Compostable Coffee Pod Test in the Hydropulper at the Disco Road Organic Processing Facility

Test Report Package

August 31, 2018

Prepared by:

Unit for Research, Innovation and a Circular Economy
Solid Waste Management Services
City of Toronto

Package Contents

1. Project Introduction prepared by the City of Toronto

2. Compostable Coffee Pod Test in the Hydropulper at the Disco Road Organics Processing Facility (DROPF) test report prepared by 2 cg Inc.
    - Appendix 1: Compostable Coffee Pod Testing Methodology For Disco Road Organics Processing Facility (DROPF)
    - Appendix 2: A7L Canada Laboratories dry matter results
    - Appendix 3: Detailed Calculations

3. Comments and Observations on the Test and Related processes prepared by Club Coffee

Compostable Coffee Pod Test in the Hydropulper at the Disco Road Organic Processing Facility

Project Introduction

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TORONTO

Introduction

On June 1-2, 2018 the City of Toronto (City), Club Coffee L.P. (Club Coffee), and 2 cg Waste Management Consulting Services Inc. (2cg) carried out the Compostable Coffee Pod Test (Test) to determine the compatibility of Club Coffee's Compostable PurPod100 (Pod) in the City's hydropulper at the Disco Road Organics Processing Facility (DROPF). The Test was undertaken to understand how the Pods would behave in the equipment used to pre-process a portion of the City's Green Bin organic waste.

This package contains:

1. This *Project Introduction* prepared by the City of Toronto;
2. *Compostable Coffee Pod Test in the Hydropulper at the Disco Road Organics Processing Facility (DROPF)* test report prepared by 2cg;
3. *Comments and Observations on the Test and Related Processes* prepared by Club Coffee

Project Scope

The scope of the Test involved the hydropulper only. The DROPF uses hydropulping technology at the pre-processing stage to remove plastic film, and other residue and contaminants. A hydropulper is similar to a giant blender that runs on an automated cycle and pulps organic matter into a homogenized slurry called "organic suspension". The impact/compostability of Pods in the anaerobic digesters, and the quality of the digestate and finished compost were not analyzed because the City first wanted to know if the Pods would even enter into the later stages. The Test was designed to assess whether Club Coffee's Pod would be removed and sent to landfill along with the other residue (e.g. plastic film) extracted during the pre-processing. For the purpose of the Test, the City assumed that any Pod components passing through the hydropulper into the digester would not have adverse effects on equipment or final compost digestate quality parameters, and determined a percentage threshold for the amount of Pods or Pod fragments that could be found in the residue as the pass-fail criterion for the test. This threshold was agreed on by both Club Coffee and the City.

Photos: Outer and Inner Views of a Hydropulper.

Background

In 2017, DROPF processed approximately 75,600 tonnes of the 158,000 tonnes of Green Bin organic waste generated and collected in the City. At the DROPF, organic waste first enters a wet pre-processing system, followed by an anaerobic digestion system that produces both valuable bio-gas and an end product called digestate. The digestate is transported off-site and aerobically processed by contracted facilities to become Grade AA compost.

Waste audit data from 2016/2017 indicates that approximately 1,300 tonnes of coffee pods (including all formats) are managed in the City of Toronto's integrated waste management system per year. The growing prevalence of coffee pods raises several questions, such as: What are the impacts of this new format on waste management systems? Are there cost-effective ways to enable consumers to divert pods and the coffee in them from landfill?

Public Works and Infrastructure Committee Direction

On October 18, 2016, the Public Works and Infrastructure Committee (which reports to Toronto City Council) directed Solid Waste Management Services (SWMS) to conduct consultations with industry and the Province, a jurisdictional scan of comparable municipalities, and to consider consumer education issues related to compostable products, and options to research, pilot and support new markets for divertible materials. The committee also directed SWMS to report back on the implications and impacts of accepting single-serve or single-use products, including coffee pods, in the City's Waste Diversion Programs. This was fulfilled on April 11, 2018 when the Public Works and Infrastructure Committee adopted a staff report entitled *Review of Single-Serve Coffee Pods in the City of Toronto's Waste Diversion Program*. The report considered the impact and implications of pods in the Blue Bin Recycling program and the Green Bin Organics program, and included a jurisdictional scan of how other municipalities manage pods. While the report reaffirmed that, at this time, pods are best managed as garbage, the City has also begun to explore options to divert pods from landfill.

Coffee Pod Industry Consultations: July 19, 2017 & February 22, 2018

The City retained 2cg to develop a scientifically rigorous testing methodology that would identify potential impacts should coffee pods be included the Green Bin program. Developing the methodology was an iterative process, and on July 19, 2017, a first draft was presented to coffee pod industry stakeholders at a City-led public consultation. At that consultation, 2cg presented an overview of how pods could be tested at five facilities that process Green Bin organic waste for the City. Also at that consultation, SWMS offered to work with any pod producer to further develop the test methodology and execute a test, provided that the pod producer would agree to certain terms and conditions, most significantly, to compensate the City for any costs associated with the test methodology, planning/coordination/logistics, execution, and reporting.

A second consultation with the coffee pod industry was held on February 22, 2018 to advise stakeholders that Club Coffee was partnering with the City to develop and conduct the Test. At this event, the City also consulted on a draft policy for the addition of new materials to waste diversion programs, knowns as the ADAPT policy.

ADAPT Policy

In June 2018, SWMS presented the ADAPT policy for the Addition of New Materials to the City's Waste Diversion Programs to the City's Public Works and Infrastructure Committee. The policy outlines the *considerations* staff apply when determining whether to include a new material in a diversion program (i.e. the Blue Bin Recycling or Green Bin Organics). As well as considerations, the policy also outlines *conditions* for the new material to be accepted to one of the programs, for example, that a producer pay the City to compensate for financial pressures associated with the acceptance of that material (e.g. collection, processing and education costs).

Engagement with Club Coffee

While the City owns the DROPF, it is operated under contract, and dedicated to organic waste processing not research, or product development for the private sector. Staff are responsible to manage risks and consider all evidence before making decisions when there could be implications for the City's assets and infrastructure. Staff are also responsible to manage the City's capital and operating expenditures and it is therefore incumbent upon staff to ensure that assets and infrastructure are used appropriately, and for their intended purposes. The Test was a first-of-its kind undertaking at the DROPF, and aligned with the Long Term Waste Management Strategy and the ADAPT Policy.

Green Market Acceleration Program

As set out in the ADAPT policy, testing at one of the City's facilities (or at contracted processor facilities) may be required in order to assess the viability of recovery or processing of the proposed material. To implement such testing with respect to Pods, the City and Club Coffee entered into two legal agreements stipulating terms and conditions: first for the development of a Test methodology, and secondly for the execution of the Test. In order to enter into these agreements, Club Coffee submitted a successful application to the Green Market Acceleration Program (GMAP). The City's Economic Development and Culture Division hosts GMAP, the aim of which is to accelerate the development of green technologies and innovations in Toronto. Club Coffee's successful application qualified the company and authorized SWMS staff to enter into the legal agreements that would provide access to City infrastructure: specifically the DROPF.

Test Results and Next Steps

As stated above, a percentage threshold for the amount of Pods or Pod fragments that could be found in the residue was agreed on by both Club Coffee and the City as the pass-fail criterion for the test. As described 2 cg's report, the Pods passed the criterion for the Test. While discussions have not yet taken place with Club Coffee, the City anticipates that next steps may include further testing at the Dufferin Waste Management Facility, a new organics processing facility anticipated to begin operations in 2019. The Dufferin facility will process approximately 55,000 tonnes of Green Bin organics annually and will use a dry, press-style technology for pre-processing, rather than wet hydropulping.

As stated above, the City's procedure for the assessment of new materials is set out in more detail in the ADAPT Policy. The policy also outlines conditions for new material to

be accepted into a diversion program which could be applied as next steps. Negotiating an agreement for extended producer responsibility is one such condition. More specifically, any such agreement would contemplate Club Coffee covering costs associated with customer/ resident education, financial pressures to the integrated waste management system, and would require Club Coffee to acknowledge efforts to standardize coffee pod formats in the industry.

City's Commitment to Waste Diversion

SWMS remains committed to exploring new ways to support waste reduction, increasing waste diversion from landfill and to achieving the objectives set out in the Long Term Waste Management Strategy. With a focus on research, innovation and the establishment of a circular economy, SWMS will continue to dialogue with stakeholders, to identify future opportunities for partnerships and full extended producer responsibility, and explore new markets for the diversion of waste from landfill.

City of Toronto *is Canada's largest city, the fourth largest in North America, and home to a diverse population of about 2.8 million people. The City's Solid Waste Management Services Division is responsible for collecting, transporting, processing, composting and disposal of municipal and some private sector waste.*

Club Coffee L.P. *is an Etobicoke based coffee company that makes a Biodegradable Products Institute (BPI)-certified compostable single serve coffee pod. Club Coffee is registered as a lobbyist with the Office of the Lobbyist Registrar as per the City's Lobbying By-law.*

2cg Inc. *is a London Ontario based environmental consulting company that specializes in waste management and sustainability planning.*

Compostable Coffee Pod
Test in the Hydropulper at the
Disco Road Organics Processing Facility (DROPF)

Report prepared for:
Club Coffee
City of Toronto

July 2018

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Executive Summary

Club Coffee manufactures compostable coffee pods (Pod or Pods) that the Biodegradable Products Institute has certified to meet the specifications detailed under the ASTM D6868 standard. Pods consist of organic materials (i.e. coffee) and compostable bioresins/paper (i.e. lid, ring, mesh).

Club Coffee participated in this test organized by the City of Toronto as part of the City's process to assess new products, packaging and materials for inclusion in its waste diversion programs and under the City's Green Market Acceleration Program. While the Pods are currently not an accepted material in the City of Toronto's green bin program, this test is one stage in the process that could lead to acceptance.

Using a detailed testing methodology, in June 2018 Club Coffee's Pods were tested at the City of Toronto's Disco Road Organics Processing Facility (DROPF). The test involved amending five batches of green bin material with Pods and running them through the DROPF's pre-processing "hydropulper"), which prepares green bin materials for anaerobic digestion while also removing the residue streams of "lights" (e.g., plastic) and "heavies" (e.g., glass).

The objective of this test was to measure the percent of Pods or Pod fragments captured in these residue streams. The City of Toronto set the key testing criterion for the pods to pass the test, which was that the percentage of the dry weight of pods found in the residue divided by the wet weight of pods put into the organic waste could be no more than 12 percent on average across all batches. This was calculated for each of the five batches and the average was determined.

The results show that the average dry weight of Pod fragments, relative to total Pods wet weight was 8.71%. Individual batch results ranged between 0.13% and 15.18%. This means that the Pods passed the criterion of this test (i.e. average Pod residue less than or equal to 12% of total Pods).

Table of Contents

Glossary

Batch- The amount of certified compostable coffee pod amended Green Bin Organic material that is tested. This may consist of one large batch or a number of smaller batches.

Certified Compostable Coffee Pod- Refers to Pods that have been certified by the Biodegradable Products Institute to meet the ASTM D6868 standard.

Green bin material/ Green Bin organic waste- Refers to material set out by residents in Green Bins, collected by the City of Toronto and delivered to processing facilities.

"Heavies"- Refers to residue from the hydropulper, which in general consists of materials that sink such as glass, stones, metal and lighter materials that get bound up in the foregoing materials.

"Lights"- Refers to residue from the hydropulper, which in general consists of materials that float such as plastics, paper, fibrous materials and heavier materials that get bound up in the foregoing materials.

Methodology- Refers to Compostable Coffee Pod Testing Methodology report attached as Appendix 1.

Pods- Refers to Club Coffee Certified Compostable Coffee Pods. Mention of any other coffee pod is specified.

Pod fragments- Refers to parts of Pods found during the test.

Test- Process to test certified compostable coffee pods in Green Bin organic waste in the hydropulper process used at a food and organic waste processing facility. A test may consist of a number of batches

1.0 Introduction

Club Coffee produces coffee in many formats, including compostable coffee Pods. Club Coffee reports that its Pod contains coffee and three other components:

- a compostable filter, made from bio-based substances, holds the coffee;
- a ring made with bio-based resins and coffee chaff (the skin of coffee beans that is a byproduct of coffee roasting) holds the Pod in place in a single serve brewer; and,
- a compostable lid made mainly of paper with polylactic acid (PLA) seals the top of the Pod.

The Biodegradable Products Institute (BPI) has certified that the Club Coffee Pods meet the specifications detailed under the ASTM D6868 standard for compostable products.

The company reports that a Pod immediately after use typically weighs between 23 and 26 grams. Of that weight, between 87% to 88.5% of the Pod is wet coffee grounds (20g-23g), while the other compostable components weigh three grams.

In June 2018 Club Coffee's Pods were tested at the City of Toronto's Disco Road Organics Processing Facility (DROPF) with a focus on their performance in the DROPF's pre-processing "hydropulper" equipment. The objective of this test was to measure the percent of Pods/Pod fragments captured in the residue streams that the hydropulper diverts and that do not proceed into the anaerobic digester for further processing.

2.0 Methods

Prior to this test 2cg developed a detailed methodology to test Pods at the DROPF. This is attached in Appendix 1.

In advance of the test, Club Coffee collected Pods at its manufacturing facility in Etobicoke. The Pods had been put through single serve coffee brewers as part of the company's regular quality assurance processes in the same way that consumers use them (Photo 1). This took place in the two weeks (i.e. the length of time it took to prepare sufficient Pods) prior to undertaking this test.

Photo 1. Prepared Pods

The test involved taking five batches, each with 11 tonnes of green bin material, and adding 55kg of Pods to each batch. These amended batches were then run through a DROPF hydropulper. The amount of Pods used to amend this green bin material was calculated in the detailed methodology (Appendix 1). The use of a standard process involving multiple batches (in this case five) was designed to ensure that the potential for anomalies specific to a single batch could be mitigated, and that a broad average could be established that would be appropriate.

Aecom/Veolia, the City-contracted operators of the DROPF, prepared (i.e. purged) a hydropulper for this test, ran amended batches through the hydropulper, and collected post-hydropulper samples.

The test was carried out on 1-2 June 2018 and consisted of the following:

1 June 2018

- Prepared five-11 tonne batches by amending (i.e. adding and mixing) with Pods;
- Collected samples of prepared (i.e. used) Pods, unamended green bin material and amended green bin material (i.e. from the five batches);
- Sorted samples of unamended and amended green bin material for Pods and other pod types (i.e. non-compostable pods);
- Retained a sample of prepared Pods for laboratory testing (i.e. dry matter);
- Isolated one of the three hydropulpers for use during the test; and
- Purged hydropulper.

2 June 2018

- Ran five-11 tonne batches of amended green bin material through a hydropulper;
- Collected five-19 litre samples of “Lights” and two-19 litre samples of “Heavies” residue streams per batch;
- Separated, counted and weighed Pod fragments from each sample;

- Separated any other pod types from each sample; and
- Retained Pod fragments from each batch and sent to laboratory for dry matter analysis.

4 June 2018

- Delivered samples to laboratory for dry matter analysis to determine the dry weights of Pods and Pod fragments, as required for this test.

3.0 Results

3.1 Prepared Pod analysis

Club Coffee delivered five carts (i.e. one per batch) that each contained approximately 60kg of prepared Pods. As each test batch was to be amended with 55kg of prepared pods, sufficient pods from each cart were removed/weighed to arrive at this total. During this process 10 samples of 25 prepared Pods were collected and weighed. On average each sample of 25 Pods weighed 506 grams or about 20.2 grams/Pod. This was lighter than the 25 grams/Pod used for initial calculations, which Club Coffee ascribes to the evaporation of moisture from the used pods over the days between brewing and delivery to the DROPF. This meant that the number of pods was increased in test batches (i.e. 250 versus 200 pods/tonne) in order to meet the methodology's 55kg weight requirement. A number of carts of Pods (particularly for Batches 2 and 3) had evidence of mold, suggesting some level of microbial decomposition prior to the test. The integrity of the Pods did not appear to be compromised (i.e. they were generally still whole).

An approximately 2l representative sub-sample of prepared Pods was collected from the above samples (i.e. 10 samples of 25 Pods), placed into a resealable plastic bag and sent to a laboratory for dry matter analysis. These prepared Pods had an approximate moisture content of 45%. This sample included 58 prepared Pods that had a wet weight of 19.82grams/Pod and dry weight of 10.86grams/Pod.

3.2 Unamended green bin material analysis

Green bin material collected on 31 May 2018 and 1 June 2018 had been set aside for this test at the DROPF. Prior to dividing this green bin material into approximately 11 tonne batches, ten-19 litre (i.e. pails) samples were collected and assessed for the presence of *any* coffee pods. A total of 110.94kg (mean=11.1kg; density 0.6kg/l) was assessed and no coffee pods were found. The closest evidence of coffee pods consisted of two “Japanese coffee pour over filters” together weighing 81.3 grams that were found in one sample.

3.3 Batch preparation

Photos 2 and 3 shows prepared Pods being added to a batch of green bin material. Fifty-five kg of prepared Pods were added and mixed into each of five batches weighing approximately 11,000 kg each. Five-19l samples of amended green bin material were collected from each batch and sorted (Photo 4) for the presence of prepared Pods.

Photos 2 and 3. Amending Green Bin Material with Prepared Pods

Photo 4. Sorting Green Bin Material Amended with Prepared Pods

Table 1 presents a summary of prepared Pods in amended batches of green bin material. Between four and 13 prepared Pods were found per batch (i.e. in the five 19l samples). Prepared Pods were on average 0.56% of the sample (i.e. prepared Pods were to amend batches to 0.50%). On average, these Pods weighed 32.4 grams indicating that Pods picked up other green bin material and/or moisture during amending and mixing (i.e. wet weight of

Pods was approximately 20.2 grams prior to amendment). A total of four K-cups were also found.

Table 1. Whole prepared Pods found in Batches

Batch	1	2	3	4	5	Average
Pods (#)	7	13	7	9	4	8
Pods (g)	213.7	407.1	232.1	300.0	142.3	259.04
%	**0.55%**	**0.88%**	**0.45%**	**0.61%**	**0.28%**	**0.56%**

3.4 Batch testing

As noted in Section 3.3, five-11 tonne batches of Pod amended green bin material were prepared for testing. Photo 5 depicts Batch 1 just prior to it being directed to the hydropulper. For each of the five batches tested five-19l samples of "Lights" and two-19l samples of "Heavies" were collected and sorted after removal from the hydropulper.

Photo 6 depicts "Lights" residue, which in general consists of materials that float such as plastics, paper, fibrous materials and heavier materials that get bound up with them. Photo 7 depicts "Heavies" residue, which in general consists of materials that sink such as glass, stones, metal and lighter materials that get caught up with them.

Photo 5. Batch of Green Bin Material Amended with Prepared Pods

Photo 6. "Lights" Residue

Photo 7. "Heavies" Residue

Each 19l sample was sorted on its own. The process for both residue streams was to remove larger materials and then key in on items that could be potentially be Pod fragments. Photo 8 depicts the sorting process. Potential Pod fragments were placed into a container and then further evaluated by 2cg, with concurrence from both the City of Toronto and Club Coffee representatives on-site during testing. Typical Pod fragments are depicted in Photo 9. They typically consisted of a ring with pieces of the lid and/or mesh partially attached. In a few cases only the ring was evident, typically whole, but in some cases severed. There was no evidence of coffee grounds.

For each batch the "Lights" samples were sorted first. Pod fragments were counted, weighed and then placed in a batch-specific "Lights" resealable plastic bag. This process was repeated for "Heavies". The bags were placed in a cooler with ice packs and delivered to A&L Canada Laboratories in London, Ontario for dry matter analysis in order to determine the dry weights of Pods and Pod fragments, as required for this test.

Photo 8. Sorting Residue

Photo 9. Typical Pod Fragments

Table 2 presents a summary of the results. Detailed calculation data is provided in Appendix 3. The Pod wet and dry weights were taken from laboratory results. It shows

each batch weight, the wet weight of samples and the wet and dry weight of Pod pieces. Further, it includes the result of the following calculation for “Lights” and “Heavies”:

*%=Dry weight of Pod fragments per batch/Wet weight of Pods per batch*100*

The weight of Pod fragments isolated during the test was extrapolated to the batch level so the dry weight of Pod fragments could be divided by total Pods per batch. The facility operator indicates that “Lights” and “Heavies” residue is on average 17.25% of a typical inbound batch of Green Bin material and residue consists of 90% “Lights” and 10% “Heavies” on a weight basis. The test methodology did not seek to confirm this data.

On this basis the results show the following:

- Pod fragments typically also carried additional residue, that is organic or other material adhered to it. This was removed to the extent possible, prior to weighing.
- That 94% (wet weight) and 96% (dry weight) of Pod fragments were found in the “Lights”
- That Pod fragments in “Lights” started off very low in Batch 1, increased until Batch 4 and then decreased somewhat at Batch 5
- There were very few Pod fragments in “Heavies”

As depicted in Figure 1 the average dry weight of Pod fragments, relative to total Pods wet weight per batch was 8.71% and individual batch results ranged from 0.13% to 15.18%. We did not evaluate why the results differed from batch to batch because it was beyond the scope of this test. Based on the residue data provided and the data collected, the Pod quantities were below the required threshold of 12% as calculated in the formula above. As such, the Pods passed the criterion that the City of Toronto had established for this test.

Table 2. Summary of Wet and Dry Weights of Pod Fragments per Batch

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
		"Lights"					
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in residue	%	**0.13%**	**4.81%**	**11.49%**	**15.13%**	**11.77%**	**8.66%**
		"Heavies"					
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in residue	**%**	**0.00%**	**0.13%**	**0.04%**	**0.05%**	**0.00%**	**0.00**
Total		**0.13%**	**4.93%**	**11.53%**	**15.18%**	**11.77%**	**8.71%**

(Note: We did not evaluate why the results differed from batch to batch because it was beyond the scope of this test.)

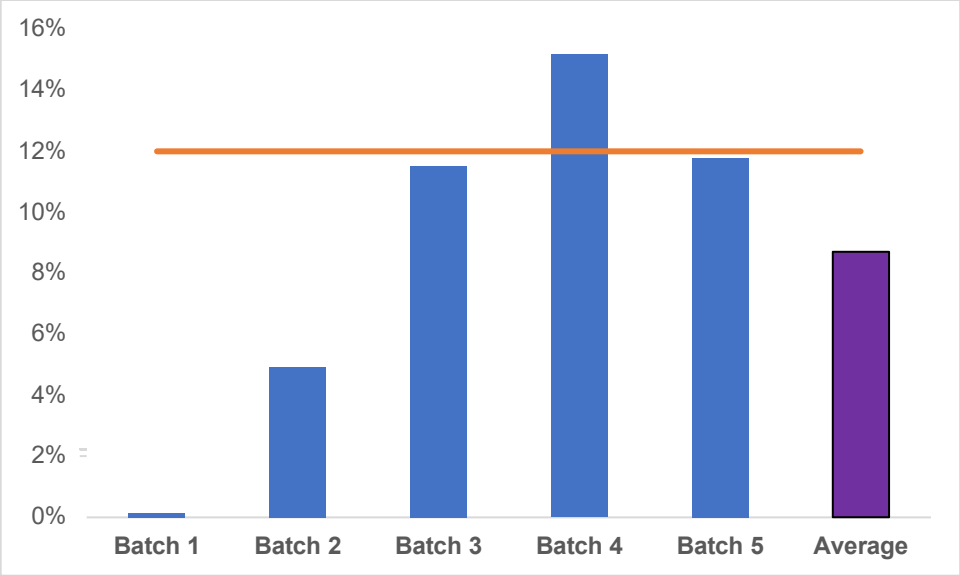

Figure 1. Summary of Pod Residue per Batch and on Average

A sensitivity test was undertaken to understand if the changing percentage residue, and proportions of residue in the "lights" and "heavies" would affect the outcome. The sensitivity test is depicted in Table 3. Detailed calculation data is provided in Appendix 3. The base case at 17.25% residue and 90% “Lights” reflects the average 8.71% presented in Table 2 and Figure 1. Increasing or decreasing the residue rate (i.e. reflecting the range presented by Aecom/Veolia) does not change the overall test outcome. Further, increasing or reducing the proportion of “Lights” to 80% and 95% respectively does not change the overall test outcome.

Table 3. Summary of Average Dry Weights of Pod Fragments- Sensitivity Analysis

	Base case	Lower	Higher
Contamination rate	17.25%	16.50%	18.00%
	Pods in contaminants		
Lights at 90%	8.71%	8.33%	9.09%
Lights at 80%	7.79%	7.22%	8.13%
Lights at 95%	9.17%	8.50%	9.57%

4.0 Conclusion

On the basis of the detailed methodology to test Pods in the hydropulper at the DROPF the average dry weight of Pod fragments was 8.71% of the total Pods wet weight per batch. This is less than or equal to 12% and therefore means that the Pods passed the criterion of the test. Further, this outcome did not change during a sensitivity analysis.

Appendix 1-
Compostable Coffee Pod Testing Methodology For Disco Road Organics Processing Facility (DROPF)

Compostable Coffee Pod Testing Methodology
For Disco Road Organics Processing Facility (DROPF)

City of Toronto

May 2018

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Table of Contents

Glossary

Batch- Normal amount of green bin material that is loaded into a processing technology. For DROPF this is 11 tonnes.

Green bin material- Material from Toronto's green bin program. This is also referred to as source separated organics (SSO).

Sample- A 11 tonne batch of Pod amended green bin material.

Sub-sample- Materials extracted from a batch/sample for further testing.

2cg Phone Numbers
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1.0 Introduction

2cg was retained to develop a test methodology to determine the flow of certified compostable single serve coffee pods produced by Club Coffee LP (Pods or compostable coffee pods), in the City of Toronto's Green Bin Organics Program for the City's Solid Waste Management Services Division (SWMS), including through the Disco Road Organics Processing Facility (DROPF).

Specifically, this methodology was developed to assess the flow of Pods through the DROPF hydropulper. It includes detail on calculating the amount of Pods required, how to prepare them for the test, running the test, sample extraction procedures, sorting procedures and data analysis procedures.

2.0 Methodology

2.1 Background Information

A brief review of all coffee pods was undertaken on 2015-2017 City of Toronto single family waste audit data. An estimated 1.4 kg/hh/year (or approximately 0.2%) of coffee pods of all types are currently disposed in the single-family household waste streams, with approximately 80% ending up in the residual stream; 15% ending up in the recycling stream and 5% ending up in the organics stream. These coffee pods comprise an estimated 0.5% of the residual stream; 0.08% of the recycling stream and 0.04% of the green bin stream.

Unused compostable coffee pods weigh approximately 15 grams, and after use they weigh about 25 grams. Unused compostable coffee pods consist of a label (0.5 grams), ring (3 grams), mesh (0.5 grams) and coffee grounds (11 grams) (Figure 1).

Figure 1. Parts Certified Compostable Coffee Pods

For this methodology two hypothetical assumptions are made: 1. All coffee pods are compostable; 2. All coffee pods end up in the green bin. These assumptions suppose that all coffee pods manufactured are compostable, and that if the City allowed them, would be all directed to the green bin.

If one assumes that all compostable coffee pods (Pods) would end up in the green bin stream and that single-family households on average divert 250kg/year of green bin material then Pods would comprise 0.56% of this waste stream (i.e. 1.4 kg/hh/year Pods/250 kg/hh/year green bin

material *100). For this test 0.5% was used (i.e. green bin material amended with 0.5% wetted Pods).

2.2 Synopsis of Test

In general, green bin material received at the DROPF is processed on the day of receipt or within a few days of receipt. It is directed to hydropulpers (1-1.5 hours cycle time) for water addition and contaminant removal ("Lights" and "Heavies"); and then the pulp is directed to digesters where they are retained for 12-14 days. Upon discharge from the digesters, remaining contaminants are removed and the digestate is sent off site for further processing.

During hydropulping, it is assumed that the various parts of the Pod may become detached from each other and, depending on their size, can be directed to the digesters or be caught up with "Lights" and "Heavies" during the contaminant extraction.

Testing will require the isolation of a single hydropulper and contaminant removal system (i.e. press for "Lights" and catch basin for "Heavies). It is impractical to undertake this monitoring during normal business hours and this work be completed over a weekend. The entire process/test will take an estimated 2-3 days.

Figure 2.1 depicts the process as it relates to <u>potential</u> Pods sampling extraction points. The focus of this methodology is on testing hydropulper outputs (i.e. contaminant streams) at the pulping floor.

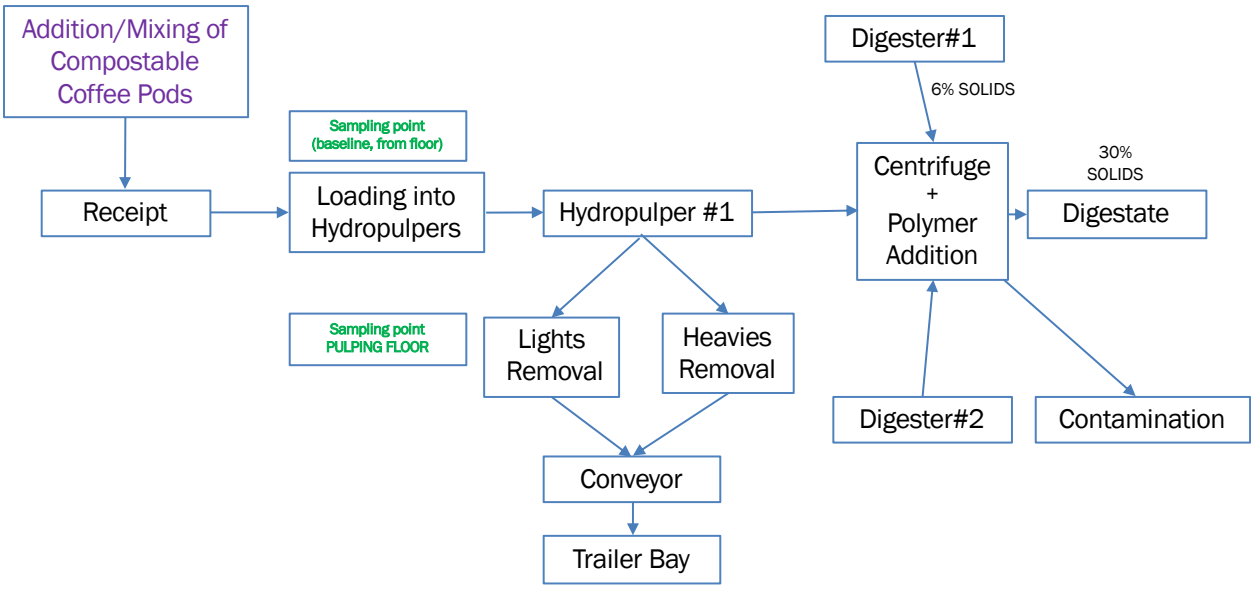


Figure 2.1 Overview of AD Process as it Relates to Potential Sampling Points

Table 2.1 presents a work plan for the DROPF.

Table 2.1 DROPF Work Plan

Item	Detail
Test overview	To execute this methodology, it is necessary to isolate a hydropulper. Test batches/samples would be run through the hydropulper and samples of "Lights" and "Heavies" contaminant fractions would be extracted. These samples would be sorted by 2cg for evidence of whole Pods or parts of Pods.
Timing	This work cannot take place during regular working hours because it would disrupt processing at the facility. The test would commence on a Friday afternoon (sample preparation, purge a hydropulper) (**1 June**), with samples processed on Saturday (2 June) and sorting concluding on Saturday (2 June) or at the latest on Sunday (3 June).
Sample size	Five batches (i.e. 55 tonnes) of Pod amended green bin waste will be tested
Compostable coffee Pods	This will require approximately 11,000 Pods or about 55kg of wetted pods per batch/sample
Sample preparation	Sample preparation would take place at DROPF.
City of Toronto assistance	City of Toronto staff and 2cg staff would prepare the sample Field work oversight (optional) Report review
DROPF Staff assistance	Receive pod amended green bin waste Run batches of pod amended green bin waste Assist with extracting "Lights" and "Heavies" contaminant samples from batches Provision of relevant data (e.g. batch weights)

2.3 Number of Pods and Green Bin Material

For the test Pods will be blended with inbound single-family household green bin material. Table 2.2 depicts the number of Pods and tonnes of green bin material required for the test. It is estimated that each batch will have approximately 55kg of Pods (i.e. 200 Pods/tonne * 11 tonnes/batch * 25 grams/Pod * 1 kg/1,000 grams).

Table 2.2 Estimate of Pods and Tonnes of Green Bin Materials Required for Test

A. CALCULATE THE NUMBER OF COMPOSTABLE COFFEE PODS REQUIRED		UNITS
1. Determine per-cent of compostable coffee pods that would be in green bin	0.5	%
2. Determine wet weight of compostable coffee pod	25	g
3. Determine dry weight of compostable coffee pod	15	g
The number of compostable coffee pods required per tonne, batch and test is desribed below.		
4. Calculate the number of compostable coffee pods required	200	pods/tonne
5. Batch size	11	tonnes
6. Total number of compostable coffee pods required per batch	2,200	#
7. Total amount of feedstock required per batch	10,945	kg
8. Number of batches required for the test	5	
9. Total number of compostable coffee pods required per test	11,000	#
10. Total amount of feedstock required per test	54,725	kg

2.4 Blending Pods with Green Bin Material

Five samples/batches of coffee pod amended single family green bin waste will be prepared for testing. Table 2.3 and Figure 2 describes this process. **This is scheduled to take place on the afternoon of 1 June 2018.**

Table 2.3 Sample Preparation

Task	Responsibility	Comments
1. Weigh in-bound carts of wetted Pods and collect a cart tare weight. Alternately deliver pre-weighed wetted pods (i.e. 55kg/batch)	City of Toronto or Club Coffee • weighing 2cg • Document weights • Weigh 10 increments of 25 wetted Pods (to determine average wetted Pod weight). • Sub-sample from 10 increments to create a wetted coffee Pod sub-sample to send to laboratory for dry weight analysis.	Club Coffee will supply 5 batches of approximately 60 kg. each in carts, from which pods can be removed at DROPF to achieve the 55kg target weight for each batch.
2. Set aside 55 tonnes of green bin waste.	City of Toronto 2cg	Five batches will be used to run the test.

Task	Responsibility	Comments
	• Prior to preparing batches collect **10-20 litre (l)** sub-samples of unamended green bin material (from 55 tonnes), weigh and inspect for coffee pods of any type	
3. Extract batch of 11 tonnes and spread to about a 50cm layer and spread over this the contents of two carts of wetted Pods. Alternately make a single large 55 tonne batch amended with wetted Pods	City of Toronto • Spread out green bin waste. • Sprinkle out 55kg of wetted pods over each sample of 11 tonnes. • Mix the batch with the loader (4-6 bucket turns) and set aside. • Repeat for each batch. 2cg • Check to make sure Pods are reasonably evenly spread out and manually make adjustments with rake/shovel, if required. • Collect **5-20l** sub-samples/batch. • Sort through samples for wetted coffee Pods (weigh and count).	

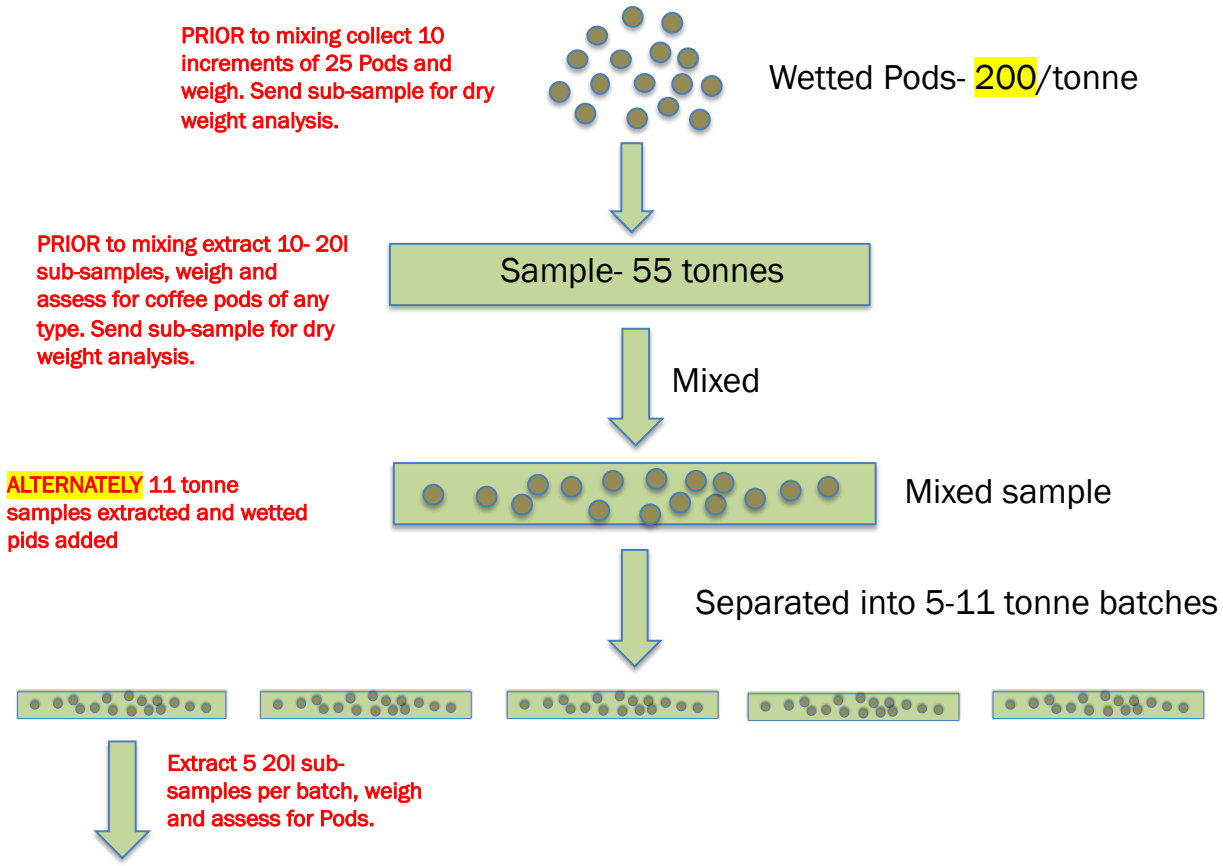


Figure 2. Overview of Sample Preparation and Sub-Sample Collection

2.5 Purge the Hydropulper

The hydropulper will be cleaned to purge it of any "lights" and "heavies" contaminants streams. **It is understood this purging will occur and be completed on 1 June 2018**. Test samples/batches will be run through the cleaned hydropulper on **2 June 2018**. It is understood that it will be possible to collect sub-samples from all five test batches as they are run.

2.6 Run the Test

Run five (test) samples/batches through the hydropulper and collect/sort sub-samples of "lights" and "heavies" contaminant streams. Table 2.4 and Figure 3 describes this process. The sub-samples of "lights" and "heavies" will be individually spread onto a sorting table and examined for whole or parts of Pods as depicted in Figure 4. See Appendix 1 for additional detail on sorting. The results will be documented on a form (Appendix 2). **This is scheduled to take place on 2 June 2018 (6am-4pm).**

Table 2.4 Run the Test

Task	Responsibility	Comments
1. Gather **5-20l** sub-samples prior to loading a batch.	**2cg**	Collect just prior to sample loading (i.e. from material that will make up the next sample). Note this may also be done during sample preparation on 1 June.
2. Sort through sub-samples for wetted coffee Pods (weigh and count).	**2cg**	
3. Load test samples/batches intro hydropulper.	**Aecom**	
4. Collect **5-20l** sub-samples of "lights" and **2-20l** samples of "heavies".	**Aecom**	Aecom to provide the sub-samples to 2cg. This will occur when there is sufficient sample material released from the system and from discussions with AECOM approximately mid-way through batch processing.
5. Sort **5-20l** sub-samples of "lights" and **2-20l** samples of "heavies".	**2cg**	Weigh contents of each 20l sub-sample and record. Count and weigh pieces of wetted coffee Pods per sub-sample and record. Per-sub-sample save all pieces in a ziplock bag for dry matter analysis.

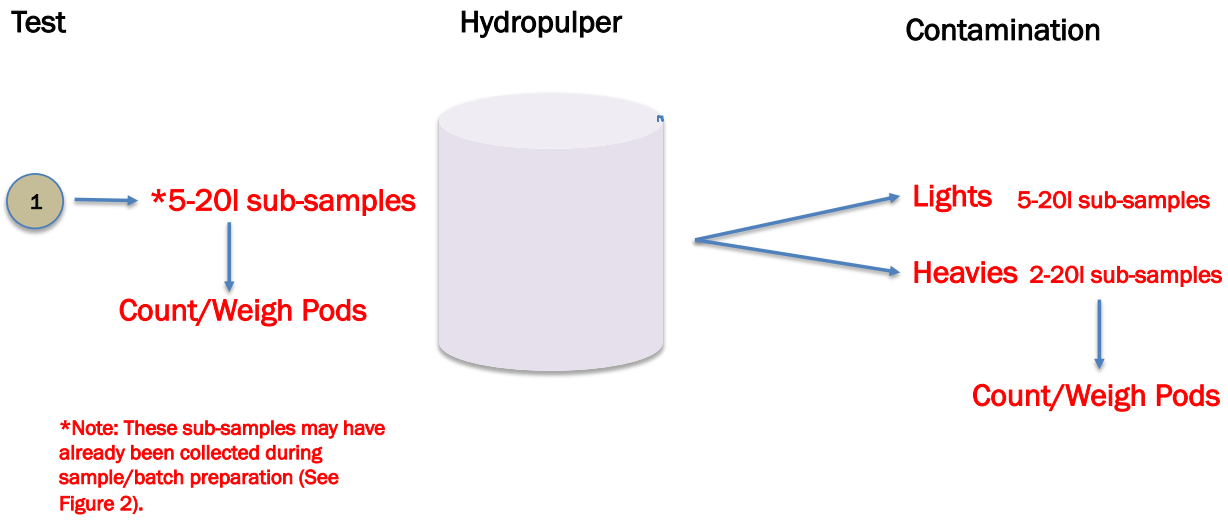
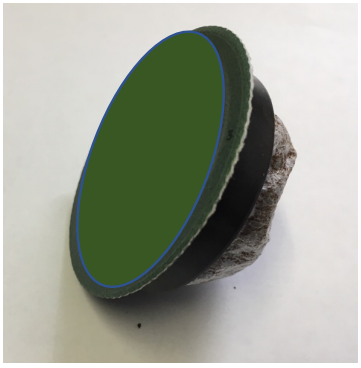


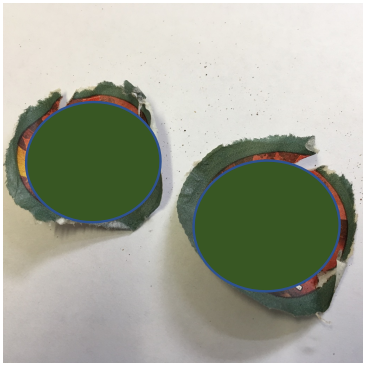
Figure 3. Overview of Test and Sub-Sample Collection



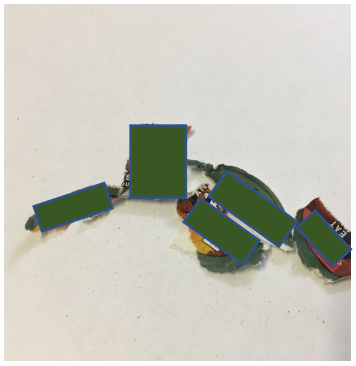
Whole pod

Rings (Whole)

Rings (Pieces)



Lids (Whole)



Lids (Pieces)

Figure 4. Pod Sorting Key

2.7 Summary of Sub-sample Collection

Table 2.5 presents a summary of sub-sample collection.

Table 2.5 Summary of Sub-sample Collection

Section	Sub-samples	Laboratory ID
2.4 Blending Pods with Green Bin Material	Weigh **10** increments of **25** wetted Pods (to determined average wetted pod weight). Record data.	
2.6 Run the Test	Collect **5-20l** sub-samples of pod amended green bin material per sample/batch. Sort for Pods and collect weight and number per sub-sample. Record data. Collect **5-20l** sub-samples of "lights" and **2-20l** sub-samples "heavies", weigh contents of each sub-sample and sort each sub-sample for Pod pieces. Count and weigh Pod pieces by key. Record data. Place all Pod pieces, per sample, into a ziplock bags (one for "lights" and one for "heavies) and send to laboratory for dry weight analysis.	**T1-LPDW; T1-HPDW** **T2-LPDW; T2-HPDW** **T3-LPDW; T3-HPDW** **T4-LPDW; T4-HPDW** **T5-LPDW; T5-HPDW**

2.8 Data Analysis and Interpretation

The test essentially calculates the amount of Pods that get pulled off the post hydropulping "lights" and "heavies" fractions. From there the amount of Pods that go to the digester is inferred. Table 2.6 shows the progress of these calculations. It shows in a hypothetical example, that for every 11 tonne batch there is, on an "as is" basis, 55kg of Pods; that 5.9kg get pulled out post hydropulper (i.e. into "lights" and "heavies" contaminant streams); and 49.1kg (or 89.3%) gets directed to the digester.

The test will also express Pods found in the “lights” and “heavies” fractions using the following City of Toronto equation:

Dry weight of Pod pieces per batch/Wet weight of Pods per batch

The only difference to the above calculations is that the numerator consists of Pod pieces on a dry weight basis. Pod pieces will be sent to a laboratory to measure dry weight. The final results will be expressed on this basis. Per Toronto’s requirements, and on this basis, a pass is 12% or less. On a sample/batch basis that is the dry weight of Pods/Pod pieces in the “lights” and “heavies” streams, divided by the wet weight of Pods.

Table 2.6 Overview of HYPOTHETICAL Results

Batch size	11,000	kg coffee pods/batch
Contaminants	1,600	kg contaminants/batch
Contamination	14.5	% contamination
"Heavies"	10	% contamination that is "Heavies"
"Lights"	90	% contamination that is "Lights"

Coffee pods	0.005	kg coffee pods/kg batch
Coffee pods	55	kg coffee pods/batch

From analysis		
Coffee pods in "Heavies"	0.3	kg "Heavies"/batch
Coffee pods in "Lights"	5.6	kg "Lights"/batch

Coffee pods in pulp	49.1	kg/batch
Coffee pods in pulp	89.3	%

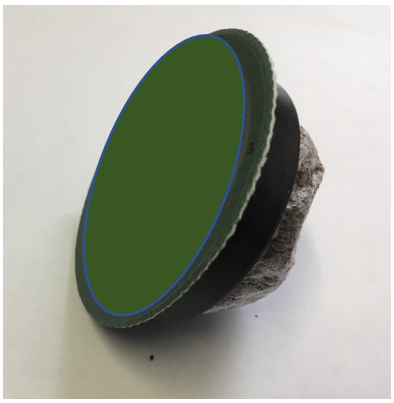
The foregoing will be summarized into a report that includes an Introduction, Methods (i.e. this document), Results and Discussion of the Results.

Appendix 1- Sorting Key

Appendix 1. Sorting Key

Sorting Methodology

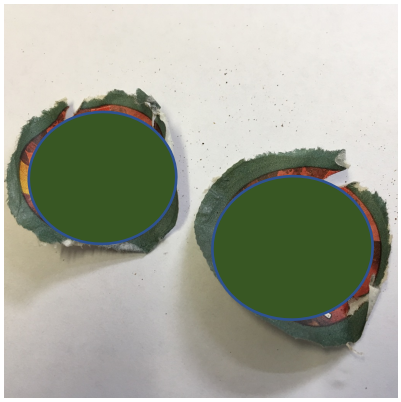
1. Collect 20 litre sample using a 5-gallon pail or similar.
2. Weigh each sample separately using a tared 5-gallon pail.
3. Sort on a white table that provides a contrast with the materials to be sorted.
4. Spread material out over table to a depth of no more than 1cm. Examine material, looking for each component (see sampling key).
5. Place various Pod parts into separate containers.
6. Weigh each component (weight of full Pods, rings, lids etc.).
7. Count each component (number of full Pods, rings, lids etc.).
8. Photograph each component (full Pods, rings, lids etc.).
9. Repeat for the required number of samples.



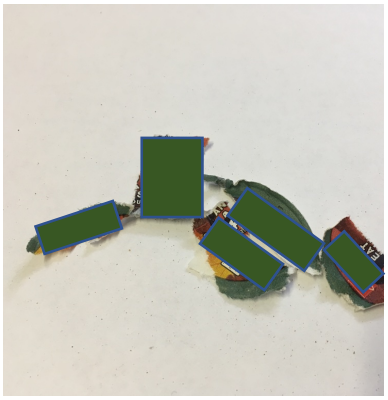
Whole pod

Rings (Whole)

Rings (Pieces)



Lids (Whole)



Lids (Pieces)

Appendix 2 Data Collection Form

Form 3. Sorting Results

Date: d/m/y	
Location:	DROPF
Test Number; Batch Number:	
Sampling Point	Tip floor Pulping floor ("Heavies") Pulping Floor ("Lights") (circle one)
Name:	

Instructions

Pods	10-25-twenty pod increments
Pre Material:	10-20-twenty litre samples of all test material
Test Batches:	5-20-twenty litre samples of all test material
Pulping floor	2-twenty litre samples per batch
Pulping floor ("Lights"):	5-twenty litre samples per batch

	Sample number	1	2	3	4	5	6	7	8	9	10
		kg									
Weight of sample											
		g									
Whole compostable coffee pods											
Mesh with coffee											
Mesh without coffee											
Lid and ring											
Ring											
Lid											
Total											
%											
		number									
Whole compostable coffee pods											
Mesh with coffee											
Mesh without coffee											
Lid and ring											
Ring											
Lid											
Total											

Notes	

Appendix 2-
A&L Canada Laboratories dry matter results

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To: 2CG
159 Ridout Street South
London, ON
N6C 3X7
Attention: Paul van der Werf
Phone: 519-645-7733
Project: Pods

Report#: C18155-70005
Sample Matrix: Solid
Date Reported: June 12, 2018.
Account#: 00174
Sample ID: Pods
Lab ID: 155-7008
PAGE: 1 of 9

Parameter	Result	Unit
Wet Sample Weight	**1149.54**	**g**
Dry Sample Weight	**629.8**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To:	2CG	**Report#:**	C18155-70005
	159 Ridout Street South	**Sample Matrix:**	Solid
	London, ON	**Date Reported:**	June 12, 2018.
	N6C 3X7	**Account#:**	00174
Attention:	Paul van der Werf	**Sample ID:**	T1-LPDW
Phone:	519-645-7733	**Lab ID:**	155-7009
Project:	Pods	**PAGE:**	2 of 9

Parameter	Result	Unit
Wet Sample Weight	**1.83**	**g**
Dry Sample Weight	**1.21**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To:	2CG	**Report#:**	C18155-70005
	159 Ridout Street South	**Sample Matrix:**	Solid
	London, ON	**Date Reported:**	June 12, 2018.
	N6C 3X7	**Account#:**	00174
Attention:	Paul van der Werf	**Sample ID:**	T2-LPDW
Phone:	519-645-7733	**Lab ID:**	155-7010
Project:	Pods	**PAGE:**	3 of 9

Parameter	Result	Unit
Wet Sample Weight	**75.83**	**g**
Dry Sample Weight	**46.72**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To: 2CG
159 Ridout Street South
London, ON
N6C 3X7
Attention: Paul van der Werf
Phone: 519-645-7733
Project: Pods

Report#: C18155-70005
Sample Matrix: Solid
Date Reported: June 12, 2018.
Account#: 00174
Sample ID: T3-LPDW
Lab ID: 155-7011

Parameter	Result	Unit
Wet Sample Weight	**156.44**	**g**
Dry Sample Weight	**111.09**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To: 2CG
159 Ridout Street South
London, ON
N6C 3X7
Attention: Paul van der Werf
Phone: 519-645-7733
Project: Pods

Report#: C18155-70005
Sample Matrix: Solid
Date Reported: June 12, 2018.
Account#: 00174
Sample ID: T4-LPDW
Lab ID: 155-7012

Parameter	Result	Unit
Wet Sample Weight	**221.57**	**g**
Dry Sample Weight	**152.46**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To:	2CG	**Report#:**	C18155-70005
	159 Ridout Street South	**Sample Matrix:**	Solid
	London, ON	**Date Reported:**	June 12, 2018.
	N6C 3X7	**Account#:**	00174
Attention:	Paul van der Werf	**Sample ID:**	T5-LPDW
Phone:	519-645-7733	**Lab ID:**	155-7013
Project:	Pods	**PAGE:**	6 of 9

Parameter	Result	Unit
Wet Sample Weight	**162.41**	**g**
Dry Sample Weight	**111.55**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To:	2CG	**Report#:**	C18155-70005
	159 Ridout Street South	**Sample Matrix:**	Solid
	London, ON	**Date Reported:**	June 12, 2018.
	N6C 3X7	**Account#:**	00174
Attention:	Paul van der Werf	**Sample ID:**	T2-HPDW
Phone:	519-645-7733	**Lab ID:**	155-7014
Project:	Pods	**PAGE:**	7 of 9

Parameter	Result	Unit
Wet Sample Weight	**23.34**	**g**
Dry Sample Weight	**10.04**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES I

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To: 2CG
159 Ridout Street South
London, ON
N6C 3X7
Attention: Paul van der Werf
Phone: 519-645-7733
Project: Pods

Report#: C18155-70005
Sample Matrix: Solid
Date Reported: June 12, 2018.
Account#: 00174
Sample ID: T3-HPDW
Lab ID: 155-7015

Parameter	Result	Unit
Wet Sample Weight	**6.97**	**g**
Dry Sample Weight	**3.46**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

A & L CANADA LABORATORIES INC.

2136 Jetstream Rd, London, ON N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

To: 2CG
159 Ridout Street South
London, ON
N6C 3X7
Attention: Paul van der Werf
Phone: 519-645-7733
Project: Pods

Report#: C18155-70005
Sample Matrix: Solid
Date Reported: June 12, 2018.
Account#: 00174
Sample ID: T4-HPDW
Lab ID: 155-7016
PAGE: 9 of 9

Parameter	Result	Unit
Wet Sample Weight	**11.11**	**g**
Dry Sample Weight	**4.31**	**g**

Results Authorized By: _____ for

A&L Canada Laboratories Inc.

Appendix 3-
Detailed Calculations

The following data sheets show data and calculations
to measure:

%=Dry weight of Pod fragments per batch/Wet weight of Pods per batch*100

The Results 90% lights 10% heavies table presents baseline data (base case) and sensitivity analyses.

The other two tables present sensitivity analyses.

Results- 90% “lights”; 10% “heavies”

Calculating the per-cent of pods in contaminants Note: Wet weight and dry weight of Pods from laboratory data

Base Case

Contamination rate	17.25%	provided by AECOM
"Lights"	90%	provided by AECOM
"Heavies"	10%	Provided by AECOM
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.13%**	**4.81%**	**11.49%**	**15.13%**	**11.77%**	**8.66%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	**%**	**0.00%**	**0.13%**	**0.04%**	**0.05%**	**0.00%**	**0.04%**
Total		**0.13%**	**4.93%**	**11.53%**	**15.18%**	**11.77%**	**8.71%**

Lower contamination

Contamination rate	16.50%	
"Lights"	90%	
"Heavies"	10%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.12%**	**4.60%**	**10.99%**	**14.47%**	**11.26%**	**8.29%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	%	**0.00%**	**0.12%**	**0.04%**	**0.05%**	**0.00%**	**0.04%**
Total		**0.12%**	**4.72%**	**11.03%**	**14.52%**	**11.26%**	**8.33%**

Higher contamination

Contamination rate	18.00%	
"Lights"	90%	
"Heavies"	10%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.13%**	**5.02%**	**11.99%**	**15.79%**	**12.28%**	**9.04%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	%	**0.00%**	**0.13%**	**0.04%**	**0.05%**	**0.00%**	**0.05%**
Total		**0.13%**	**5.15%**	**12.03%**	**15.84%**	**12.28%**	**9.09%**

Sensitivity Analysis- Results- 80% “lights”; 20% “heavies”

Calculating the per-cent of pods in contaminants

Base Case

Contamination rate	17.25%	
"Lights"	80%	
"Heavies"	20%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.11%**	**4.27%**	**10.21%**	**13.45%**	**10.46%**	**7.70%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	**%**	**0.00%**	**0.25%**	**0.08%**	**0.10%**	**0.00%**	**0.00**
Total		**0.11%**	**4.53%**	**10.29%**	**13.55%**	**10.46%**	**7.79%**

Lower contamination

Contamination rate	16.00%	
"Lights"	80%	
"Heavies"	20%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.10%**	**3.96%**	**9.47%**	**12.47%**	**9.70%**	**7.14%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	%	**0.00%**	**0.23%**	**0.07%**	**0.09%**	**0.00%**	**0.08%**
Total		**0.10%**	**4.20%**	**9.54%**	**12.57%**	**9.70%**	**7.22%**

Higher contamination

Contamination rate	18.00%	
"Lights"	80%	
"Heavies"	20%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.12%**	**4.46%**	**10.65%**	**14.03%**	**10.92%**	**8.04%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	%	**0.00%**	**0.26%**	**0.08%**	**0.10%**	**0.00%**	**0.09%**
Total		**0.12%**	**4.72%**	**10.74%**	**14.14%**	**10.92%**	**8.13%**

Sensitivity Analysis- Results- 95% “lights”; 5% “heavies”

Calculating the per-cent of pods in contaminants

Base Case

Contamination rate	17.25%	
"Lights"	95%	
"Heavies"	5%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.13%**	**5.07%**	**12.13%**	**15.97%**	**12.42%**	**9.15%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	**%**	**0.00%**	**0.06%**	**0.02%**	**0.02%**	**0.00%**	**0.00**
Total		**0.13%**	**5.14%**	**12.14%**	**15.99%**	**12.42%**	**9.17%**

Lower contamination

Contamination rate	16.00%	
"Lights"	95%	
"Heavies"	5%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.12%**	**4.71%**	**11.25%**	**14.81%**	**11.52%**	**8.48%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	%	**0.00%**	**0.06%**	**0.02%**	**0.02%**	**0.00%**	**0.02%**
Total		**0.12%**	**4.77%**	**11.26%**	**14.84%**	**11.52%**	**8.50%**

Higher contamination

Contamination rate	18.00%	
"Lights"	95%	
"Heavies"	5%	
Pods/batch	55	kg

		Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Average
Batch	Wet weight (kg)	10,860	11,060	11,400	11,320	11,520	11,232
				"Lights"			
Samples (5)	Wet weight (kg)	29.58	30.34	31.12	32.20	30.82	30.81
Pod fragments	Wet weight (g)	1.83	75.83	156.44	221.57	162.41	123.62
Pod fragments	Dry weight (g)	1.21	46.72	111.09	152.46	111.55	84.61
Pods in contaminants	%	**0.14%**	**5.30%**	**12.65%**	**16.66%**	**12.96%**	**9.54%**
				"Heavies"			
Samples (2)	Wet weight (kg)	26.18	27.5	31.32	30.76	29.86	29.12
Pod fragments	Wet weight (g)	0	23.34	6.97	11.11	0	8.28
Pod fragments	Dry weight (g)	0	10.04	3.46	4.31	0	3.56
Pods in contaminants	%	**0.00%**	**0.07%**	**0.02%**	**0.03%**	**0.00%**	**0.02%**
Total		**0.14%**	**5.36%**	**12.67%**	**16.69%**	**12.96%**	**9.57%**

Club Coffee L.P. Comments and Observations on the Test and Related Processes

Club Coffee L.P. is pleased to comment on the process we have pursued to gain formal acceptance of our pods in the green bin system for consumers in Toronto and elsewhere.

Our company has been in business in Toronto since 1906. We identified consumer concerns about the waste associated with traditional single serve coffee pods and began the R&D process in 2013. We recognized the importance of developing a solution that would deliver what consumers want. For that reason, we sought and earned certification of the compostability of our pods by the Biodegradable Products Institute against the established ASTM6868 standard.

We also reached out to leaders of public and private sector food and organic waste processing operations in Canada and the United States to get their perspectives on how to make this solution work for all stakeholders to the extent possible. This reflected facts such as the most recent market data indicating that about 750 tonnes of coffee per year are being sold in single serve pods across the City of Toronto. As the pods are almost 90% coffee, there is an opportunity to move coffee from landfills to waste diversion programs with compostable pods being a simple, intuitively obvious choice for consumers.

The process of working with municipalities has been eye-opening for a small business such as Club Coffee. In some municipalities, we dealt with individuals who were immediately hostile to our innovation, wanting to dictate the terms of business innovation and access to single serve coffee, regardless of consumer preferences. However, we were pleased at the many officials who were intrigued by the idea of a compostable pod and were supportive of testing to determine if the pods would actually break down in their waste diversion operations. In case after case, test results demonstrate that our compostable pods break down in aerobic composting facilities that are managed to generate high-quality compost. They have shown that our pods convert to compost in as little as five weeks, which is faster than many typical food wastes such as bones, nutshells, citrus peels and corn cobs.

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The City of Toronto represents a special case in two ways. First, other municipalities would like a common approach to acceptance of our pod, which includes acceptance by Toronto. Second, Toronto focuses its green bin organics processing on an anaerobic digestion model that is usually only seen in smaller, private sector-run operations. As a result, Club Coffee had only one prior opportunity to test the pods in an AD setting. In that case, the operator reported that the pods were broken up sufficiently to release 95% of the pod and its contents into the AD reactor for biogas production.

As a Toronto-based company, and recognizing that Toronto is home to almost 8% of the Canadian population, Club Coffee and the City of Toronto's Solid Waste Management Services Division have been discussing acceptance of our pods since 2014. Those discussions accelerated after Toronto City Council's Public Works and Infrastructure Committee directed Solid Waste staff to examine single serve pods. This led to the test in June 2018 discussed in detail throughout the report to which these comments are attached.

As the question about how best to test the pods in Toronto's hydropulper was new for all parties involved, there was a certain amount of "learning step-by-step" but our experience has been positive to date. We believe that discussions and negotiations to date have been reasonable. They have demonstrated a shared desire to collaborate in order to find ways to make the process work for this specific situation and to serve as a sound model to learn from for similar efforts involving other companies, products and packaging in the future.

Given the requirement that Club Coffee pay for all costs of the testing process, including compensating the City for the time of staff already on its payroll, we were particularly pleased to negotiate contract terms ensuring that we would be:

- onsite for the test with full and appropriate access to the facilities;
- fully and fairly consulted in the preparation of this report; and
- given the opportunity to provide this commentary on the entire process.

Our observations of the testing process were that it went as negotiated and that decisions in practice were made on rational grounds. We identified no situations that gave rise to concerns about the transparency or legitimacy of the process and the testing methodology. We believe that a reasonable precedent has been set and that all parties to the process have gained useful experience.

Taking a broader perspective, Club Coffee remains convinced that this and similar processes have to focus clearly on "how do we make this work, given the business need in the real world and consumer preferences." We appreciate that it is a challenge for managers of individual waste diversion programs to respond effectively when consumer realities change rapidly but this is now the reality. We live in an era in which products are increasingly designed for use by consumers in many countries, not just a single market, let alone a single municipal market. Businesses increasingly seek to leverage specific product formats, such as different single serve formats, for competitive reasons.

Club Coffee acknowledges the City's position that it can determine formally what it does or does not accept in waste diversion programs. However, it is clear that consumer-driven realities will always influence how these programs work in real life, just as shifts in consumer expectations about sustainable packaging and single-use products are now creating innovation opportunities. Ontario and Canada can get ahead of the curve to become a focal point for research and innovation that takes the legitimate interests of all stakeholders, private and public, into account to find solutions that work sustainably – and that become global models.

Until that happens, Club Coffee will work with municipal and other waste system partners where the goal is to find pathways to success. We look forward to ensuring that Torontonians have access to a simple, effective and affordable means to divert the hundreds of tonnes of coffee annually in pods away from landfills. The test described in this report demonstrates that the Green Bin already provides this solution.