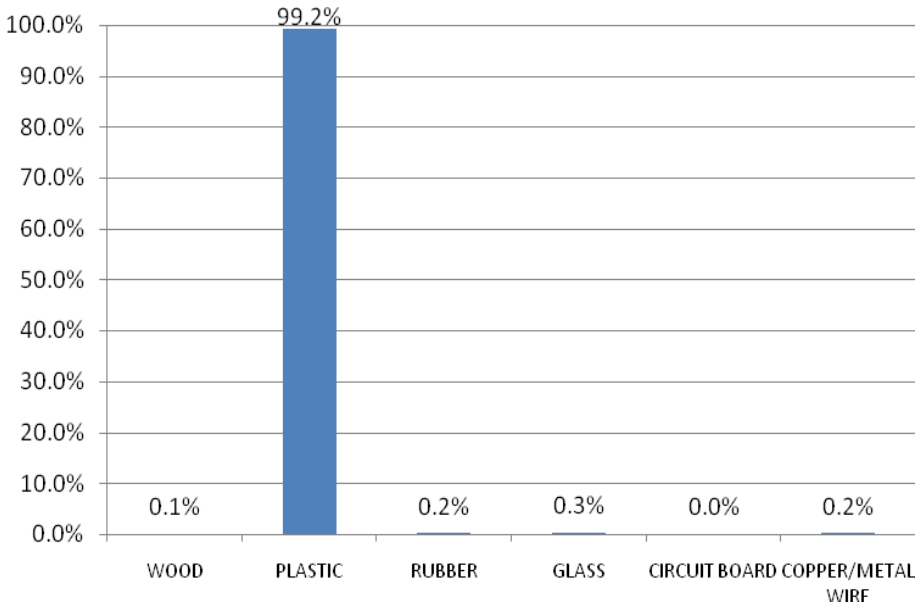

Figure 43: Trial 7 Heavy Output Composition

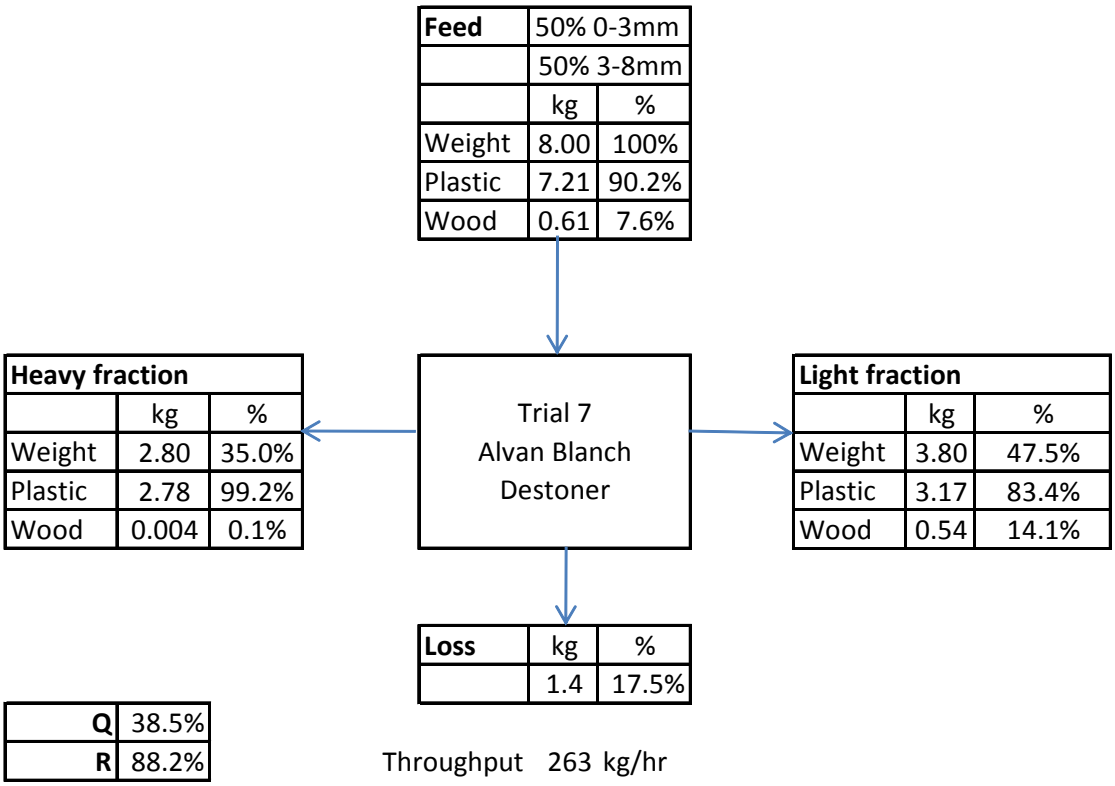

Figure 44: Diagram of trial 7 results

8.4 Discussion of results

Figure 44 is a diagram of the trial 7 results. The composition of the feed for the trial was back-calculated from the output fractions, which gave a composition of 90% plastic and 8% wood.

The heavy fraction was 35% of the feed with a composition of 99% plastic and 0.1% wood. The heavy fraction is still virtually all plastic and there is very little wood present.

The light fraction was 48% of the feed with a composition of 14% wood and 83% plastic. The amount of plastic in the light fraction is very substantial and equates to a loss of 44% from the feed. Again, it was difficult to stop the flow of plastic into the light output even with adjusting the system settings.

There was a loss of 18% of the material, which is less than trial 4 but still significant.

The product separation efficiency, which is the probability of the plastic being correctly separated into the heavy fraction, was 39% which is very poor. The reject separation efficiency which is the probability of the wood being sorted into the light fraction was much higher at 88%.

The throughput was measured at 263kg/hr.

8.5 Conclusions from trial

The separation of the 50:50 mixture of 0-3mm and 3-8mm material was very poor and the destoner could not able to handle the high percentage of fines. Trial 7 produced the worst

results out of all the trials. Increasing the percentage of fines clearly has a negative effect on the separation. It would not be economically viable to use a destoner to process material of this type.

9.0 Overall final conclusion of trial

The aim of the trial was to test the ability of the destoner to separate wood and plastic whilst measuring the effect particle size had on the efficiency of the separation.

Figure 45 shows the product and reject separation efficiency for all seven trials. The general trend is for a decrease in the product separation efficiency as the percentage of fines in the feed increased. The decrease is most apparent when fines are initially introduced, trial 3 to trial 4. The effect of the fines on the separation efficiency becomes smaller as more fines are added. Small particles with a close size range, i.e. 0-3mm can be processed successfully.

The trend for the reject separation efficiency is interesting. Initially the efficiency decreased with the addition of fines but it reached a minimum of 73% for trial 4 and then increased for the last three trials.

The 100% 0-3mm and 100% 3-8mm fractions produced the best combination of both separation
efficiencies.

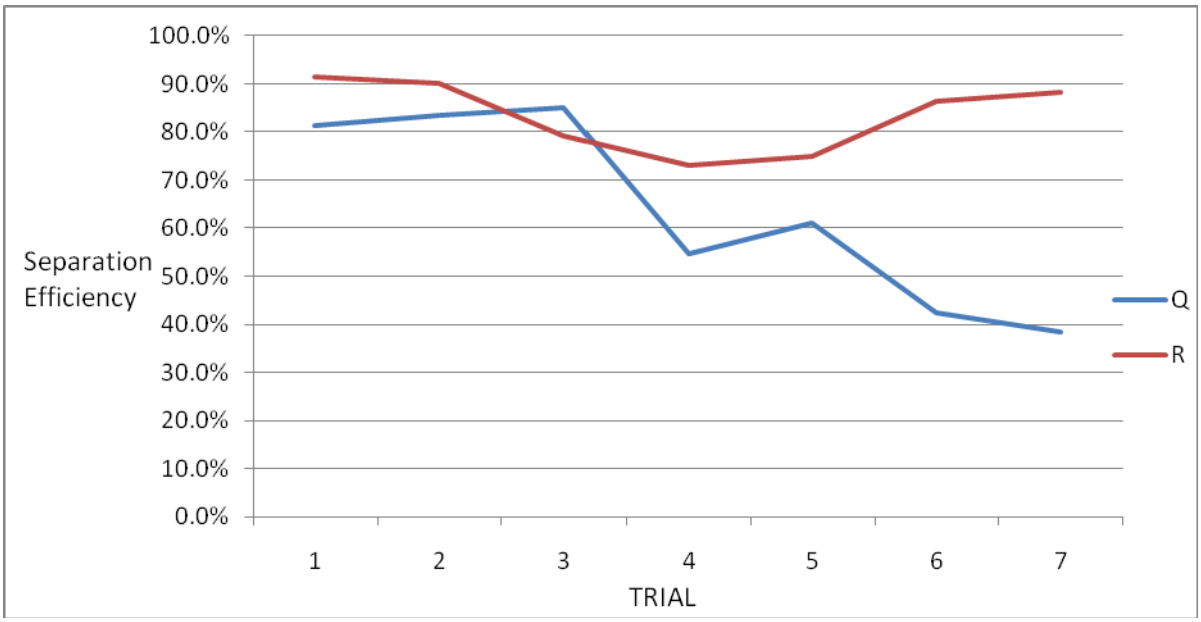

Figure 45: Separation efficiency of the trials

As separating efficiency decreased, the composition of the light output changed dramatically. Figure 46 shows the compositional change of the light fraction. Generally, as the percentage of fines increased the amount of plastic in the light output also increased. The composition of the heavy stream stayed quite consistent for all the trials, with the plastic content remaining above 98% for all the trials.

Trials 4 to 7 had light output fractions with similar compositions.

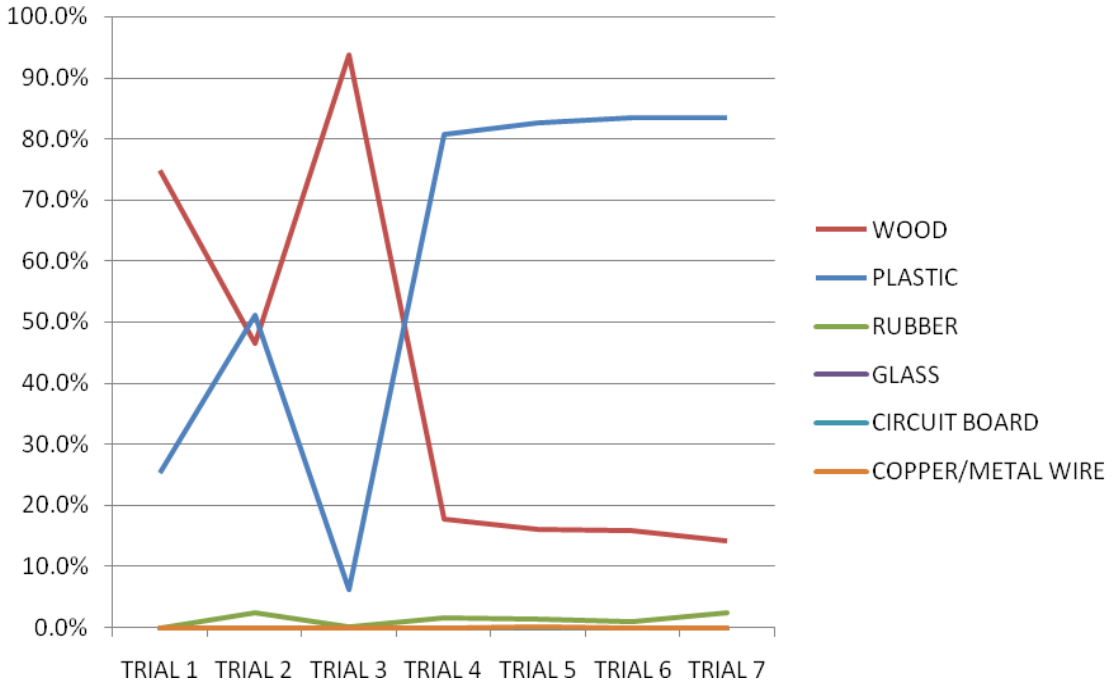

Figure 46: Light Output Compositional Changes

Overall the conclusions from the trial are clear and the trial objectives were achieved. As the percentage of fines increased, the separation efficiency decreased. The increased presence of smaller sized particles, and increased particle size distribution, had a negative effect on the separation ability of the destoner. Small particles with a close size range, i.e. 0-3mm, can be processed successfully as can material in the size range 3-8mm. Based on the trial results the technique could be used to separate wood from plastic, depending on the material. If the percentage of fines is high and the particle size distribution is over 8mm then the destoner is not a suitable technique for wood removal.