Trial plan - Allmineral wet jigging

Trial host/location: Allmineral, Germany

Trial date: 8-9 December 2008

Duration: 1 day

Attendees: Nicola Myles (Axion), Roger Morton (Axion),

Trial contact: Andreas Horn, horn@allmineral.com, Tel: +49 (0) 20 66-99 17-0, Ralf Orczewski, orczewski@allmineral.com, Mobile: +49-172-2161933.

Trial equipment: The equipment for this trial is a wet jig. Allmineral has two set-ups. At their own pilot plant and workshops they have a 'laboratory-scale' stratification jig that can be used to demonstrate the principle of wet jigging and test likely separation efficiency at full scale but cannot test throughput or the effectiveness of material removal at the jig outlet. Effectiveness of material removal has been a problem with other WEEE plastic separations trialled by Allmineral due to bridging of particles in the outlet duct. Previous trials have used plastic mixtures with particle sizes up to 50mm. The current trial will use material in a smaller size range in order to try to avoid this problem.

The laboratory-scale test rig has previously been used to separate copper/PCB/glass from plastic but has never been tested for plastics only separations. At the Technical University of Aachen Allmineral has a pilot scale unit which can be used to test for continuous operation and throughput. This rig requires feeding equipment, dewatering screens and other ancillaries.

Both pieces of equipment work by the same method; air is used to create pulses in the water. The particles contained within the water will stratify due to the pulsations if they are of different densities. Low density particles rise to the surface whilst heavy particles settle in the lower levels of the bed. The jigging stroke can be controlled by a rotary or poppet value and pulsation frequency, amplitude and shape can all be controlled during operation to optimise the separation. The laboratory-scale jig can handle particles sizes from 1mm to 50mm and process 30-50kg per batch whilst the pilot plant jig can only deal with particles up to 15mm in size.

No further information about the unit at the University of Aachen is available at the moment.

Trial objectives: The main objective of the trial is to separate the sample material at different densities. Two sets of sample material will be trialled with specific objectives as follows:

a) The first trial is to separate copper/stone/glass from mixed plastic. Copper wires can range in shape and radius from PVC coated wires 50mm long and 4mm in diameter to really fine copper wires 5mm long by only 0.5mm in diameter. This can make the separation very difficult because of the wide range of settling velocities of the copper particles. The stone and glass particles tend to have more uniform size and shape. Lab settling tests by Axion indicates that (for the size range of material to be used in this trial) a reasonable separation of copper and stone/glass from plastic can be achieved at a settling velocity of around 0.1m/s in water. The objective of this trial will be to test whether the wet jig can successfully create a copper-rich fraction which

could be sold. Market research indicates that the copper fraction will be saleable if it contains less than 5% combustible material. Glass and stone in the copper fraction do not create a major problem for smelters but plastic and other combustibles cause excessive gas flows in the furnace.

b) The second trial will test the separation of different density plastics - for example polypropylene (SG ~0.95), polystyrene (SG ~ 1.02-1.05), ABS (SG ~1.04-1.08) from other heavy plastics (for example filled plastics and PVC SG ~1.2-1.3). Although this separation has not been done before on a wet jig Axion would like to test this approach because it may allow bulk polymer separations at density cuts greater than 1 without using modified density solutions. Using modified density solutions for sink/float separation of plastics greatly increases the cost of the separation due to the need to create solutions by the addition of salt and then to wash the plastics after separation in order to remove the salts again. A salt-free plastic separation process at density 1.08 or 1.2 would greatly improve the economics of polymer recovery from WEEE and similar mixtures.

Sample material: The sample material required for the trials is 4-12mm particle size, post granulator material. It should be noted that a wet jig has previously been tried at material of 30mm and the separation did not work effectively due to solids bridging and excessive water flow in the heavy fraction outlet duct.

The specific samples which will be tested are as follows:

a) PVC rich copper mixture from WEEE; and
b) A sample of mixed plastics (Axion product PS07) for bulk plastic separation.

Samples (a) is for the first objective whilst sample (b) is for the second objective. All of these materials are sourced from Axion's own WEEE processing plant in Salford, UK.

For the trial on the laboratory-scale stratification jig at Allmineral approximately 30 litres of each sample is required.

Sample shipping address:

Huemmler Maschinenbau

Att. Mr Johannes Hummler

Kalkwerkster 70

57413 Finnentrop-Fretter

Germany

All samples must be labelled **'Allmineral Project No. 07.1.10023'**.

Queries for trial host: Further information on the feeding system to the jig is required.

Trial procedure: Trials have previously been performed on the Allmineral stratifying rig with 30-50mm plastic particles. These trials indicated that a density separation should be feasible if the particle size is smaller. Details of the trials are as follows:

a) For the first part of the trial the intention is to separate the PVC/copper mixture to produce a much purer copper fraction which would have potential to be sold. If

required the copper fraction can be processed through the rig more than once to assess the possibility of multiple passes.

b) The bulk separation of mixed WEEE plastic (Axion grade PS07) is to produce well defined density fractions. Ideally, the material will be separated into density fractions 1.0-1.08 and 1.08-1.2. This is likely to require several attempts and adjustment of the unit to find the optimal separation set-up.

Depending on the results of this initial trial the proposal will be to use the Allmineral pilot scale wet jig at the University of Aachen on the most promising separations in order to obtain more representative results of how well an actual wet jig would perform. This will also provide an opportunity to perform throughput trials on the equipment. At the present stage no plan has been made for the trial at the University of Aachen. This will be developed based on the results of the initial trial at Allmineral.

Samples/results to be collected during the trial:

During the trial samples need to be taken of the product materials for the two proposed separations as shown in the table below.

Trial	Input material	Light product fraction	Heavy product fraction	Input weight	Light product weight	Heavy product weight
(a) copper from plastic						
(b) Density separation of PS07 plastics						

If multiple passes are completed the samples required are just repeats of those in the table above.

Any important settings for the machine should be noted during operation along with taking photographs of the equipment and material when possible and relevant.

Further analysis of the samples including hand sorting of the results from the copper separations and FTIR testing of the polymer separation will be conducted at Axion's laboratory.

Should the results from the wet jig trial prove successful then a full scale throughput trial on the equipment at the Technical University of Aachen will need to be arranged.

All the trial material should be returned to:

Axion Polymers

Langley Road South

Salford

Manchester

M6 6HQ

Other information:

For the initial trial in Germany the following schedule has been arranged.

Day 1 - 8th December: Fly out to Dusseldorf from Manchester; meet Ralf Orczewski at the airport and travel to the hotel located near to test facility in Finnentrop-Fretter.

Day 2 - 9th December: Being trial at 8.30am, joined by Thomas Neumann, and conduct all trials during the day, conclude with discussion of trial results. Travel back to Dusseldorf airport from Finnentrop with Thomas for evening flight to Manchester.

Date	Operator	Flight code	Route	Departs	Arrives
8th December 08	Lufthansa	LH4885	Manchester to Dusseldorf	15:00	17:25
9th December 08	Flybe	BE7218	Dusseldorf to Manchester	20:25	20:55

Nicola Myles, Axion Recycling, November 2008