



# Defining 'Flushability' for Sewer Use

## Final Report

Prepared for:

**Municipal Enforcement Sewer Use Group of Canada**

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## Abstract

Evolving 'flushability' definitions for consumer products have been introduced over the last decade and a half against a backdrop of a rising number of issues in municipal wastewater systems caused by products that should not be disposed via toilets. This report seeks to shed light on the characteristics of a wide range of consumers' products and guidance on their disposal. The focus is on products that, if inappropriately disposed in toilets, may cause issues ranging from clogged pumps, drainline and sewer blockages, and their untreated discharge to lakes and rivers due to combined sewer overflows (CSOs) and backups. A systematic approach was undertaken to collect data for over a hundred consumer products from ten different product categories. Consumer products were tested for toilet and drainline clearance, disintegration under the International Water Services Flushability Group (IWSFG) specification, and fibre composition. Additionally, an evaluation of product package labelling was performed to determine the degree to which the manufacturers are adhering to the Code of Practice criteria issued by the nonwoven products industry associations for labelling products that do not pass the flushability assessment. Given that most consumer products tested during this project do not sufficiently disintegrate under the IWSFG specification, this report presents a practical approach to tackling the problem around products that may misleadingly and incorrectly be labelled 'flushable'. The importance of adhering to the industry Code of Practice for package labelling and the IWSFG flushability specification is stressed, as well as the need for these to be adopted as standards rather than voluntary measures.

## Acknowledgements

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We would also like to thank all those who have visited the Water Resources Engineering Laboratory at Ryerson University while the project was in progress. Their comments and helpful suggestions resulted in improvements in the testing apparatus and project objectives. Finally, we would also like to thank MESUG and CWWA members for their valuable comments on this project.

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## 1. Introduction

Many consumer products are currently available that are marketed and labelled as being ‘flushable’, and more such products are continually introduced to the public (global annual growth of 5.4% is reported by ResearchAndMarkets.com, for example). In addition to providing confusing labeling to consumers, such as “flushable”, “biodegradable”, “eco-friendly” and “natural”, the composition of these products is quite diverse and not entirely disclosed to both consumers and the wastewater industry. Concurrently, sewer system operators are reporting a growing problem that involves consumer products, resulting in sewer and pump station blockages due to the lack of dispersion of these ‘flushable’ products under normal operating conditions. While the manufacturers’ associations have developed guidance for assessing both the flushability and labelling of their products (INDA and EDANA, 2018), it is not clear to what extent the manufacturers have adopted and are adhering to these recommendations. Thus, a comprehensive study of ‘flushable’ products to cover a wide range of products was required. The International Water Services Flushability Group (IWSFG), comprised of water associations, utilities, and professionals seeking to provide clear guidance on what should and should not be flushed down the toilet, has recently finalized the flushability specifications for products that are marketed as safe to flush down the toilet (IWSFG, 2018a). The IWSFG specifications are recent and many products are yet to be tested to assess their performance.

### 1.1 Project Objectives, Scope, and Purpose

The main objective of this project was to conduct flushability testing of many consumer products in accordance with the recently released IWSFG Publicly Available Specification (PAS) 1: 2018 (IWSFG 2018b). The project aimed to incorporate a variety of products to include toilet tissue, facial tissue, moist wipes labelled flushable and ‘Do Not Flush’, toddler wipes, baby wipes, and some other items that have been labelled flushable, such as toilet cleaning brushes, dog poop bags, and diaper liners. The IWSFG criteria are grouped into five categories: environmental protection, toilet and drain line clearance, disintegration, settling, and biodisintegration. This project focused on three of these criteria (IWSFG 2018b) due to budgetary reasons, with a view of implementing other tests in the longer term:

1. Drain line clearance – as outlined in INDA/EDANA 2013, FG501: Toilet and Drainline Clearance Test
2. Disintegration – as outlined in IWSFG 2018: PAS 3 Disintegration Test Methods – Slosh Box
3. Environmental protection – according to TAPPI/ANSI Test Method T 401, Fiber Analysis of Paper and Paperboard.

An additional objective, added during the course of the project, was to conduct an evaluation of the adherence of tested product package labelling to the INDA/EDANA voluntary guidance (INDA and EDANA, 2018).

Broader goals of the project are to: 1) raise public awareness regarding appropriate disposal methods of products that may misleadingly and incorrectly be labelled ‘flushable’, 2) provide valuable evidence to municipal wastewater system managers on the disintegration and potential environmental impacts of products following the current, international testing specifications, and 3) facilitate the continuance of evidence-based dialogue between IWSFG and manufacturers.

## 1.2 Methodology

The testing in this project followed the IWSFG *PAS 3: 2018 Disintegration Test Methods—Slosh Box* (IWSFG, 2018c). In the testing, the two criteria - toilet and drainline clearance and disintegration, required two fundamental steps:

- 1) Preconditioning, and
- 2) Agitation.

These fundamental steps were performed for each of the products tested. A complete test for each product required 5 samples.

A physical model consisting of a toilet (6/4.1L) and a private drain connection was set up in the Water Resources laboratory in the Department of Civil Engineering at Ryerson University. The preconditioning step consisted of flushing a product sample down the toilet and allowing it to remain at the end of the drainline in a catch basket for a 30-minute period. However, if the product sample did not clear the drainline in the first flush, additional flushes were used subsequently at 5-minute intervals until the product reached the downstream end of the drain, for a maximum of six flushes. The purpose of this fundamental step was to enable the hydraulic forces and interaction between the water and product to rinse the sample of its lotions.

Once the preconditioning step was complete, the sample was transferred from the catch basket to the slosh box. With the sample inside, the slosh box was continuously tilted at  $11^{\circ} \pm 0.5^{\circ}$  on either side for a 30-minute period for each product sample. The agitation step was performed using a slosh box with specified parameters (IWSFG, 2018c). Parameters such as the tilt angle, and rotations per minute of the oscillating motor were calibrated accordingly. The variables considered in the design of the slosh box, such as Reynold's number of 20,000 and 4-litres of water at  $15^{\circ}\text{C} \pm 1^{\circ}\text{C}$ , were designed to be closely representative of conditions in existing municipal wastewater collection systems, as per IWSFG (2018c). Finally, a test report detailing the variables and constraints used for calculations as specified in IWSFG (2018c).

## 2. Product Inventory

The comprehensive list detailing all 101 products tested during this project is provided in Appendix A. The selection of products was intended to be representative of consumer products found across local stores in Southern Ontario or available online for purchase to a consumer located in Southern Ontario and may vary considerably in different geographic regions. This section of the report presents various summaries regarding product categories and subcategories, package labelling, and information about manufacturers. The universal ‘Do Not Flush (DNF)’ symbol referred to in the succeeding section of this report is shown in Figure 1.



Figure 1- Universal DNF Symbol

### 2.1 Products Tested

Figure 2 shows the number of products tested in each of the 10 categories displayed. Cleansing wipes represent the largest proportion of products tested, and almost half of the products tested within this category are labelled as ‘flushable’. While some product packages display a DNF statement and symbol, others display either the statement or the symbol, or neither.

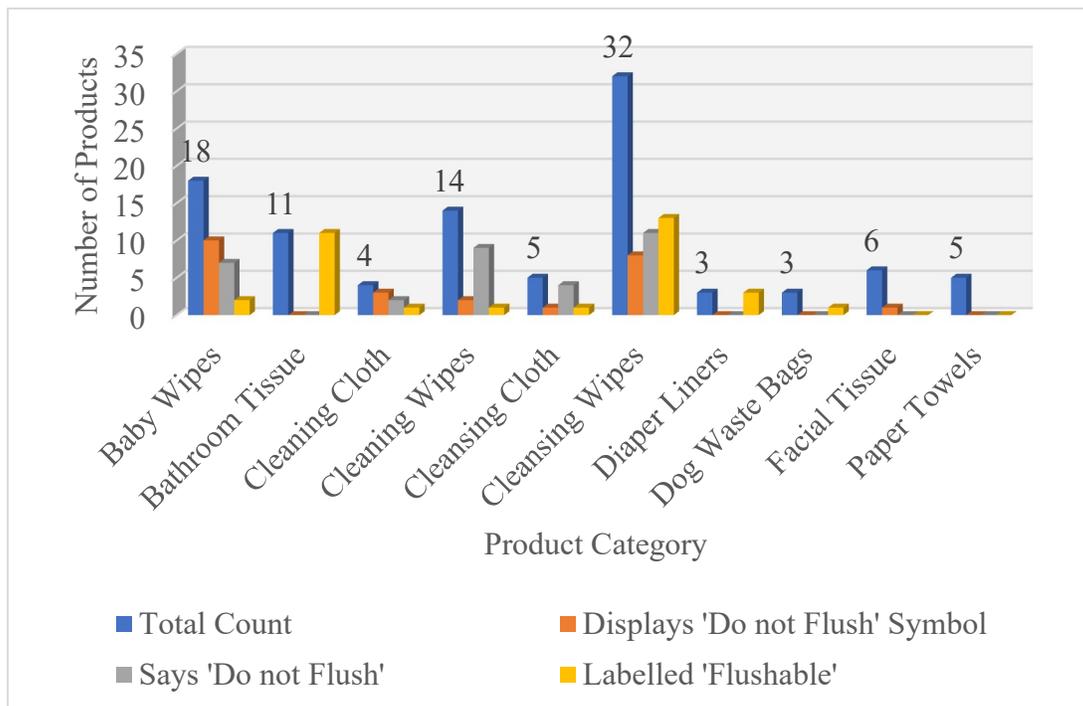


Figure 2- Overview and Labelling Summary of Products Tested within Each Category

Figure 3 summarizes the usage of the three package labelling statements— ‘flushable’, DNF, and the DNF symbol, across all products tested. Although these products appear alike visually, and may be indistinguishable to a consumer, about a third of the products are labelled ‘flushable’ while a third are labelled ‘DNF’.

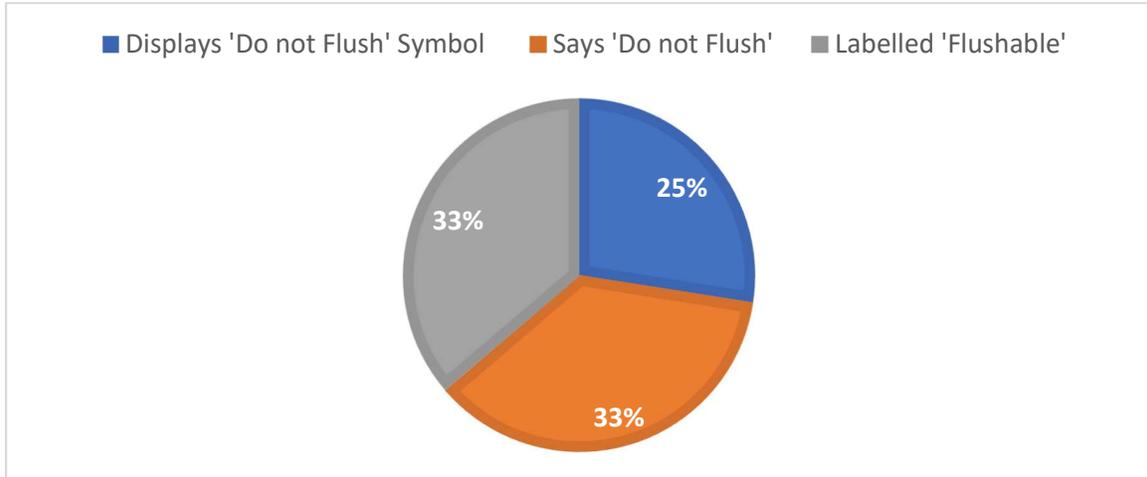


Figure 3- Graphical Representation of Package Labelling

Figure 4 is a graphical representation indicating the various manufacturing countries of the products tested in this project, which include countries across multiple continents, including Asia, Europe, and North America. As represented in Figure 4, the majority of the 101 products tested in this project were manufactured in the USA. As aforementioned, the inventory for this project was designed to be representative of consumer products found across local stores and available for purchase to a consumer in Southern Ontario.

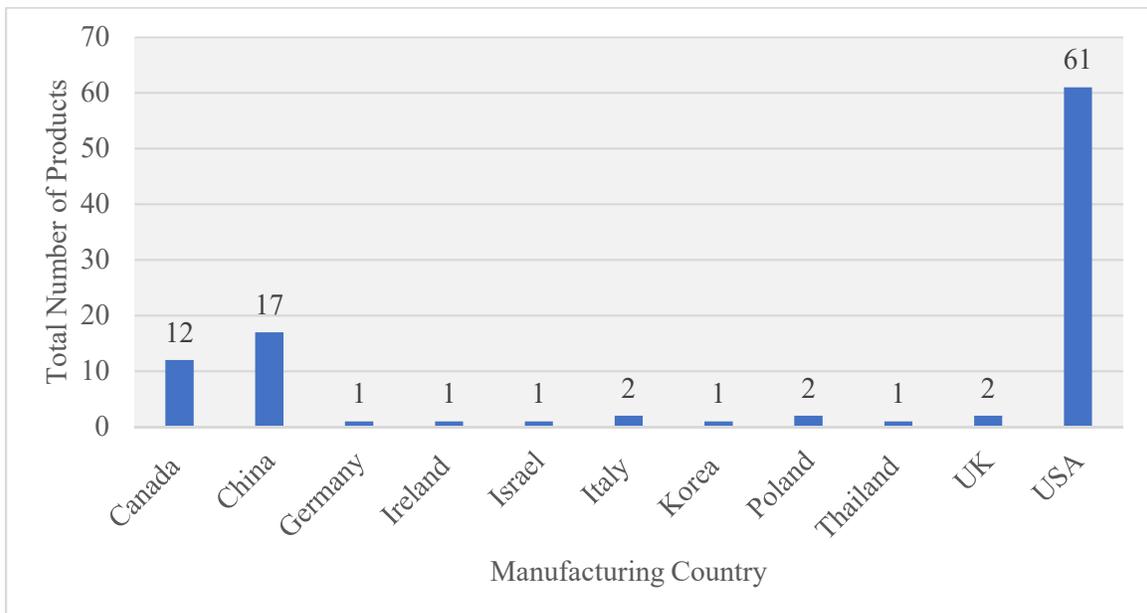


Figure 4- Manufacturing Countries of Products Tested

## 2.2 Statement on the Industry Code of Practice for Nonwoven Wipes

The industry Code of Practice set forth by the Association of the Nonwoven Fabrics Industry (INDA) and European Disposables and Nonwovens Association (EDANA) has been developed in collaboration with various associations, including major North American water and wastewater associations, member and staff representatives from the National Association of Clean Water Agencies (NACWA), the Water Environment Federation (WEF), the American Public Works Association (APWA), and the Canadian Water and Wastewater Association (CWWA) (INDA and EDANA, 2017). The intent of the Code of Practice (CoP) is to direct manufacturers to make it evident on product packaging to not flush products that could be problematic for wastewater systems but have the potential to be flushed down the toilet by consumers. Additionally, it was designed to direct manufacturers to clearly indicate the appropriate disposal method of the product on its packaging.

The Code of Practice is summarized in a decision tree to indicate whether a product is required to display a DNF symbol. The decision tree indicates that for a product to be ‘flushable’, it must pass an *appropriate* flushability assessment. It is pointed out that the word *appropriate* here refers to the current guidance document (GD) 4 testing criteria, which has not been accepted by wastewater professionals in North America, and may not be as robust as other wastewater industry specifications (e.g. UKWIR and IWSFG). Aside from making it evident on product packaging, the CoP directs manufacturers to perform flushability testing on all of their consumer products. Additionally, the CoP provides on-pack consumer criteria for manufacturers, which includes the location, colour, size, wording, and CoP implementation timing of the DNF symbol. The symbol to be used to indicate that the product should not be flushed is the universal DNF symbol shown previously in Figure 1.

Using the industry CoP, each of the 101 products tested during this project were systematically examined for adherence to package labelling guidance. The results and analysis of this procedure are presented in Section 3.4 of this report.

### 3. Results

#### 3.1 Drainline Clearance

As per the procedure in the PAS 3 (IWSFG, 2018c), product samples were required to clear the drainline within a 30-minute period. The drainline used in the apparatus of this project was 20 metres in length and consisted of 75mm and 100mm PVC pipes with two 90-degree elbow fittings. Some products were conveyed out of the drainline within the allotted time while others remained inside the drainline. Products that did not clear the drainline within one flush were flushed subsequently every 5-minutes until they cleared the drainline, for a maximum of 6 flushes within 30-minutes. Heavier products, such as those within the product categories of baby wipes, cleaning cloth, cleaning wipes, cleansing cloth, cleansing wipes, diaper liners, and paper towel, often required multiple flushes to clear the line. Figure 5 shown below depicts the average number of flushes per product category, with cleaning cloth showing about 4 flushes on average as the maximum and bathroom tissue showing just below 2 flushes on average as the minimum between the ten product categories tested. Products with a slightly lower mass, such as those within the product categories of bathroom tissue, dog waste bags, and facial tissue, often cleared the drainline in 1-2 flushes. Products that required another flush or two would normally flow past the two elbow fittings and stop quarter-way through the drainline at about 5 metres.



Figure 5- Schematic of Average Number of Flushes per Product Category

Figure 6 indicates the percentage of products in each category that required x number of flushes. The figure shows that 100% of diaper liners and dog waste bags required 2 flushes to clear the drainline, whereas 80% of cleaning cloth products required more than 2 flushes to clear the drainline. Some baby wipes required more than 5 flushes to clear the drainline.

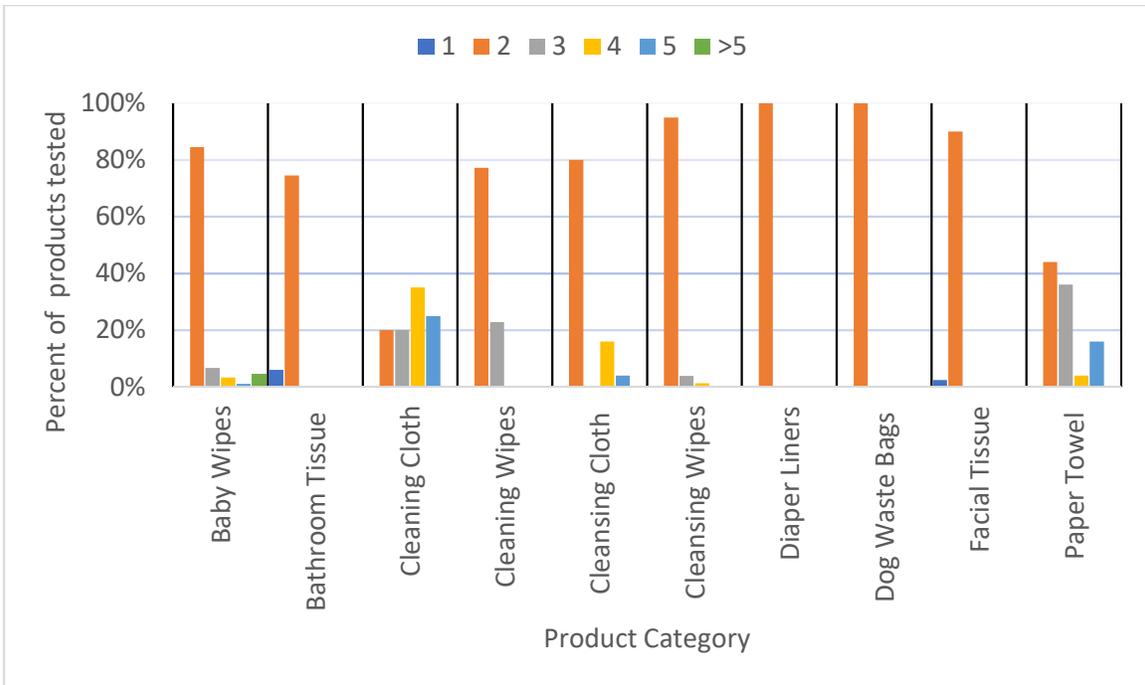


Figure 6-Distribution of Average Number of Flushes per Product Category

### 3.2 IWSFG Disintegration Testing

As mentioned in Section 1.2, test reports for each of the 101 products were generated using the template provided in IWSFG PAS 3: Disintegration Test Methods—Slosh Box (2018). Amendments were made to the methodology specified in the PAS 3 (IWSFG, 2018c) and are presented in the latter of this report. Each test report contains information specific to the five test samples used per product. The results from the testing performed in accordance with the PAS 3 (IWSFG, 2018c) are summarized through the figures and tables presented in this section.

Table 1 shows that only 17 out of the 101 products tested showed some visible evidence of disintegration. From these 17 products, 11 products fully disintegrated. However, all 11 of these products were from the bathroom tissue category. Other products, such as cleansing cloths, cleansing wipes, facial tissues, and paper towels partially disintegrated, whereas products from the categories of baby wipes, cleaning cloths, cleaning wipes, diaper liners, and dog waste bags did not show any evidence of disintegration.

Table 1- Summary of Product Disintegration

Product Category	Number of Evaluated Product that Fully or Partially Disintegrated	% of Products that Fully or Partially Disintegrated*
Baby Wipes	0/18	0.0
Bathroom Tissues	11/11	100.0
Cleaning Cloths	0/4	0.0
Cleaning Wipes	0/14	0.0
Cleansing Cloths	1/5	20.0
Cleansing Wipes	1/32	3.125
Diaper Liners	0/3	0.0
Dog Waste Bags	0/3	0.0
Facial Tissues	3/6	50.0
Paper Towels	1/5	20.0
Total	17	

\* A summation of the % of material passing for 5 test repetitions, as per PAS3 specification.

Figure 7 shows the proportion of products labelled ‘flushable’ that disintegrated. While a total of 23 out of 101 products tested are labelled ‘flushable’, only 2 products partially disintegrate, and **none** of these 23 products fully disintegrate. Bathroom tissue is not included in this count of 23 consumer products. It should be noted that bathroom tissue is not *labelled* ‘flushable’ but is used as a comparison to show that it fully disintegrates. Moreover, from the 101 products assessed for flushability, 90 (out of 101) products were deemed as **FAIL** (see Figure 8) according to the PAS 3 (IWSFG, 2018c), as the specification states that at least 95% or more of the material must pass through a specified sieve to be classified as a **PASS** (IWSFG, 2018). As stated previously and reiterated below in Figure 8, only 11 (out of 101) products fully disintegrated and were classified as a **PASS** and all of the products that passed were toilet tissue controls.

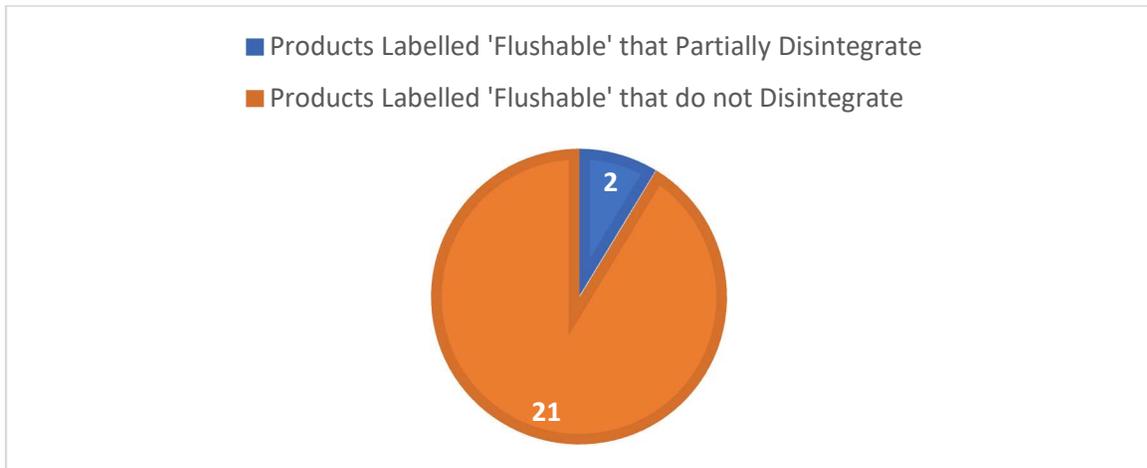


Figure 7- Graphical Representation of 'Flushable' Products' Performance

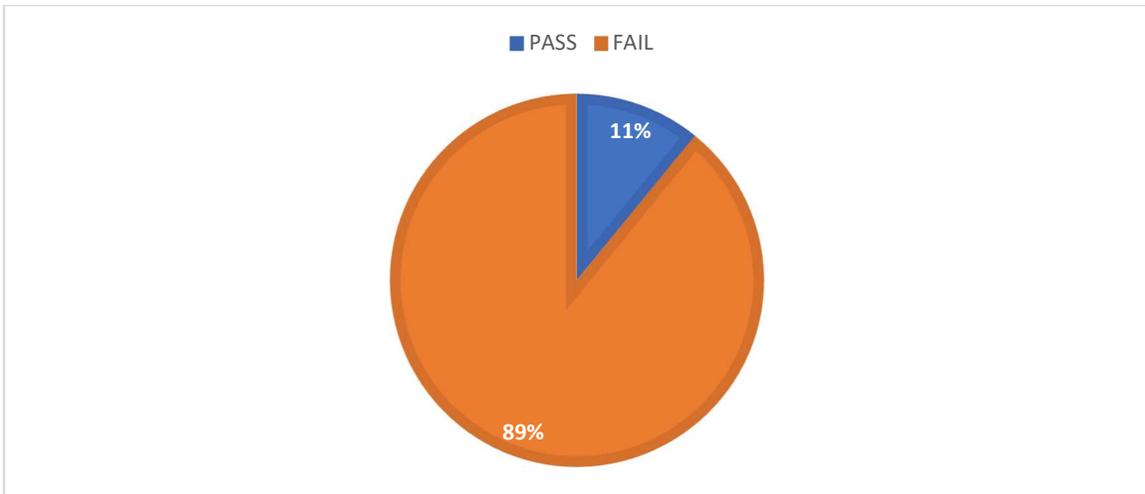


Figure 8- Graphical Representation of Products Deemed PASS or FAIL

To illustrate the degree in variance of product disintegration during the agitation period (see Section 1.2 for a brief overview of the *preconditioning* and *agitation* periods of testing), figures representing two different consumer products labelled ‘flushable’ are presented below. Figure 9 shows a cleansing wipe labelled ‘flushable’ at *the end* of the 30-minute agitation period. It is visibly evident that this cleansing wipe does not show even partial disintegration. On the other hand, figure 10 is an image of toilet tissue acquired *before* the 30-minute agitation period of the disintegration test was complete. It is visibly evident that the toilet tissue had disintegrated before starting the test. The time recorded in the slosh box for this product to fully disintegrate was 3 minutes and 24 seconds. From the products tested during this project, 89.1% of products remained fully intact after the completed disintegration test. Hence, majority of the products were classified as a **FAIL** according to the PAS 3 (IWSFG, 2018c).



Figure 9- Example of Cleaning Wipe Disintegration After Testing



Figure 10- Example of Bathroom Tissue Disintegration After Testing

### 3.3 Fibre Composition

As the third objective of this project, an analysis was conducted on the fibre composition of a select number of consumer products. The complete list detailing the 20 products evaluated for fibre composition is provided in Appendix B.

Based on the testing results shown in Table 2, the most prevalent fibre type amongst the 20 products evaluated was softwood. The dominant regenerated cellulose material amongst the consumer products evaluated was rayon, whereas the recessive material used was lyocell. From additional research, an estimation of 20-35% composition of polypropylene was made for products #6 and #11, as shown in the table on the following page. Overall, 75% of the consumer products evaluated for fibre composition in this project contain at least one type of man-made material—synthetic or regenerated cellulosic material. Nonwovens' industry claims that the volume of nonwovens converted into wipes for consumer and industrial applications will rise 6.3% per year from 1.20 million tons in 2018 to 1.63 million tons in 2023 (Steed and Pira, 2018). Given this trend, manufacturers may be increasing the usage of regenerated cellulose and synthetic materials in consumer products to make them more durable.

### 3.4 Adherence to Package Labelling

It is important to note that the industry Code of Practice is currently a voluntary measure. However, because it is evident that manufacturers have been making flushability claims on product packaging, it is plausible to state that the Code of Practice may be followed by manufacturers. The systematic approach to determine whether the products tested adhered to the package labelling criteria utilize the decision tree, exemplified in the Code of Practice. Table 3 shows the percentages of each category where a DNF symbol was required versus the percentages of those products which met the specified criteria.

As evident from Table 3, specific categories like baby wipes, cleansing wipes, and diaper liners, required that all their products display a DNF symbol. However, **none** of the products tested adhered to the criteria for package labelling in the Code of Practice, including those which were required to display the symbol. The results indicate that there is a great deal of inconsistency with package labelling as there are varying percentage compositions that display a DNF symbol. Some product categories, such as cleansing cloths, dog waste bags, facial tissue, and paper towel displayed a DNF symbol even though the criteria do not specify that such is required. Other categories like diaper liners, where 100% of the products are required to display a DNF symbol, showed that **none** of the products displayed a DNF symbol.

Table 2-Fibre Composition of Select Product Samples

Product #	% Fibre Type						
	Natural			Man-Made			
	Softwood	Hardwood	Cotton	Regenerated		Synthetics	
				Lyocell	Rayon	Polyester	Polypropylene
1 Baby wipe (flushable)	70.5	1.1		28.4			
2 Baby wipe (flushable)	75.8	0.3		23.9			
3 Baby wipe (DNF)			24		20.8	55.2	
4 Baby wipe (DNF)					34	35.5	
5 Baby wipe (DNF)					64.5	35.5	
6 Baby wipe (DNF)							20-35 estimate
7 Baby wipe (DNF)					29	71	
8 Bathroom tissue	41.6	58.4					
9 Cleansing wipe (DNF)				100			
10 Cleansing cloth (Flush)	99	1					
11 Cleansing wipe (DNF)							20-35 estimate
12 Cleansing wipe (Flush)	61.8	0.4			37.8		
13 Cleansing cloth (Flush)	73.6	0.1		12.4	14		
14 Cleansing cloth (Flush)	59.1	0.2			40.8		
15 Cleansing cloth (Flush)	70.7	1.4		27.8			
16 Denture wipe (DNF)					87.2		12.8
17 Diaper liner (flush)					100		
18 Diaper liner (flush)	100						
19 Facial tissue (DNF)	30.1	69.9					
20 Paper towel	62.7	37.3					
Total count of product tested containing fibre type	11	10	1	5	9	4	1

Table 3- Product Adherence to Package Labelling

Product Category	% of products that require a DNF symbol	% of products that display a DNF symbol	% of products that meet DNF symbol criteria
Baby Wipes	100	56	0
Bathroom Tissue		0	
Cleaning Cloths	25	75	0
Cleaning Wipes	86	15	0
Cleansing Cloths		20	
Cleansing Wipes	100	26	0
Diaper Liners	100	0	0
Dog Waste Bags		0	
Facial Tissue		17	
Paper Towel		0	
*Note		Greyed out cell indicates that based on Code of Practice, product category does not require a DNF symbol or is out of scope (used for comparison only)	

The following is a statement extracted from the INDA and EDANA Code of Practice (2017): “Because of consumer confusion, it is highly recommended and strongly encouraged that Baby Wipes should not be marketed as ‘Flushable’, and all Baby Wipes are required to display the DNF symbol both on the top or front panel of the package visible to the consumer “on shelf” without the consumer having to touch the package, and also a DNF symbol reasonably visible near the point where individual wipes are taken out of their container”. From this statement, it can be gathered that regardless of how a baby wipe product performs based on a flushability assessment, it is required to display a DNF symbol. As an example, 56% of baby wipes tested in this project, as presented in the Table 3, displayed a DNF symbol. As mentioned on the previous page, the Code of Practice states specific on-pack consumer information regarding the location, colour, size, wording, and timing of the DNF symbol. For example, the symbol should not be obscured by packaging seals/folds or obscured by other package design elements (INDA and EDANA, 2017). Based on the on-pack consumer information, these baby wipes did not meet the criteria due to a lack of adherence to visual criteria, and failure to meet other specifications.

A key visual observation made during the evaluation of product adherence to package labelling was that although 19 products displayed a DNF symbol, the symbol failed the stated criteria because of several reasons. These reasons may have included the following:

- DNF symbol appears on plastic wrapper that is designed for removal prior to product usage in which case, DNF symbol is not visible to user after wrapper has been discarded
- DNF symbol is either too small or hidden
- DNF symbol is displayed under the product fold
- Symbol displayed is not the universal DNF symbol

## 4. Conclusions and Recommendations

### 4.1 Main Findings

The key conclusions are formulated based on the quantitative and qualitative data gathered, observations stated, and analyses presented throughout this report. This project included an inventory of over a hundred consumer products, representative of the variety present on store shelves in Southern Ontario and/or online, and aimed to incorporate a variety of products based on their potential to be flushed. However, there exists countless other products in the consumer market that remain untested and unaccounted for with regards to flushability assessments. The findings presented below are based on the portion of consumer products tested in this project *only*.

#### 4.1.1 Drainline Clearance

Most of the products tested for drainline clearance did not clear the drainline in a single flush, sometimes requiring up to six 6-L flushes. Low-flush toilets consume a significantly smaller amount of water and may be utilized in various residences, including homes and residential buildings, for water efficiency. As observed during the FG501: Toilet and Drainline Clearance Test, the consumer products took several flushes to clear the drainline with a higher volume flush. There is an even higher potential for clogging with low-flow toilets. Lower water flows pose challenges such as less reliable wastewater transportation and frequent clogging in drainage systems (Shuaeb and Han, 2017). Therefore, a consumer product that is potentially incompatible with toilets and plumbing systems may cause delays and blockages in transport to larger sewage conveyance systems (INDA and EDANA, 2018). Although the data on causes of drainline blockages are scarce, these types of blockages remain as a significant cost burden on municipalities due to the need to respond to many of these calls for service by utility customers. For example, a quick review of the published City of Toronto 311 data indicates that close to 10,000 events labelled “Sewer Service Line-Blocked” were reported *annually* over the 2010-2018 period.

#### 4.1.2 Disintegration Testing

The flushability assessment based on IWSFG PAS 3: Disintegration Test Methods—Slosh Box showed that bathroom tissue disintegrated within the test time as specified, while some products showed no visible evidence of disintegration (IWSFG, 2018c). Some of the bathroom tissue tested partially disintegrated during the *preconditioning* period of the test. All bathroom tissue tested fully disintegrated before the end of the 30-minute *agitation* period. Overall, **none** of the products labelled ‘flushable’ disintegrated within the allotted time to an extent required to pass the test.

#### 4.1.3 Fibre Analysis

From the sample of twenty products drawn from the total of 101 products tested for other criteria and tested for fibre composition, 75% of the test products contain durable man-made material. These synthetics may be hazardous to the natural environment because of their potential to exist in local water bodies by means of combined sewer overflows (CSOs) where such sewers exist. It is important to note that as mentioned previously, the trend in increasing consumption of wet wipes and other such consumer products may result in the production of stronger and more durable versions of these products. Since synthetics may be used as binders in consumers products like wet wipes, the presence of synthetics in

evolving consumer products may be at a rise. In other words, the increasing consumption of consumer products may indicate a growing number of these products in wastewater collection systems.

#### 4.1.4 Package Labelling

Although it is evident that efforts have been made by manufacturers to distinguish products that are 'flushable' from those that are not, it appears that there is no significant distinction in product composition based on the TAPPI/ANSI Test Method T 401, Fibre Analysis of Paper and Paperboard. The similarity in the visual aspect of these consumer products along with the inconsistency in package labelling may be a source of confusion for consumers. The confusion around which products are flushable and those which are not is a growing concern for many reasons. The lack of awareness around flushing habits may result in an inability to effectively treat the products prior to their release to the environment and result in sewer overflows that can impact public health and the environment (IWSFG, 2018a).

Currently, different versions of flushability specifications are provided by various industries and associations (e.g. UK Water Industry 2019, IWSFG 2018, INDA/EDANA 2018a), which are not consistent with each other. Although these specifications have the shared view on the importance of proper disposal of consumer products, variability between them may be a cause for variability in disintegration performance of consumer products by some manufacturers (UK Water Industry, 2019).

#### 4.2 Amended Methodology for IWSFG PAS 3 (2018)

While this application of the PAS 3 (IWSFG, 2018c) serves to provide thorough quantitative data for consumer products labelled 'flushable', it may be worthwhile to exclude some steps of the procedure under time constraints. As an example, for 82.2% of the products tested, it was visually evident whether the sample disintegrated or not. As aforementioned, many of the products remained fully intact and this was clear through a visual speculation. Therefore, a visual observation may be enough to classify a product as a **PASS** or **FAIL**. In this case, the steps detailing the weighing process for the initial dry mass of the samples and the oven drying process for the dry mass of the samples may be eliminated.

Moreover, recording the weights of the samples can often become tedious given the number of times the masses are to be recorded. It may be best to include the weighing process only when products show evidence of disintegration. This does not cause any delays in the procedure as the masses are to be recorded after the testing has been performed. Hence, no repetition of procedure would be necessary.

Presented on the following page is a schematic detailing an amended methodology for the PAS 3 (IWSFG, 2018c). The methodology presented is mainly the same as that presented in the PAS 3 (IWSFG, 2018c) with slight modifications. The schematic outlines the procedure for one product sample. However, the procedure should be repeated for five sequential product samples to obtain the total dry mass of the retained material from the sieve and an additional five product samples to obtain the initial dry mass, where necessary.

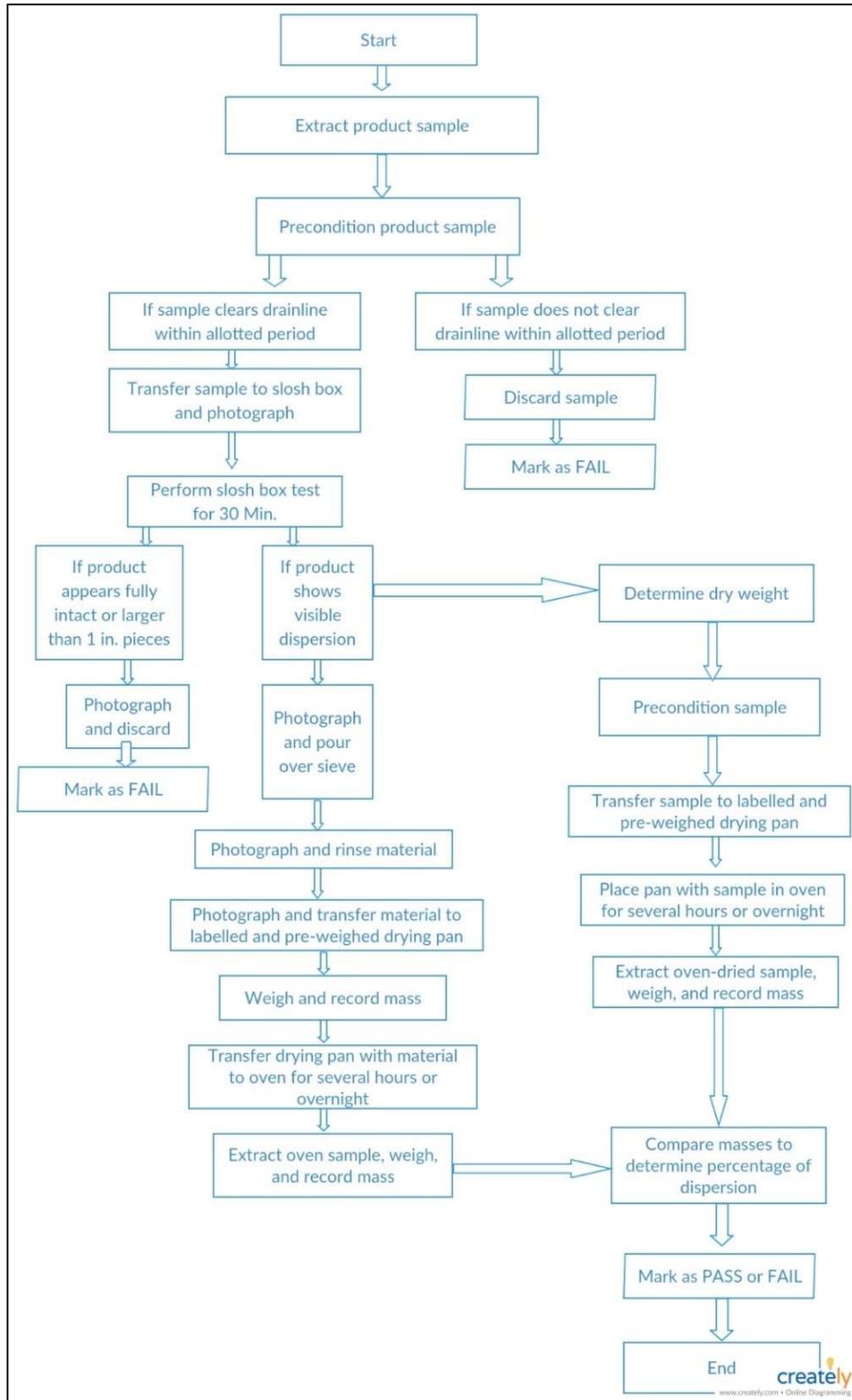


Figure 11- Schematic of Proposed Amendments to IWSFG PAS 3 (2018) Methodology

### 4.3 Recommendations

The following recommendations are made based on the results of the testing conducted in this project:

1. Raise public awareness around flushing habits.

Though many Canadian municipalities have spent time, money, and resources developing and delivering educational programs detailing what is and what is not flushable, the problem may be related to a lack of awareness (Orr, 2013). An increase in public awareness of appropriate disposal methods, combined with current efforts, may result in consumers taking more care when disposing these products in order to prevent blockages in their homes which result in inconvenience and expense to the homeowner.

2. Eliminate the use of the word 'flushable' on consumer products.

The use of the word 'flushable' indicates that a product is safe for wastewater collection systems. However, based on the results presented in this report, it is evident that none of the products other than bathroom tissue are 'flushable'. Therefore, eliminating the use of the word 'flushable' from consumer products can help to reduce, if not eliminate, the presence of these products in wastewater collection systems, treatment plants, and the natural environment.

3. Advocate and provide support to government bodies to include the IWSFG specification, and the INDA/EDANA Code of Practice into legislation (IWSFG, 2018c; INDA and EDANA, 2017).

Many of the consumer products tested during this project were manufactured outside of North America in countries such as China, Germany, Ireland, Israel, Italy, Korea, Poland, and Thailand. The need for a global definition of a 'flushable' product exists and it is vital that it be brought into legislation in an effort to combat misconceptions around consumer products that may exist internationally.

4. Monitor and communicate with manufacturers and their associations (e.g. INDA, EDANA) to ensure policies and guidance are followed.

As mentioned in the Introduction of this report, it is unclear to what extent manufacturers are practicing appropriate methodology in determining the flushability of consumer products as well as their labelling. Regulation of specifications in place may help to ensure that consumer products are correctly labelled with a 'Do Not Flush' statement or DNF symbol.

5. Increase efforts to collect the information on the causes of reported sewer blockages.

Studies often cited to indicate the low content of 'flushable' wipes in sewer systems are hardly representative of the potential impacts of many consumer products that are being flushed on the entire sewerage system, starting from private drains to wastewater treatment plants. Work orders completed by crews responding to sewer blockages often contain valuable information on the potential causes, and these should be collected and processed to gain further insight. In the longer term, a methodology needs to be developed to collect the information on blockage causes in a more systematic and easy way in order to better understand this issue and aid in developing effective control alternatives.

6. Continue the testing of consumer products with manufacturers' input.

The current study should be expanded to include the testing of products sold in other jurisdictions, as well as other consumer products such as feminine hygiene products, kitty litter, and dental floss. The consumer products that are of interest here undergo changes in terms of the manufacturing process and materials used, and these should be accounted for through closer communication with manufacturers and possible re-testing. In addition, the products that pass the drainline and disintegration tests should be subjected to the remaining tests under the IWSFG Publicly Available Specification (PAS) 1: 2018 (IWSFG 2018b).

## References

- Association of the Nonwoven Fabrics Industry (INDA) and The European Disposables and Nonwovens Association (EDANA). (2017). CODE OF PRACTICE: Communicating Appropriate Disposal Pathways for Nonwoven Wipes to Protect Wastewater Systems, Second Edition 2017.
- Association of the Nonwoven Fabrics Industry (INDA) and The European Disposables and Nonwovens Association (EDANA). (2018). Guidelines for Assessing the Flushability and Disposable Nonwoven Products.
- International Water Services Flushability Group (IWSFG). (2018a). IWSFG Flushability Specifications. <http://iwsfg.org/iwsfg-flushability-specification> (accessed 31 January 2019)
- International Water Services Flushability Group (IWSFG). (2018b). Publicly Available Specification (PAS) 1: 2018 Criteria for Recognition as a Flushable Product.
- International Water Services Flushability Group (IWSFG). (2018c). Publicly Available Specification (PAS) 3: 2018 Disintegration Test Methods—Slosh Box.
- Orr, B (2013). The Toilet Toll. Water Canada. <https://www.watercanada.net/feature/the-toilet-toll/> accessed (31 January 2019)
- Shuaeb M.A.M., and Han M., (2018). Clogging potential of low-flush toilet branch drain system, *Urban Water Journal*, 15:1, 68 74, DOI: [10.1080/1573062X.2017.1395898](https://doi.org/10.1080/1573062X.2017.1395898)
- Steed, J and Pira, S, (2018). Four Trends Shaping the Future of Nonwoven Wipe Demand. *Nonwovens Industry since 1970*. 2019 Rodman Media. [https://www.nonwovens-industry.com/issues/2018-4/view\\_features/four-trends-shaping-the-future-of-nonwoven-wipe-demand](https://www.nonwovens-industry.com/issues/2018-4/view_features/four-trends-shaping-the-future-of-nonwoven-wipe-demand) accessed (05 February 2019)
- TAPPI (2018). Fiber analysis of paper and paperboard TAPPI/ANSI Test Method T401 om-15. TAPPI.
- UK Water Industry (2019). Fine to Flush: Specification for a Testing Methodology to Determine Whether a Product is Suitable for Disposal Through a Drain or Sewer System. *Fine to Flush*, 1:1, 30. Water UK.

## Appendix A - Detailed List of 101 Consumer Products Tested

<b>Product #</b>	<b>Product Category</b>	<b>Manufacturing Country</b>	<b>Do Flush Logo?</b>	<b>Not Flush?</b>	<b>Says Do Not Flush?</b>	<b>Do Labelled Flushable?</b>	<b>Pass Rate</b>	<b>Pass/Fail</b>
1	Baby Wipes	USA	No	No	Yes	0	Fail	
2	Baby Wipes	Poland	No	No	Yes	0	Fail	
3	Baby Wipes	China	No	No	No	0	Fail	
4	Baby Wipes	Poland	Yes	No	No	0	Fail	
5	Baby Wipes	USA	No	Yes	No	0	Fail	
6	Baby Wipes	USA	Yes	Yes	No	0	Fail	
7	Baby Wipes	China	No	No	No	0	Fail	
8	Baby Wipes	USA	Yes	No	No	0	Fail	
9	Baby Wipes	USA	Yes	Yes	No	0	Fail	
10	Baby Wipes	Israel	No	No	No	0	Fail	
11	Baby Wipes	China	Yes	No	No	0	Fail	
12	Baby Wipes	USA	Yes	No	No	0	Fail	
13	Baby Wipes	USA	No		Yes	0	Fail	
14	Baby Wipes	UK	Yes	No	No	0	Fail	
15	Baby Wipes	USA	Yes	Yes	No	0	Fail	
16	Baby Wipes	USA	Yes	Yes	No	0	Fail	
17	Baby Wipes	USA	Yes	No	No	0	Fail	
18	Baby Wipes	Ireland	Yes	Yes	No	0	Fail	
19	Bathroom Tissue	China	No	No	Yes	100	Pass	

<b>Product #</b>	<b>Product Category</b>	<b>Manufacturing Country</b>	<b>Do Flush Logo?</b>	<b>Not Flush?</b>	<b>Says Do Not Flush?</b>	<b>Do Labelled Flushable?</b>	<b>Pass Rate</b>	<b>Pass/Fail</b>
20	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
21	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
22	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
23	Bathroom Tissue	USA	No	No	Yes	100	Pass	
24	Bathroom Tissue	USA	No	No	Yes	100	Pass	
25	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
26	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
27	Bathroom Tissue	USA	No	No	Yes	100	Pass	
28	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
29	Bathroom Tissue	Canada	No	No	Yes	100	Pass	
30	Cleaning Cloth	China	Yes	Yes	No	0	Fail	
31	Cleaning Cloth	USA	Yes	No	No	0	Fail	
32	Cleaning Cloth	Canada	Yes	Yes	No	0	Fail	
33	Cleaning Pad	Thailand	No	No	Yes	0	Fail	
34	Cleaning Wipes	China	No	No	Yes	0	Fail	
35	Cleaning Wipes	USA	No	Yes	No	0	Fail	
36	Cleaning Wipes	USA	Yes	Yes	No	0	Fail	
37	Cleaning Wipes	USA	Yes	Yes	No	0	Fail	

<b>Product #</b>	<b>Product Category</b>	<b>Manufacturing Country</b>	<b>Do Flush Logo?</b>	<b>Not Flush?</b>	<b>Says Do Not Flush?</b>	<b>Do Labelled Flushable?</b>	<b>Pass Rate</b>	<b>Pass/Fail</b>
38	Cleaning Wipes	USA	No	Yes	No	0	Fail	
39	Cleaning Wipes	USA	No	Yes	No	0	Fail	
40	Cleaning Wipes	USA	No	No	No	0	Fail	
41	Cleaning Wipes	USA	No	No	No	0	Fail	
42	Cleaning Wipes	USA	No	Yes	No	0	Fail	
43	Cleaning Wipes	USA	No	No	No	0	Fail	
44	Cleaning Wipes	USA	No	Yes	No	0	Fail	
45	Cleaning Wipes	China	No	No	No	0	Fail	
46	Cleaning Wipes	USA	No	Yes	No	0	Fail	
47	Cleaning Wipes	USA	No	Yes	No	0	Fail	
48	Cleansing Cloth	USA	Yes	Yes	No	0	Fail	
49	Cleansing Cloth	USA	No	Yes	No	0	Fail	
50	Cleansing Cloth	USA	No	Yes	No	0	Fail	
51	Cleansing Cloth	USA	No	No	Yes	34.98	Fail	
52	Cleansing Cloth	China	No	Yes	No	0	Fail	
53	Cleansing Wipes	USA	Yes	Yes	No	0	Fail	
54	Cleansing Wipes	USA	No	Yes	No	0	Fail	
55	Cleansing Wipes	USA	Yes	No	No	0	Fail	

Product #	Product Category	Manufacturing Country	Do Flush Logo?	Not Flush?	Says Do Not Flush?	Do Labelled Flushable?	Pass Rate	Pass/Fail
56	Cleansing Wipes	USA	Yes	No	No	No	0	Fail
57	Cleansing Wipes	USA	No	No	No	Yes	48.67	Fail
58	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
59	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
60	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
61	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
62	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
63	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
64	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
65	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
66	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
67	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
68	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
69	Cleansing Wipes	USA	No	No	No	Yes	0	Fail
70	Cleansing Wipes	Italy	No	Yes	No	No	0	Fail
71	Cleansing Wipes	USA	Yes	Yes	No	No	0	Fail
72	Cleansing Wipes	USA	Yes	Yes	No	No	0	Fail
73	Cleansing Wipes	Italy	No	No	No	No	0	Fail
74	Cleansing Wipes	USA	No	yes	no	no	0	Fail

<b>Product #</b>	<b>Product Category</b>	<b>Manufacturing Country</b>	<b>Do Flush Logo?</b>	<b>Not Flush?</b>	<b>Says Do Flush?</b>	<b>Do Labelled Flushable?</b>	<b>Pass Rate</b>	<b>Pass/Fail</b>
75	Cleansing Wipes	China	No	Yes	No	0	Fail	
76	Cleansing Wipes	China	No	Yes	No	0	Fail	
77	Cleansing Wipes	USA	No	No	No	0	Fail	
78	Cleansing Wipes	UK	Yes	Yes	No	0	Fail	
79	Cleansing Wipes	USA	No	yes	no	0	Fail	
80	Cleansing Wipes	Germany	No	No	No	0	Fail	
81	Cleansing Wipes	USA	Yes	Yes	No	0	Fail	
82	Cleansing Wipes	Korea	Yes	No	No	0	Fail	
83	Cleansing Wipes	China	No	No	No	0	Fail	
84	Cleansing Wipes	China	No	No	No	0	Fail	
85	Diaper Liners	USA	No	No	Yes	0	Fail	
86	Diaper Liners	China	No	No	Yes	0	Fail	
87	Diaper Liners	USA	No	No	Yes	0	Fail	
88	Dog Waste Bags	China	No	No	Yes	0	Fail	
89	Dog Waste Bags	China	No	No	No	0	Fail	
90	Dog Waste Bags	USA	No	No	No	0	Fail	
91	Facial Tissue	USA	No	No	No	0	Fail	
92	Facial Tissue	China	No	No	No	68.23	Fail	

<b>Product #</b>	<b>Product Category</b>	<b>Manufacturing Country</b>	<b>Do Flush Logo?</b>	<b>Not Flush?</b>	<b>Says Do Not Flush?</b>	<b>Do Labelled Flushable?</b>	<b>Pass Rate</b>	<b>Pass/Fail</b>
93	Facial Tissue	Canada	No	No	No	No	0	Fail
94	Facial Tissue	Canada	No	No	No	No	0	Fail
95	Facial Tissue	USA	Yes	No	No	No	68.25	Fail
96	Facial Tissue	China	No	No	No	No	37.78	Fail
97	Paper Towels	USA	No	No	No	No	0	Fail
98	Paper Towels	Canada	No	No	No	No	37.28	Fail
99	Paper Towels	Canada	No	No	No	No	0	Fail
100	Paper Towels	USA	No	No	No	No	0	Fail
101	Paper Towels	USA	No	No	No	No	0	Fail

# Appendix B - Summary of Products Evaluated for Fibre Composition

<i>ID</i>	<i>Product Type</i>	<i>Category</i>	<i>Subcategory</i>	<i>Manufacturing Country</i>
1	Nonwoven	Baby Wipes	Flushable	USA
2	Nonwoven	Baby Wipes	Flushable	Poland
4	Nonwoven	Baby Wipes		Poland
7	Nonwoven	Baby Wipes		China
10	Nonwoven	Baby Wipes		Israel
14	Nonwoven	Baby Wipes		UK
18	Nonwoven	Baby Wipes		Ireland
27	Bath/Facial Tissue	Bathroom Tissue		USA
47	Nonwoven	Cleaning Wipes		USA
51	Nonwoven	Cleansing Cloth	Flushable - Body	USA
56	Nonwoven	Cleansing Wipes	Body	USA
58	Nonwoven	Cleansing Wipes	Flushable - Body	USA
59	Nonwoven	Cleansing Wipes	Flushable - Body	USA
61	Nonwoven	Cleansing Wipes	Flushable - Body	USA
63	Nonwoven	Cleansing Wipes	Flushable - Body	USA
70	Nonwoven	Cleansing Wipes	Denture	Italy
86	Nonwoven	Diaper Liners	Flushable	China
87	Nonwoven	Diaper Liners	Flushable	USA
95	Bath/Facial Tissue	Facial Tissue		USA
97	Towel	Paper Towels		USA