Smart Planet Technologies Repulpability Report Last Updated: February 15, 2019

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Production, Re-pulping, and Recyclability Results

Paperboards coated with highly-mineralized resin, EarthCoating®

Updated on 01/12/18

This report summarizes three EarthCoating® EC-40 repulping and recyclability pilots and testing results: one pilot conducted at Ineos Corporation under supervision of a leading global chemical corporation, hereby identified under the pseudonym, “X Corp, another at Georgia Tech Institute of Paper Science and Technology “IPST”, a third at a leading U.S. paper mill, and a fourth at Lenzing Papier, of Lenzing, Austria . Using polyethylene (PE) as a control, the testing and pilots included both coating manufacturing processes and recycling assessments. Baled EC-40 coated paper processes far differently than plastic coated papers. Upon re-pulping, EarthCoating mineralized coatings break down into small, dense, easily discharged particles. which are easily process through standard paperboard recycling equipment, without the normal difficulties associated with plastic coatings. EC-40 accept/reject particles easily wash out and process through coarse screens, pressure screens and centrifugal cleaners. Therefore, papers coated with EC-40 can be collected and re-processed in a widespread fashion within the existing collection and recycling infra-structure.

EarthCoating EC-40 Pilot at Ineos Corporation, Cologne, Germany

This report summarizes EC-40 pilot results conducted under supervision of a leading global chemical corporation, hereby identified under the pseudonym, "X Corp.". X Corp. completed an EarthCoating EC-40 (SCC-80148) production and recycling proof of concept (POC) pilot vs. PE coatings. The POC was designed to validate previously completed in-depth Georgia Tech-IPST studies. Both PE and EC-40 production and testing were done at the same time and using the same equipment, protocols and testing standards. Approximately 8,000 lbs. each of PE and EC-40 material were coated at INEOS Corporation, Cologne, Germany. Subsequently, the coated papers completed head-to-head recycling testing in a nearby facility. EC-40 and PE coatings were applied to 58 g/m^2 weight virgin paper grades. For each coating type, two separate coat weights were trialed: 25 g/m2 (cup stock coat weight) and 15 g/m2 (common folding carton weight)."

Both the coatings and paper are qualified as direct food contact acceptable under EN and FDA standards.

Upon completion of the pilot, it was determined that the EC-40 showed excellent results under multiple pulping durations in comparison to PE. The results are illustrated in Figure 1 through Figure 3 below.

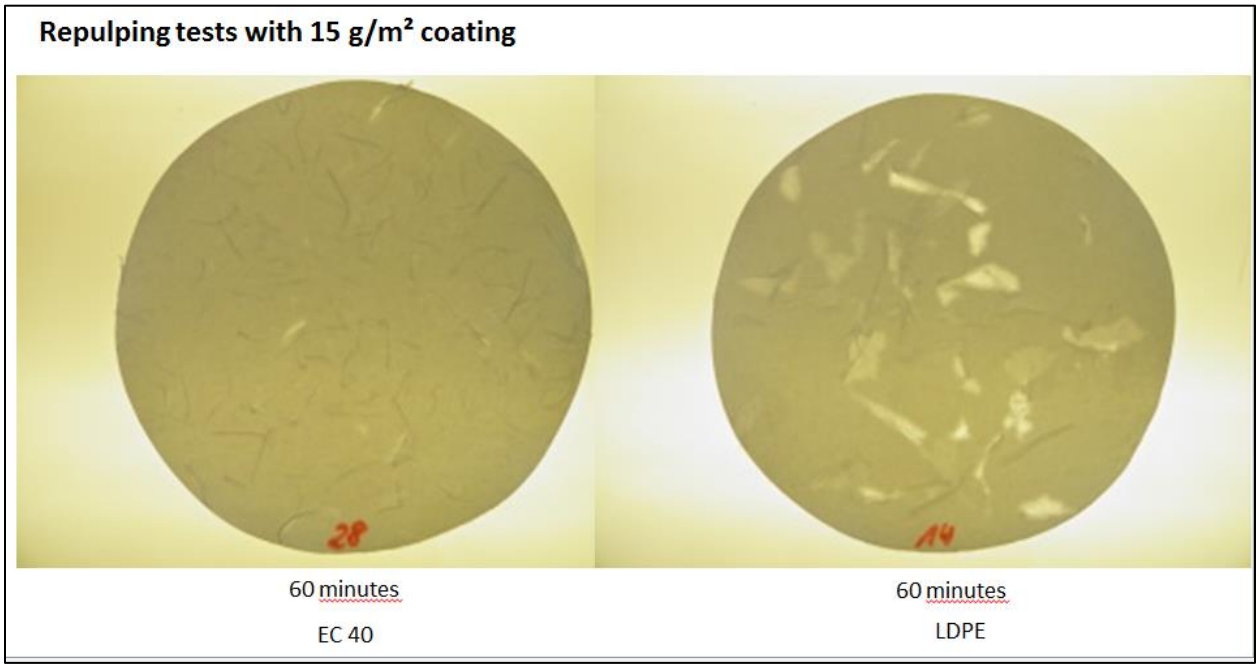

Figure 1: Finished Handsheets with 15 g/m^2 coating – EC40 vs. LDPE

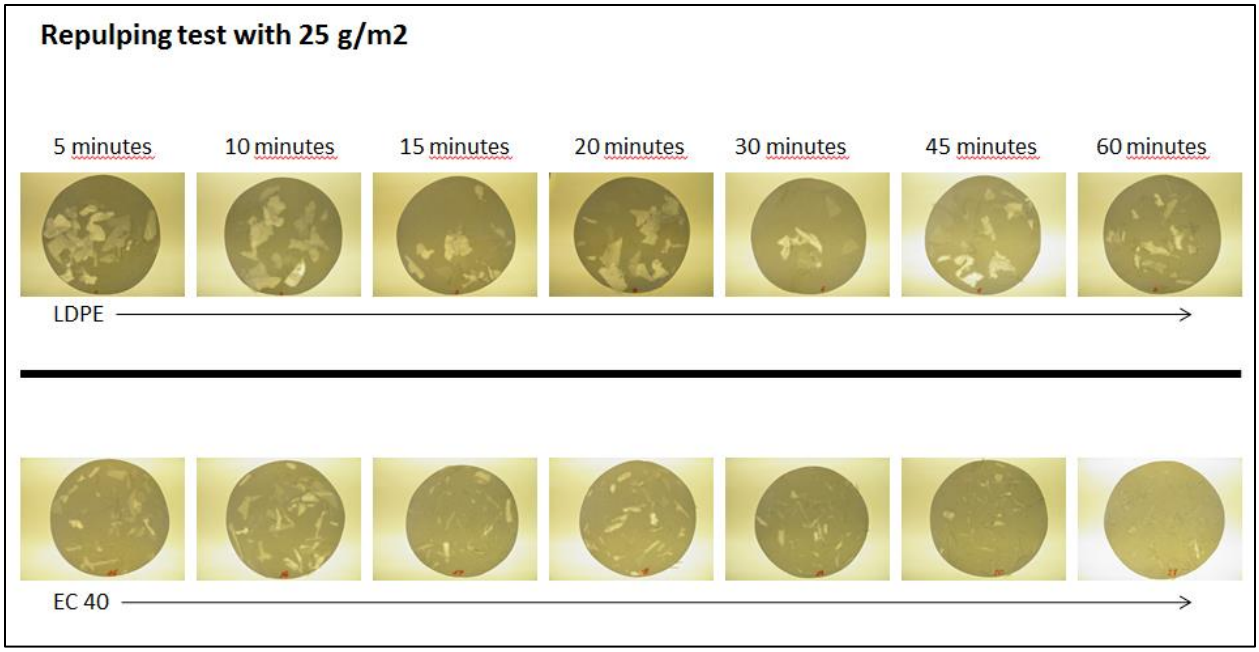

Figure 2: Finished Handsheets with 25 g/m^2 coating – EC40 vs. LDPE

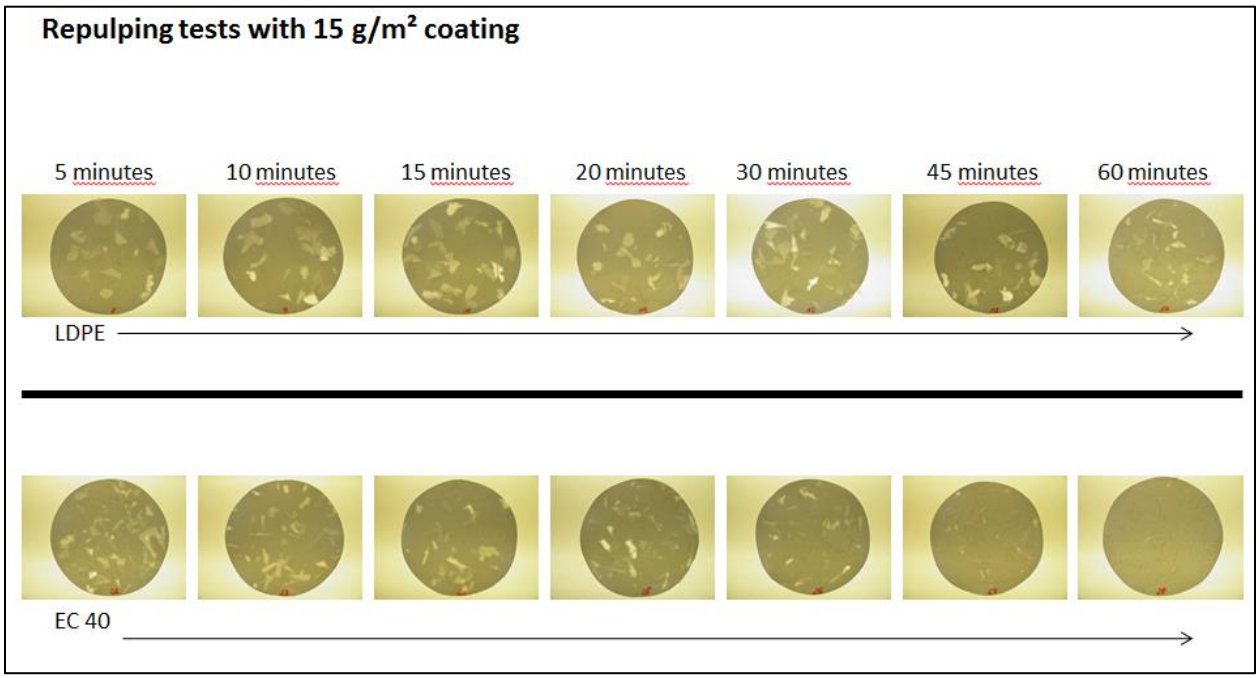

Figure 3: Finished Handsheets with Cup Sidewall Weight and 15 g/m^2 coating – EC40 vs. LDPE

Georgia Tech Institute of Paper Science and Technology EarthCoating EC-40 Study

Prepared by Georgia Tech Institute of Paper Science and Technology, "IPST" October 22, 2013.

1. Summary

Coated paper boards were repulped to produce three fractions: the accepts, the rejects and the wash-out. A full study including repulpability, compositions of different fractions, stickies analysis, fate of rosin acids and starch has been performed. Results indicated that the accept yield was over 78%, and an overall recovery of almost 100% was reached when the accepts, the rejects and the wash-out were added up. In general, the accepts were dominated with fibers, which accounted for over 92% of the mass. However, small amounts of plastics and inorganics (fillers and coatings) were also present. The rejects were mainly plastics, but significant amount of inorganics were also found in some samples. The wash-out collected from the washing liquor contained significant amounts of fibers and inorganics with small portion of plastics. Stickies content determined in mm2/g was 108 and 123 respectively for sample CLWR-2 and CLWR-8.1. GC/MS data indicated that the rosin acids were found in almost all three fractions, but most of them associated with the accepts and the wash-out. An iodine detect technique found that the starch was in the accepts and the wash-out, and the rejects was practically starch-free.

2. Experiment

2.1. Ash Content

Ash content was measured following Tappi standard T413. The time at maximum temperature was extended to 8 hours to ensure complete ash.

2.2. Re-pulpability

Around 25 g oven dry paper sample were torn into 1x1 inch pieces and weighted into a pre-heated (around 52 degree C) Waring blender, which equipped with special blade to reduce fiber cutting. After 1500 ml 52 degree C hot water was added, the paper was disintegrated on low speed (15,000 rpm) for 4 minutes. The content was then transferred quantitatively into a British disintegrator using 500 ml hot water as rinsing liquor, so that the pulp slurry has a temperature around 52 degree C. The pulp suspension was then de-flaked for 5 minutes with British disintegrator (3000 rpm). The disintegrated pulp was screened by using a Valley flat screen with 0.01" slot opening for 20 minutes. During the screening, a water head over the screen was maintained at 3" and water flow was kept constant. Accepts and rejects were collected and were used to calculated the screen yield (acceptances/starting paper*100) and overall recovery ((acceptances+rejects)/starting paper*100). Images of the acceptances and rejects were taken to examine the fibers and flakes.

2.3. Determination of fibers, plastics and ash compositions

2.3.1. Determined ash content of the fraction following the procedure stated in 2.1.

2.3.2. Around 0.2 g mass was weighted into a 50 plastic vial. After 1.8 ml 72% sulfuric acid was added, the content was mixed thoroughly and the sample mass turned to a paste. The vial was then set in 30 □C heating block for 1 hour, and the content was stirred periodically. By the end of heating treatment, water was added into the vial until a total of 50 ml volume was reached. The vial was capped and set in a 121□C autoclave for two hours. This would completely hydrolyze the carbohydrate components and solubilize the acid soluble inorganics. By the end of hydrolysis, the acid insoluble substances were collected over a tarred glass filter which was pre-heated at 550□ overnight. The collected substances were plastics plus acid insoluble inorganics (ash), which was determined by procedure stated in 2.1. Thus, the fibers content was calculated from the weight difference of starting materials and substances after hydrolysis minuses the acid soluble inorganics. This portion of inorganics was determined from the ash content stated in 3.1 minuses acid insoluble inorganics. The plastics were the weight difference of acid insoluble substances minus acid insoluble inorganics.

2.3.3. Validation. In validation run, 1.5 g starting materials was first hydrolyzed with 15 ml 72% sulfuric acid under room temperature for 1 h followed by 3% sulfuric acid hydrolysis of 4 h under boiling temperature.

2.4. Stickies analysis.

Around 0.3 g materials were hydrolyzed following procedure stated in 2.3.3. The hydrolyzed content was filtered through a black filtering paper (15 cm diameter). The retained white residues were thoroughly washed with plenty water until neutral. When the filter paper was dry, the residues on the black filtering paper were scanned with a HP scanner. A known dimension shape was placed in the scanner as reference. The image thus acquired was input to Image-J software. Set threshold at 125/255 and scale based on the insert reference. The particles was analyzed and the output was input into Excel for further calculated. The stickies content was expressed as specified stickies area, which was defined as total stickies area in mm2 /weight of starting materials in g.

2.5. Fate of rosin acids

Proper amount of mass from each fraction was weighted into a 15 ml vials. After 10 ml DCM and 3 drops of 2 M HCL were added, the vial was firmly caped with Teflon-lined caps, and shaken for 3 minutes. The vial was set in room temperature overnight. 1 ml extract was filtered through a layer of sodium sulfate, and 100 µl clear filtrate was measured into a 1 ml GC vial. After the content was dried under a stream of nitrogen, the residues were derivatized with MSTFA (N-Methyl-N-(trimethylsilyl) trifluoroacetamide) at 50 °C for 30 minutes with periodic shaking. 1 µl derivatized mixture was injected into the GC/MS for analysis. The GC was equipped with 60 meter SPB DB-5 fused silica capillary column and helium was used as carrying gas. GC operation conditions were set as following: initial temperature 120 °C, initial time 5 min., rate 15 °C/min., final temperature 315 °C and final time 30 minutes, inject port temperature 250 °C. The components were analyzed using a HP 5975C mass detector in EI mode. The operation parameters were properly set to realize maximum detection limit. Identification of individual compound based on the commercial mass spectra libraries and in-house libraries. Peak area was used to anticipate the total mass of rosin acids.

2.6. Starch detection

Around 0.2 g materials were weighed into 10 ml vial. After 5 ml water was added, the vial was caped and placed in a 105 °C oven overnight. Around 2 ml water extract was transferred to a test tube and added with 2 drops 0.1 M iodine solution. If the solution inside the test tube turned blue, it indicated the present of starch.

3. Results

3.1. Repulpability

Coated paper board and product are repulped and recovered in three fractions: accepts, rejects and wash-out. The oven dry weight of each fraction, along with the accepts yield and overall yield are listed in Table 1.

Table 1: Repulpability of the paper samples

	Start pulp, g	Accepts, g	Rejects, g	Washout, g	Accepts Yield, %	Overall Yield, %
CS-1	26.616	22.388	2.255	1.711	84.12	99.01
IP Mix	26.170	20.573	1.376	3.770	78.61	98.28
CLWR_2	25.257	20.123	1.056	3.930	79.67	99.42
CLWR_8.1	25.550	20.572	0.919	3.941	80.51	99.53

Results indicated that accepts yield for all the studied samples is close to 80%. Sample CS-1 has the highest accepts yield and the least wash-out. This may be due to the uncoating nature of the based paper sheet. For all the samples, the overall yield almost reaches 100%, indicating the excellent recovery of the starting materials in the three fractions. Figure 4 through Figure 11 show the magnified images of the accepts and the rejects. As indicated, all the accepts have particles of impurities in various sizes. Accepts of some samples also contain fragments of plastics that may have been broken down from the plastic coating. Judged from the reference ruler, the size of those particles is less than 1 mm in length. The rejects also contain small quantity of fibers.

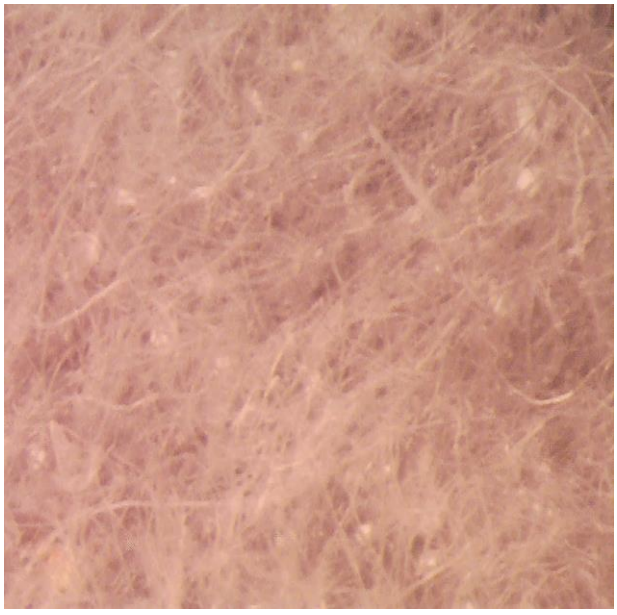

Figure 4: Image of accepts from sample CS-1

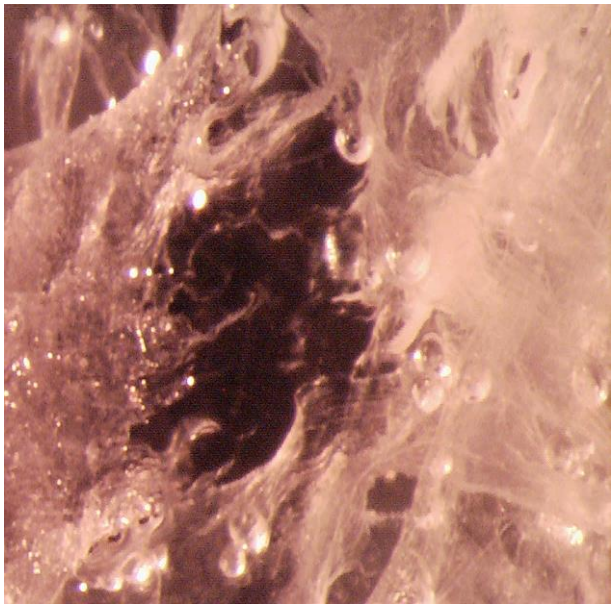

Figure 5: Image of rejects from sample CS-1

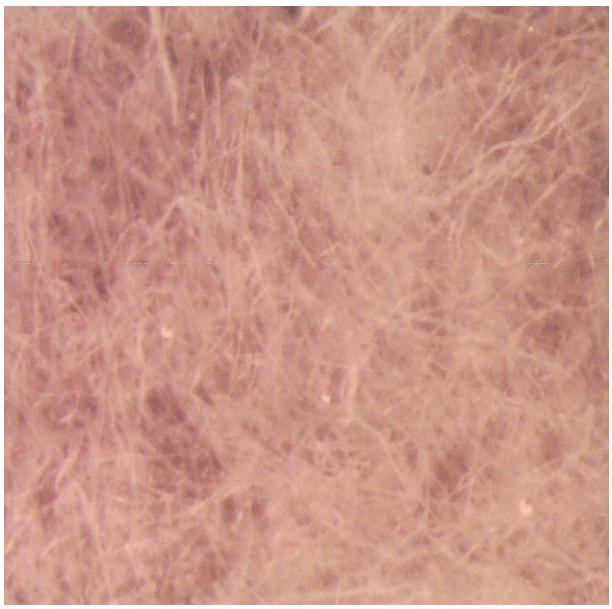

Figure 6: Image of accepts from sample IP Mix

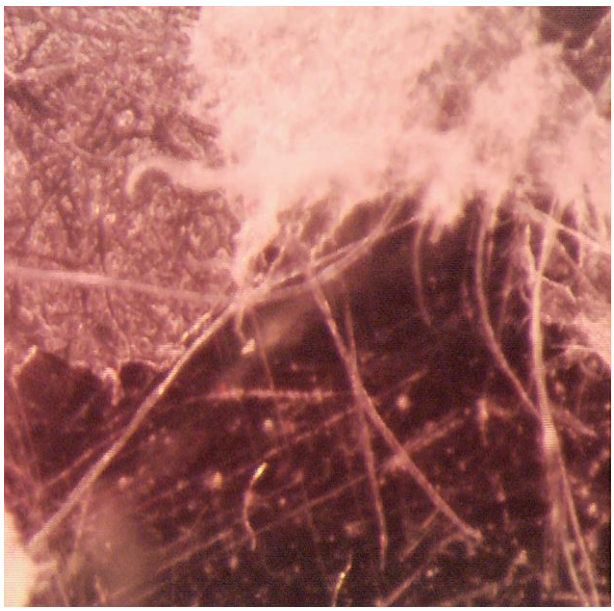

Figure 7: Image of rejects from sample IP Mix

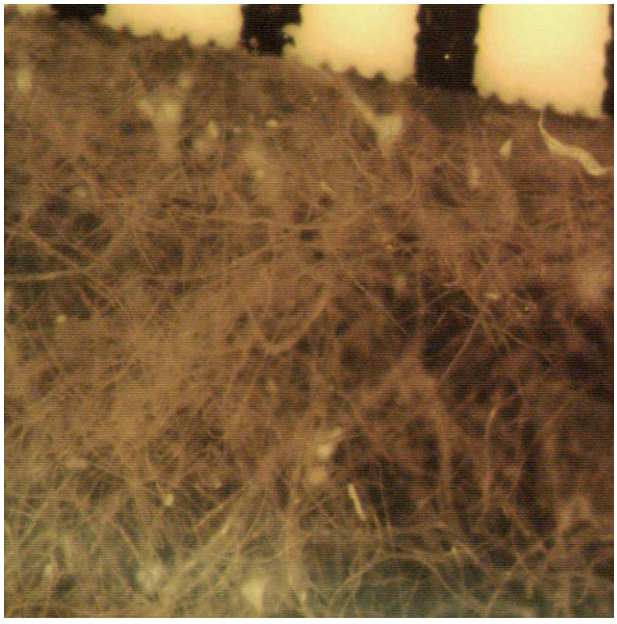

Figure 6: Image of accepts from sample CLWR-2. Upper part of image displays a ruler with 1mm intervals

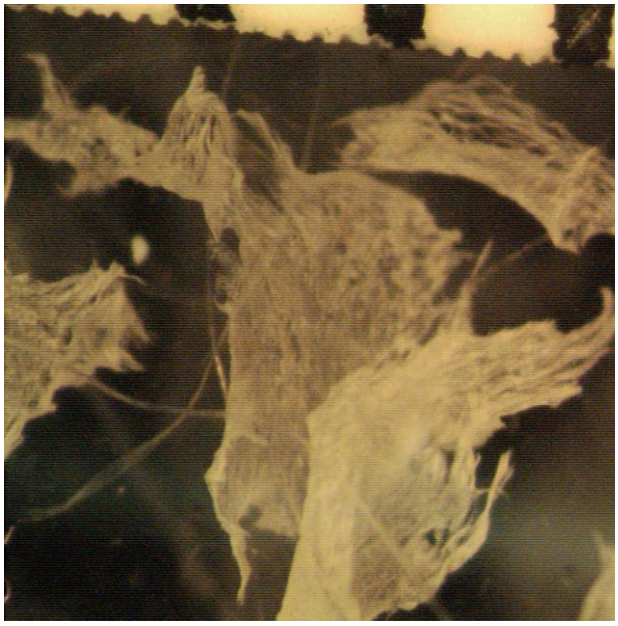

Figure 7: Image of rejects from sample CLWR-2. Upper part of image displays a ruler with 1mm intervals

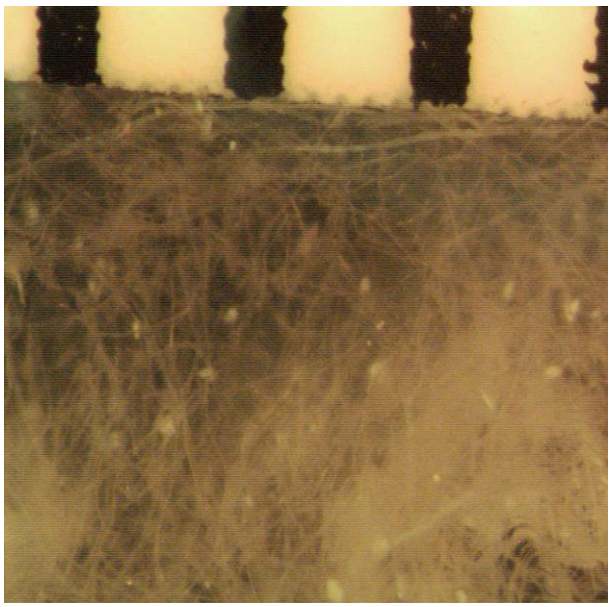

Figure 8: Image of accepts from sample CLWR-8.1. Upper part of image displays a ruler with 1mm intervals

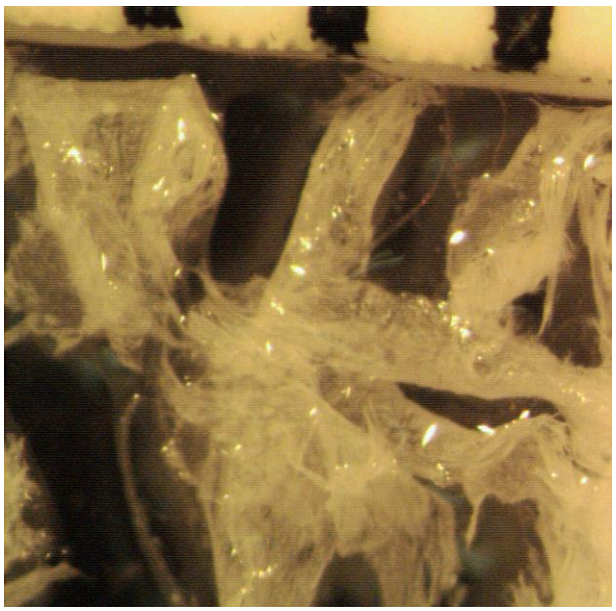

Figure 9: Image of rejects from sample CLWR-8.1. Upper part of image displays a ruler with 1mm intervals

3.2. Compositions of the three fractions.

Compositions of the fractions are divided into three categories: fibers, plastics and inorganics which may come from the fillers in the base paper and the mineral coatings in the coating layers. Through the acid hydrolysis-ash operations, the fibers, plastics and inorganics can be distinguished and quantified. This is based on the fact that fibers are composed of carbohydrates and they are readily hydrolyzed in sulfuric acid solution under elevated temperature. Plastics, however, are generally resistant toward such hydrolysis and will be recovered as insoluble substances. In the ashing process, both fibers and plastics will be burnt out. Inorganics survive this process and are recovered as ash.

Table 2 listed the experimental results indicating each fraction compositions in term of percentages.

. *Table 2: Compositions of the three fractions*

Sample	Ash %	Accepts			Rejects			Wash-out		
		Fibers %	Plastics %	Ash %	Fibers %	Plastics %	Ash %	Fibers %	Plastics %	Ash %
CS-1	0.24	98.92	0.74	0.40	3.56	96.44	0.04	82.44	1.47	17.78
IP Mix	8.18	92.18	3.21	4.75	1.05	89.28	9.22	68.43	2.56	29.01
CLWR_2	10.33	94.43 (94.17)	1.04 (1.30)	4.53	5.05	57.43	37.52	63.07	2.21	34.72
CLWR_8.1	8.43	94.42 (94.11)	1.00 (1.31)	4.58	10.59	54.87	34.54	61.82	2.79	35.39

Note: Numbers in parentheses are validation runs

In order to obtain reliable results, analysis to accepts of sample CLWR-2 and CLWR-8 was performed in triplet runs: a duplicate run to produce the average result, and a third run in large sample size to serve as validation .As indicated, the majority of the accepts is fibers, accounting for over 92% of the mass. Ash and plastics are minor components existing probably in the forms of small particles. Comparing to sample CS-1, all the accepts from other three samples contains higher amounts of inorganics. As to the plastics components, IP Mix has substantial high quantity than CS-1, whereas those among CS-1, CLWR_2 and CLWR-8.1 are comparable. Plastics are the dominant components in the rejects fraction, especially in sample CS-1. Sample IP Mix, CLWR-2 and CLWR-8.1 have increasingly amounts of inorganics in the rejects. It is not known if these inorganics are closely packed inside the plastics or presented as separated particles. In the washout, the fibers are the major components, especially in sample CS-1 and IP MIX. Sample CLWR-2 and CLWR-8.1 have increasingly amounts of inorganics, probably presented as colloid particles in the washing liquor.

3.3. Stickies analysis

Impurities in the accepts are the major concern in the recycled pulp fibers. Although composition analysis in Section 3.2 provides information regarding these impurities, a visual analysis can provide more subtle features of the impurities. Stickies analysis is thus performed to reveal the particle content and size distribution.

Table 3 lists stickies analysis results. Figure 10 and Figure 11 below are images of stickies from samples CLWR-2 and CLWR-8.1. Figure 12 displays the plot of percentage stickies against particle sizes in square millimeter.

. *Table 3: Stickies analysis results*

	CLWR-2			CLWR-8.1		
	Fibers	Rejects	Washout	Fibers	Rejects	Washout
Stickies, mm^2/g	108	n/a	n/a	123	n/a	n/a
Rosin	+++	+	+++	+++	+	+++
Starch	+	Not detected	+	+	Not detected	+

Figure 10: Image of stickies from sample CLWR-2

Figure 11: Image of stickies from sample CLWR-8.1

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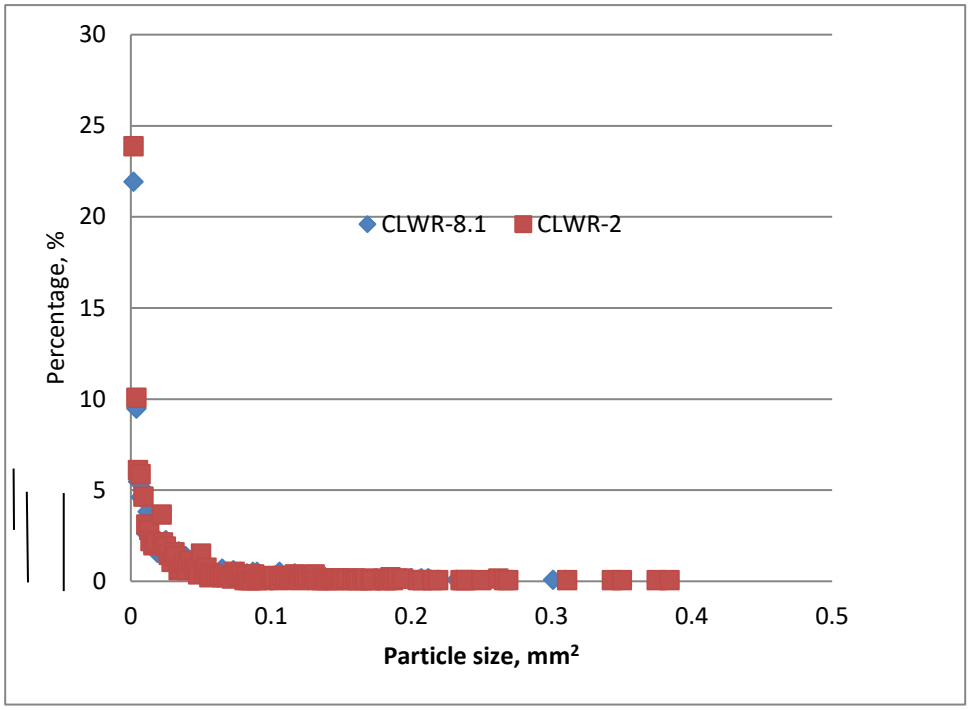

Figure 12: Chart of accepts from sample #6

The result indicates that contents of stickies in both CLWR-2 and CLWR-8.1 are comparable. The images clearly show the white stickies with the black ground. The white rectangle area in the images is a referential block with 12.8 mm length. Particle size distribution plots indicate that all the stickies have a size less than 0.4 mm^2. The particles with an area less than 0.05 mm^2 are dominant. This result, however, is highly in line with what has been observed in the images shown in Figure 4 through Figure 8.

3.4. Fate of rosin acids

Rosin is a collective name given to a group of chemicals including abietic acid, pimaric acid, isopimirc acid, palustric acid, dehydroabietic acid, etc. The rosin used in the paper making process can also be oxidized into different forms. Nonetheless, the acids are readily extracted by using DCM in acidic medium, and can easily be separated by using a neutral GC capillary column.

Results of GC/MS analysis of the three fractions from samples CLWR-2 and CLWR-8.1 are shown in Table 3. Figure 13 illustrates a typical total ion spectrum of the DCM extract.

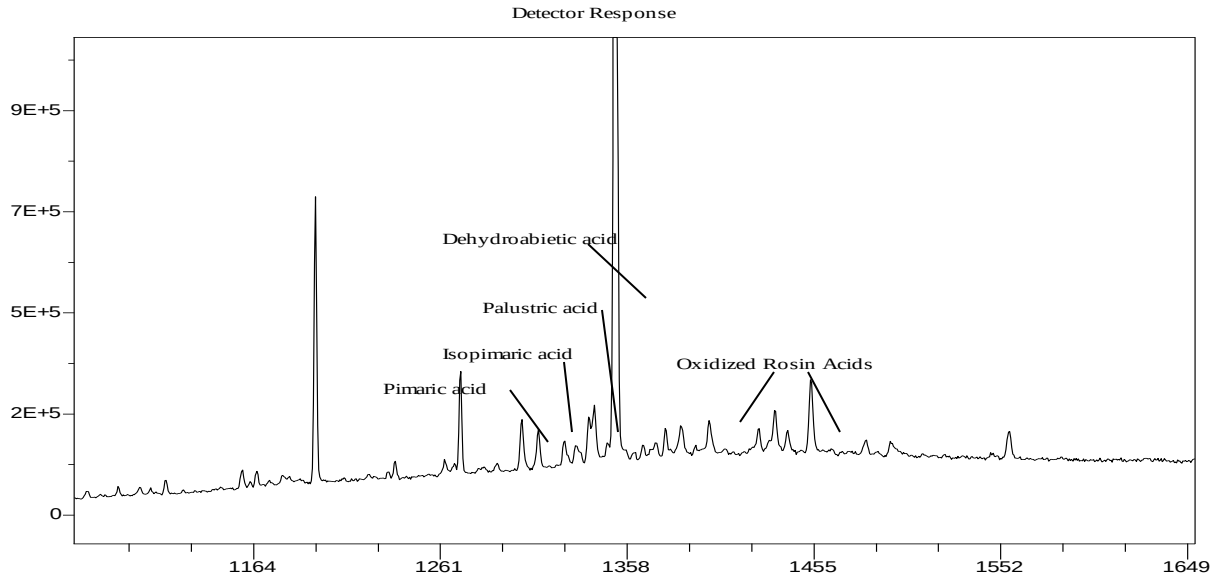

Figure 13: Total ion spectrum of DCM extract from washout fraction of sample CLWR-2

As indicated, the rosin acids are separated completely by GC. Judged by the peak area, the fibers fraction contains the higest amount of rosin, followed by the washout and the rejects.

3.5. The whereabouts of starch

Starch's whereabouts among the three fractions is determined by iodine detection. Starch will turn the iodine-containing solution blue. Based on this phenomenon, starch is found in both the fibers fraction and washout fraction, but not in the rejects fraction, as indicated in Table 3.

3.6. Post-wash slotted screens, completely clean with no clogging or special cleaning needed.

Refer to the image in Figure 14, below.

Figure 14: Post-wash slotted screens

US Paper Mill EarthCoating EC-40 Pilot

On October 28th, 2015 a successful pilot was completed at Fox River Fiber, located at 1751 W Matthew Drive, De Pere, WI, verifying the pulp-ability and process-ability of paperboard coated with EarthCoating EC-40, a highly mineralized resin alternative to traditional polyolefin barrier coatings for paperboard packaging applications such as paper cups, folding cartons, food trays, etc."

The successful completion of this pilot validated prior test results documenting that highly mineralized coatings have significantly different and unique re-pulping and recycling characteristics relative to those of non-mineralized polyethylene coatings. In comparison to plastic coatings, EarthCoating improvements are a result of coating density, accept/reject particle sizes, coating break-up during pulping, wash-out mass, and discharge behavior. The pilot focused on pulp and coating processing in coarse screens, high density cleaners, primary pressure screens, and fine pressure screens. The pilot was 100% successful. EC-40 paper bales processed easily without complications, special handling or cleaning. The bales completely re-pulped and recycled. Based on the pilot results, the bales can now be purchased and routinely processed in the pulp furnish. Although the paper in the bales contained EarthCoating, the paper behaved differently than paper having out-throw or prohibitive content contamination.

The pilot was executed and supervised by Fox River Fiber. Fox River Fiber is a large producer of high quality, high brightness (85 UV excluded), high freeness, and low florescence ECF pulp, as shown in *Figure 15*. Their products offer the lowest levels of dirt and stickies within the industry, allowing customers to add up to 100% post-consumer content into their products.

Figure 15: Fox River Fiber finished product

The baled material was 100% pre-consumer waste with an EC-40 (SCC-80148) coating having a 1.25 g/cm3 specific gravity and 40% dispersed mineral content by weight. The coating was extrusion applied to 353 gsm unprinted bleached board (SBS) having a Tappi T-314 moisture content of 7.1. The materials were selected to validate processing data previously published by the IPST at Georgia Tech. This type fiber is commonly used for cup, folding carton, and corrugated top sheets.

Upon arrival of the coated board, the mill extracted bale samples. Using the samples, lab hand sheets were made (see Figure 16) and disintegration testing was completed. The hand sheets and disintegration testing qualified the bales for production release and were consistent with IPST results. Also, based on mill QC protocol, production hand sheets were made using EC-40 (figure 3) and compared to an uncoated paper control (figure 4). The final handsheet is shown in figure 5.

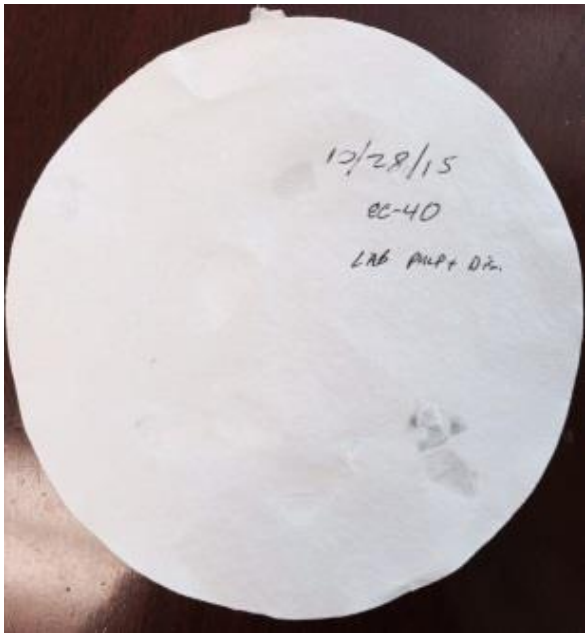

Figure 16: Lab Sheet

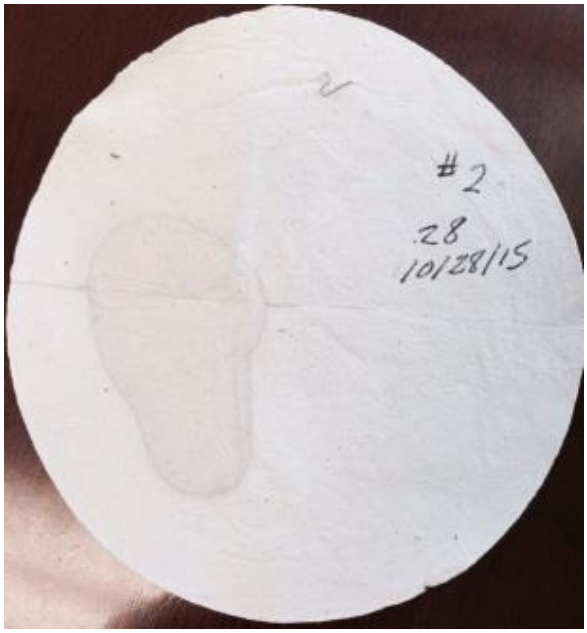

Figure 17: Production Sheet

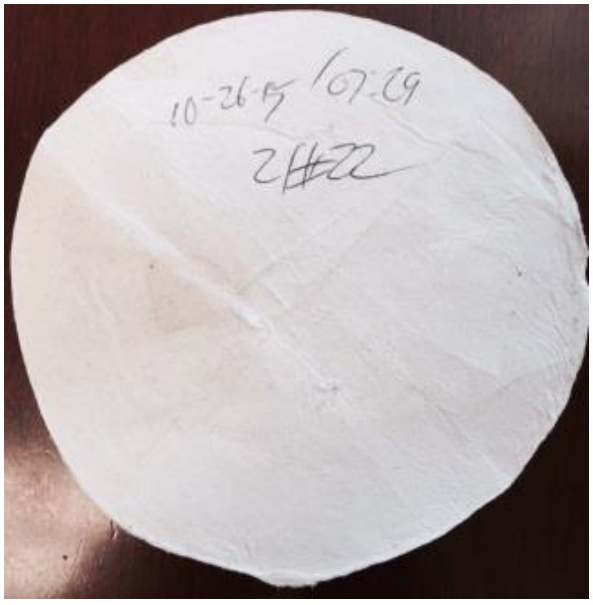

Figure 4: Control Sheet

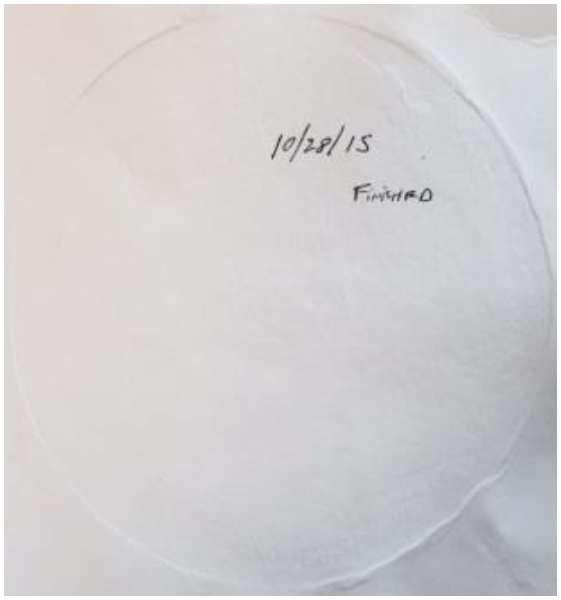

Figure 18: Finished Sheet

The pulper was high consistency with a batch cycle of 22 minutes. Two separate batches were processed. Both were successful. Upon completion of a 22 minute cycle, the pulp passed through approximately .25" coarse screens. Just before the pilot, de-trasher reject samples were pulled and kept as control (*Figure 19*). Corresponding production EC-40 rejects are shown in *Figure 20*. During the pilot, the rejects were inspected vs. control and found to be well within processing guidelines. After the coarse screens, the accepts passed successfully through a series of high density cleaners.

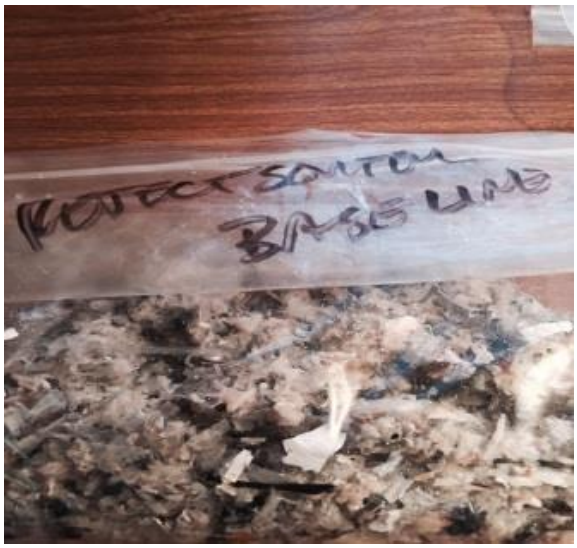

Figure 19: Rejects - Control

Figure 20: Rejects - Pilot

Figure 21: Primary Rejects

Figure 22: Fine Screen Accepts

Throughout the batch, multiple samples of rejected material were collected and inspected at the .010" slot primary screens (*Figure 21*). In the mill control room, real time pressure screen monitoring took place. The monitoring sensors continuously output screen pressure levels. Screen pressures are indicative of clogging or the presence of contaminants. Monitoring and physical sampling failed to detect evidence of processing impediments or unfavorable conditions at the primary screens. Next, the pulp successfully passed through .005" round slot fine

screens. Similar to the primary screens, no unusual pressure or processing irregularities occurred. Fine screen accepts were collected (*Figure 22*).

Conclusion

The Fox River Fiber EC-40 (SCC-80148) pilot was a complete success. The pilot confirmed the prior IPST and X Corp. results. Coating characteristics such as density, particle sizes, break-up during pulping, and discharge behavior resulted in different processing characteristics compared to traditional plastic coatings. Inspections, sampling, and hand sheets were completed before, during, and after production. No processing issues were encountered while pulping, de-trashing, cleaning, or during primary and fine pressure screening. The mill deemed the bales commercially viable, repulpable, and recyclable. Finally, viability of post-consumer collection potential was confirmed.

Lenzing Papier, Short Duration Batch Pulping and Recycling Testing

Lenzing Papier GMBH is high quality recycled paper manufacturer located in Lenzing, Austria that has been operating paper mill production in Europe for approximately 100 years. Today, Lenzing Papier collects paper sourced throughout the UK and EU. Their facilities use traditional paper recycling equipment. They are not configured for specialized recycling of plastic coated papers, therefore, Lenzing Papier carefully screens out plastic and does not purchase paper containing plastic coatings. Lenzing Papier manufactures recycled paper comprised of 100% recovered fiber that achieves high whiteness without optical brightening agents and chlorine bleaching, thanks to a special converting process for recovered fiber. Their product exhibits high opacity and good sheet formation as well as maximum ageing resistance and excellent usability on all types of processing machinery for applications from envelopes to annual reports.

Testing was performed for the purpose of closely simulating the pulping and recycling behavior of Smart Planet EU compliant coating specifications. These specifications are scheduled for publication in May-June 2017. Another objective was to qualify a large-scale mill pilot and then begin collection programs by authorized Smart Planet Technologies, Inc. cup producers and their customers located in the UK and EU areas. The final objective was to extend Smart Planet Technologies' paper mill-direct testing validation for EarthCoating™ when coated paperboards are processed by fast, batch pulpers used by recyclers not having specialized de-poly systems, to ensure that when recycled in these conditions, the materials will not contaminate the general paper stream.

In support of the these objectives, Lenzing Papier completed extensive repulping and recycling testing simulating their fast duration 20 minute batch repulping process as well as detailed inspection of finished handsheets. The materials tested included two grades of Georgia-Pacific "GP" Masterserve CPC cupstock. This cupstock is currently approved by Smart Planet Technologies, Inc. for EU area reCup™ production. Also, this is the same cup stock grade that has successfully completed production trials and is currently offered for sale by authorized Smart Planet UK and US area cup manufacturers. The cup bottom stock is 182 micron GP CPC 126, having a basis weight of 205 GSM. The tested bottom stock was coated on two sides using EC-40 (SCC-80148). The tested cup sidewall included 419 micron GP CPC 180, having a basis weight of 293 GSM. The sidewall stock was coated on one side with 20 GSM EC-40 (SCC 80148) and 20 GSM EC-51 (SCC 78332) in separate batches. To insure accuracy, the uncoated GP paper and Earth Coated ™ GP stock was tested multiple times as both uncoated control and coated test samples. The EarthCoating ™ GP paper tested had mineralized coating mass significantly above US specifications for the purpose of closely simulating pulping results of the soon to be published Smart Planet Technologies, Inc. EU compliant cup specifications. The EU specifications are compliant with Commission Regulation (EU) No: 10/2011, migration test per EN 1186, including chloroform soluble extracts. To avoid contamination and unacceptable pulping results, the tested coatings were mineralized throughout the entire coating layer and did not contain unfilled resin on any surface of the coating.

Summary of Lenzing Papier Testing Results

The testing was entirely successful and therefore Lenzing Papier predicted a high probability of satisfactory processing and usability. Based on the testing data, large scale collection pilots have been approved. The testing results are shown in the table below.

Anforderer:Hoffman 26.01.2016							
Laborauftragsnummer: 23		**Pulp Duration**					
Grade	5Min.	10Min.	15Min.	20Min.	holzhaltig	W-/W+/LAB/Wcie	geeignet ja / nein
GP Masterserve 293 GSM Uncoated	ok	ok	-	-	nein	80,8 / 80,9 / 93,9 / -0,5 / 3,7 / 68,2	
GP Masterserve 293 GSM Uncoated	ok	ok	-	-	nein	81,6 / 81,7 / 94,1 / -0,5 / 3,6 / 69,7	
GP Masterserve 210 GSM Uncoated	ok	ok	-	-	nein	81,8 / 82,0 / 94,1 / -0,3 / 3,3 / 71,0	
GP Masterserve 210 GSM C2S EC-40	Plast.sonst ok	Plast.sonst ok	-	-	nein	80,8 / 80,9 / 93,7 / -0,4 / 3,5 / 68,9	
GP Masterserve 210 GSM C2S EC40	Plastik Stippen	Plastik wenig	-	-	nein	81,1 / 81,2 / 93,9 / -0,1 / 3,4 / 69,7	
GP Masterserve 293 GSM Uncoated	ok	ok	-	-	nein	81,1 / 81,1 / 93,8 / -0,5 / 3,5 / 69,1	
GP Masterserve 293 GSM EC-40	Plast.sonst ok	Plast.sonst ok	-	-	nein	81,2 / 81,6 / 93,9 / -0,3 / 3,4 / 70,8	
GP Masterserve 293 GSM EC-40	Plast.sonst ok	Plast.sonst ok	-	-	nein	80,9 / 81,0 / 93,7 / -0,3 / 3,4 / 69,1	
GP Masterserve 210 GSM C2S EC40	Plast.sonst ok	-	-	-	nein	80,9 / 81,2 / 93,7 / -0,1 / 3,2 / 70,7	
GP Masterserve 293 GSM C1S EC51	Plast.sonst ok	-	-	-	nein	81,7 / 81,9 / 94,0 / -0,3 / 3,2 / 71,0	
GP Masterserve 210 GSM C2S EC40	Vereinz.Stippen / Fiber bundles	ok	-	-	nein	81,8 / 81,9 / 94,1 / -0,3 / 3,2 / 71,0	
GP Masterserve 293 GSM C1S EC51	ok	ok	-	-	nein	81,6 / 81,6 / 94,2 / -0,4 / 3,6 / 69,2	
GP Masterserve 210 GSM Uncoated	Vereinz.Stippen / Fiber bundles	ok	-	-	nein	81,8 / 81,9 / 94,1 / -0,3 / 3,3 / 70,9	
GP Masterserve 293 GSM Uncoated	Vereinz.Stippen / Fiber bundles	ok	-	-	nein	81,2 / 81,2 / 94,0 / -0,4 / 3,6 / 68,8	
20 GSM EC-40 & EC-51 Coating							
Uncoated GP Masterserve Control Samples							
Plastik = Folio undissolved						Bearbeiter: Höglinger	

As shown on the chart, the 20-minute batch pulping cycle is broken down into four-5 minute testing increments. Hand sheet samples were taken during each 5-minute increment and closely evaluated. In all cases, the test samples disintegrated rapidly – within 10 minutes or by the end of the second pulping increment. Therefore, all tested samples are highly suitable for batch pulpers. Consistent with the previous Georgia-Tech IPST particle analysis (contained within this report), the small amount of plastic particles remaining in the pulp were benign. The EC-51 sidewall samples showed the best results, disintegrating within 5 minutes, a result similar to that of the uncoated control samples. Even the heavily coated two side bottom stock disintegrated within 10 minutes, therefore, only requiring 50% of the available pulping duration.

Conclusion

All the tested samples demonstrated a very high probability of successful recycling. Smart Planet Technologies, Lenzing Papier, and authorized cup manufacturers are now coordinating reCUP coffee cup collection programs within the UK.

Servicing the E.U. region and beyond, PTS is an advanced paper and packaging industry testing authority located in Papiertechnische Stiftung Hess-Strasse 134, 80797 Munich, Germany. In September, 2017 printed and finished hot cup samples manufactured by Cupprint, Ireland were sent for recyclability testing per PTS test method PTS-RH 021/97, including DIN EN ISO 5263 (disintegration), ZM V/18/62 (defiberability), DIN 54358 (sheet formation), ZM V/1.4/86 (Furnish Screening). The sample reCUPs are compliant with Smart Planet Technologies, Inc. approved E.U. hot cup specifications. They are also compliant with E.U. “Reach” certifications. Testing was conducted as a double determination in the areas of:

1. Speck free defiberability
2. Trouble free sheet formation (absence of stickies)
3. Disintegration and Furnish
4. Sheet formation from furnish
5. Furnish screening and accept sheet formation

The results of this testing were 100% recyclable. Copies of this test may be made available upon request.

Having an approximate turnover of $2.0 billion USD, the Mayr-Melnoff Group is the world-leader in coated recycled carton board with a growing position in virgin fiber based board and Europe’s leading manufacturer of folding cartons with a growing presence outside of Europe. The group’s operations are entirely concentrated on the core business areas which are managed in two operative segments MM-Karton and MM-Packaging.

Printed and converted “reCUPs” made with EarthCoating were sent to MM testing laboratories in Germany located at Wannersdorf 80, A-8130 Frohnleiten, Austria for repulping testing and recyclability evaluations.

The samples were lab repulped and sheets were formed. The paper fraction of the pulp fully disintegrated within 5 minutes and yielded carton sheets of good quality appearance. Further, the test results stated the “reCUP” samples to be 100% recyclable and a non-contaminant to the general paper stream. Copies of this test may be made available upon request.

CPSC California Product Stewardship Council SM

Smart Planet Technologies wins the 2017 Green Arrow Award from the California Product Stewardship Council

By virtue of proven recyclability of Earth Coated packaging, Smart Planet Technologies (SPT) has won the 2017 Green Arrow Award from the California Product Stewardship Council (CPSC) in recognition of EarthCoating technology which may be used to create paperboard barrier packaging materials that are valuable to the recycling industry.

SPT was presented the Green Arrow Award on August 22, 2017 by Heidi Sanborn, Executive Director of the California Product Stewardship Council (CPSC) in partnership with the California Resource Recovery Association (CRRA) at the CRRA’s 41st Annual Conference and Tradeshow event in San Diego, CA.

Allan Company EarthCoating re-pulping test results.

The Allan Company is large recycling company located in Southern California. They currently provide comprehensive recycling programs to over 2,000 commercial accounts and governmental agencies throughout the nation, working hard to make sure municipalities and commercial entities meet or exceed their diversion / recycling goals. They are currently conducting over 3,000 transactions per day with the general public at numerous facilities.

A series of pulping tests were conducted by Allan Company's recycled paper customers beginning in June, 2013 and continuing through August 2017. Testing was resumed in 2017 because paperboard packaging made with EarthCoating will soon be available for widespread collection.

During the first testing, samples were submitted having the EarthCoating EC-40, SCC-80148 coating applied in various weights to a variety of folding carton grades comprised of printed and unprinted virgin and recycled boards. The re-pulping tests were very successful. Upon completion of the tests, the Allan Company qualified paperboards with EarthCoating in the paper grades listed below. They also released paperboards with EarthCoating for full commercial pilots.

Qualified Paper Grades, June 2013

Mixed Paper- Rolls
Boxboard Cuttings/Chipboard Rolls
Light Print BSK/SBS Rolls
Heavy Print BSK/SBS Rolls
Unprinted BSK/SBS Rolls

Allan Company completed another round of re-pulping testing in August, 2017. This testing focused on 12 oz. reCUP coffee cups. The reCUP testing was coordinated at the 2540 S. Main St. location. Testing included the entire double wall cup and the outer sleeve. The reCUPs re-pulped with 100% success. Below, are pictures of the tested cups and handsheets. Handsheet #1 is the entire double wall cup. Handsheet #2 is the cup outer wall. Test results indicated rapid EarthCoating disintegration and very clean hand sheets. During the post-test meeting on 8.18.18., Allan Company recommended priority collection and commercial piloting of single and double wall cups made from virgin SBS. The reCUP could be collected and sold as several uncoated paper grades including, for example, white ledger.

12 oz. reCUP | Hand Sheet #1 | Hand Sheet #2


In summary, the reCUP has completed testing in California and deemed suitable as a high value, uncoated, paper grade. Therefore, reCUP and other paper substrates coated with EarthCoating are now ready for commercial mill pilots and collection throughout the Southern California area. By collecting reCUPs and other valuable paperboard barrier packaging made with EarthCoating, the potential to significantly lower greenhouse gas emissions and divert large amounts of solid waste from California landfills may become realized.

ALLAN COMPANY Recovered Materials Management

Dear Sir/Madam,

Allan Company has been a leader in the recycling industry since 1963. We are the largest independently owned broker, packer and exporter of recovered fiber in the United States, marketing over one million tons annually. As an industry leader we are constantly look to find both new markets for our material as well as new materials to be recycled.

We are pleased to announce that we can now accept a new material for recycling namely a new type of coated fiber. This new coating is a highly mineralized resin comprised of 40% or greater mineral content. We have run tests at consuming mills to ensure that pre-consumer packaging comprised of mineralized resin coated fiber products can be recycled. This material is currently being introduced into the market to produce paper cups, two examples are the "reCUP" and "RecycleMe" brands. Allan Company classifies this type of pre-consumer coated fiber as accepted material for paper recycling. Opportunities also exist for the recycling of post-consumer material however all material must be source separated from all other material grades and contaminants.

If you have any questions regarding the material please feel free to contact Adam Holt at your convenience.

Respectfully Yours,

Adam Holt
Vice President

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WASTE MANAGEMENT > DRAIN CLEANING > C.C.T.V. PIPE AND DRAIN SURVEYING > DOMESTIC AND COMMERCIAL WHEELIE BINS > RECYCLING

Panda
An Animal for Recycling

I.P.R.
Irish Packaging Recycling Ltd

Seamus Kenny,
Broderick Group Ltd,

21/ Nov/ 2017

Dear Seamus,

Many thanks for taking the time to meet with us last week.
It was great to get an understanding of your business and how we can help with your recycling targets.
We love the whole idea of the coffee cup going directly back into the recycle loop without extra processing or segregation. In this regard we see the reCup that you are promoting in Ireland as an excellent innovation. The earth coated material developed by Smart Planet technologies seems a very good solution and we are delighted that it is made in Ireland by Cup Print and we are happy to say that we can close the loop but supplying the board manufactures with the recycled material that we collect nationwide. This is closed loop recycling and the circular economy working as it should in a real world situation.
We are in a position to start immediately with this project. If you need any further information please just let me know.

Yours sincerely,

Beauparc Business Park, Navan, Co Meath
Callsave: 1850 65 65 65 Tel: 046 9024111 Fax: 046 9024189
E-mail: info@pandawaste.ie Website: www.panda.ie

C E R T I F I C A T E

Recyclability of Packaging

The company receives the certification of recyclability for the following packaging.

Designation

reCUP (beverage cup, ca. 300 ml)

Test result

Allocation to path/specification:	**Mixed Waste Paper, type 5.01**
Recycling path:	**Mixed Waste Paper, type 5.01**
Recyclate (final product):	**Paper fibres**

Test standard/ scope of application: Requirements and assessment catalogue of the institute cyclos-HTP (state of 03.08.2017)

In accordance with the test results and the examination documents the recyclability of the packaging amounts to:

95 % (EU, CH)

This certificate (No. 2062-2018-000293) is valid until the **31.05.2020** (2 years upon issue) relating to the countries identified in the assessment report.This certificate will lose validity in case of qualitative or quantitative changes of packaging components.

* (with adaptions from 16.01.2019)

Aachen, dated 23.05.2018*

Dr. Joachim Christiani
Publicly appointed and sworn expert for the IHK for packaging waste disposal
Competent authority: IHK Aachen

Examination documents (No. 2062-2018-000293) with 7 following pages

Institute cyclos - HTP

Institute cyclos-HTP GmbH
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fax: +49 (0) 241 / 949 00-49

C E R T I F I C A T E

Recyclability of Packaging

The company receives the certification of recyclability for the following packaging.

Designation

earthcoated CUP (beverage cup, ca. 300 ml)

Test result

Allocation to path/specification:	**Mixed Waste Paper, type 5.01**
Recycling path:	**Mixed Waste Paper, type 5.01**
Recyclate (final product):	**Paper fibres**

Test standard/ scope of application: Requirements and assessment catalogue of the institute cyclos-HTP (state of 03.08.2017)

In accordance with the test results and the examination documents the recyclability of the packaging amounts to:

Classification **AAA** **(> 95 %)**

This certificate (No. 2062-2018-000293) is valid until the **31.05.2020** (2 years upon issue) relating to the countries identified in the assessment report.This certificate will lose validity in case of qualitative or quantitative changes of packaging components.

* (with adaptions from 16.01.2019)

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