

**An Investigation into the Sustainability of Liquid Sugar in comparison to Granulated
Packaged Sugar**

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APSC 262

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**An Investigation into the Sustainability of Liquid Sugar in
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ABSTRACT

Sustainable development requires the smart utilization of resources and balancing the needs of the community and the businesses that are invested in the project. In an effort to make UBC a more sustainable university, UBC Food Services (UBCFS) has switched to liquid sugar pumps as a replacement for single serving package of regular dry sugar in key locations on campus. This report will focus on the research into the impact of the switch. A detailed triple bottom-line assessment of whether liquid sugar is actually more sustainable is reported here. In this triple bottom-line assessment the social, environmental and economic implications of this switch were investigated.

Some findings that resulted from this research were that liquid sugar is significantly more expensive than the single serving sugar packets, the plastic containers of the liquid sugar are more environmentally sustainable and the clients and staff of UBCFS locations with the liquid sugar pumps enjoy the convenience and cleanliness of the liquid sugar pumps.

In the end, even though liquid sugar appears to be more environmentally and socially sustainable, it is not very feasible economically because of the expensive costs associated with the switch. However, the environmental and social benefits are quite significant and some recommendations to reduce the cost of the switch are presented.

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GLOSSARY

British Thermal Units

A British Thermal Unit is a unit of energy equivalent to 1055 joules.

LIST OF ABBREVIATIONS

BTU	British Thermal Unit
FBI	Food & Beverage Industry
GHG	Green House Gases
KWh	Kilowatt Hour
mL	Millilitre
PUI	Packaging Use Intensity
UBC	University of British Columbia
UBCFS	UBC Food Services

1.0 INTRODUCTION

UBC is a leader in sustainability, therefore it is important to be constantly making improvements towards a more sustainable campus. This way UBC can set the bar high and share research which can help communities and other universities reach their sustainability goals. One of these possible improvements that UBCFS is investigating is the switch to liquid sugar from single serving sugar packets.

Striving towards improving social, environmental and economic sustainability will bring many benefits to the UBC campus. The goal of this switch to liquid sugar would be to provide an improved amenity to UBC Food Service customers, minimize the environmental impact of UBC's sugar needs all while making sure that this switch makes sense financially for UBCFS.

In this report, a triple bottom line assessment is performed on liquid sugar to determine if it is more economically, environmentally and socially sustainable than sugar packets. In the end, a conclusion will be reached as to whether liquid sugar is more sustainable. Also, a recommendation of if UBC should continue using liquid sugar will be made based on our investigation.

2.0 ECONOMIC IMPACT

UBCFS is a “fully self-funded, ancillary department” (Richer, n.d.) and although it is not-for-profit, sustainable initiatives must fit within the budget in order for the service to be financially sustainable. We also consider other factors than can affect the cost of the switch – like the potential of cost reduction due to a decrease in theft or an increase in cost due to a need for pump replacements in the liquid sugar bottles.

2.1 Package Cost Comparison

We can find see how much switching to liquid sugar can cost by comparing the cost per package before and the cost per pump after the switch. To ensure fair comparison, we must verify that: a) the volume of one package of granulated sugar is equal to one pump of liquid sugar, and b) the types of sugar compared is as alike as possible.

In our measurements, one package of sugar is equal to 1 pump of liquid sugar, each serving was 7.4mL. We will be using the terms “pump” and “package” interchangeably to represent the same unit serving volume (7.4mL) of sugar.

In a sugar velocities document provided by UBCFS (see Appendix A), we are given data for both raw sugar as well as white sugar. However, there are three types of liquid sugar: cane, sweetener (artificial) and honey (see Appendix C). For the most equal comparison, we will be using an average cost of two types of granulated sugar to compare with the liquid cane sugar, which is the most similar liquid sugar type. We will be using the terms “liquid sugar” to mean the liquid cane sugar specifically in this section.

Table 1

Cost per Package for Various Brands and Types of Sugar

Brand	Cost per package (7.4mL)	N
Monin (liquid sugar)	\$0.0851	1
GFS & Rogers Sugar	\$0.0135	6.3
Sugar Stix	\$0.0161	5.28
Sugar Tubes	\$0.0149	5.7
Organic Fair Trade Sugar	\$0.047	1.8 (or 2.5)
N = Cost multiplier – 1 pump of liquid sugar is N times the cost per package		

As shown in Table 1, the cost per pump of the liquid sugar is the highest amongst all the brands of granulated sugar (see Appendix D for full calculations). In fact, liquid sugar per pump is 6.3 times as expensive as the most commonly found brand of granulated sugar: GFS and Rogers. Looking at the per package cost, switching from granulated raw and white sugar to the liquid cane sugar is not very economically sensible.

2.2 Constant-Price Volume Comparison

Another method to compare the cost in switching to liquid sugar is to keep the amount spent constant and compare the change in volume of sugar. We will be using the word “budget” to refer to the amount of money it would cost UBCFS if they were to order all their sugar (402,000 packages) from that brand – or in other words, the sum of the “Total Cost” columns for white and raw sugar (see Appendix B).

Table 2

Number of Pumps per Budget of Various Brands and Types of Sugar

Brand	Budget	Number of Packages	Difference in Volume
GFS & Rogers Sugar	\$5428	63,783	-84.1%
Sugar Stix	\$6508	76,475	-81.0%
Sugar Tubes	\$5994.28	70,438	-82.5%
Organic Fair Trade Sugar	(not given, see Appendix D)	220,096	-45.2%

Total number of packages ordered in 2011: 402,000

UBCFS will not get as many servings of sugar as it could potentially get if the switch from granulated sugar to liquid sugar is rolled out to all of its locations. In Table 2, we can see that if we were to use the same budget allotted to the GFS and Rogers brand of sugar, we would only be able to get 63,783 pumps in comparison to 402,000, which is an 84% reduction in volume of sugar.

2.3 Other Contributing Factors

In addition to the cost of actual product, there are other factors that may affect the cost of switching from granulated sugar to liquid sugar. There is not enough numerical information to provide a definitive amount that it will increase or decrease the cost per package, but we feel they are important and should be brought to the attention of UBCFS, in case the information becomes available in the future.

2.3.1 Pump Replacement

An associated cost with the use of liquid sugar is the replacement of the pump mechanism if it is ever damaged. However, when a bottle is empty, it is the bottle that gets replaced with a new one and the same pump is used until it is damaged.

The frequency of pump replacements is not tracked, and we do not have sufficient information to assess whether or not UBCFS would need to order additional pumps, which is an

additional cost associated with liquid sugar usage. However, we do observe that there is a potential for an increase in costs associated with liquid sugar due to the fact that there is an added mechanism in place that may break and need to be replaced.

2.3.2 Theft

One economic benefit of liquid sugar is the reduction of costs due to the reduction of theft. Single serving packages of granulated sugar are small and it is easy to take more packages than needed without feeling guilty. However, the likelihood of someone walking away with a 1L bottle of liquid sugar is close to 0. In a survey conducted on campus locations, 65% of students answered that they would often take 4-6 packages of sugar with them to go. 56% of students answered that they use 3-5 packages of sugar in their coffee, we can assume that the students tend to overestimate the amount of sugar they use by about 1-2 packages.

However, recalling the comparison of the most common brand of sugar (GFS/Rogers) with the liquid sugar, the liquid sugar costs 6.3 times more than the packaged sugar. And if we were to generalize those survey results and assume that every student would take extra packages of sugar, students would have to take an additional 5.3 packages for every package of sugar they used for the cost of granulated sugar to be equal to one pump of liquid sugar. However, we can see in our survey that this is not the case. Fewer students take additional packages of sugar with them to go and the students that do take 1-2 additional packages per visit.

The susceptibility to theft increases the cost associated with the packaged granulated sugar. However, we do not see it as a substantial increase in the cost per package, as the base price per package is very low.

2.4 Conclusion

By making the switch over from granulated, packaged sugar to liquid sugar, UBCFS would be spending at least two times the cost it currently spends to maintain its current velocity of sugar. To look at the numbers in a different perspective, if UBCFS did not change how much money is spent on its sugar supply: for the same amount of money it spends on a particular brand of granulated sugar, UBCFS would at most be getting 54.8% the volume in liquid sugar, which can lead to an observable shortage in sugar on campus.

At the end of the day, UBCFS must make a profit in order to sustain itself as well as its many other sustainable initiatives. This initiative is expensive and it will be hard to roll out to all the locations due to its high cost.

3.0 ENVIRONMENTAL IMPACT

Some areas of concern in terms of the environmental impact of the switch to liquid sugar were: if it would really prevent less waste being produced, if it would encourage less wastage of sugar and if the process to manufacture the sugar was as environmentally friendly.

3.1 Packaging Impact

The food and beverage industry (FBI) uses a lot of packaging to prevent damage or spoiling of products during storage and transportation. The packaging for sugar is considered primary packaging as it is in direct contact with the food (Maxime, 2010). Packaging causes huge waste issues as Canadians contribute 1.4 tonnes of food packaging waste annually (Maxime, 2010). The packaging industry uses an indicator called the Packaging Use Intensity which is a ratio between the prices of the packaging materials purchased per the value of the goods produced (Maxime, 2010). In Canada the sugar and confectionary industry had a PUI close to 0.10 with the median range being between 0.07 and 0.10 (Maxime, 2010).

As for the packaging itself the single serving sugar packages use compostable paper. While the paper packaging is compostable in a survey of clients at UBCFS locations we found that the average patron did not know about this and ended up throwing the sugar packaging into the garbage 65% of the time. Liquid sugar is held in 1L bottles made out of number 1 plastic.

Number 1 plastic is made out of polyethylene terephthalate (Howard, ND). Polyethylene terephthalate is a type of plastic that is commonly used as it is light weight, inexpensive, easy to recycle and is considered to pose a low risk of leaching (Howard, ND). There is a demand for the materials from the recycling process and polyethylene terephthalate can be recycled multiple times (NAPCOR, ND). It is very important that the liquid sugar bottles get recycled properly as polyethylene terephthalate is not biodegradable and will stay in landfills for a very long time. In terms of energy it takes approximately 5 – 31 million BTU / 1000 pounds of resin produced and the process emits 800 – 2700 pounds of CO₂ equivalent / 1000 pounds of resin produced (Franklin Associates , 2010, pg 40). Where the plastic fits on these ranges depends on how much post-consumer content has been used (Franklin Associates , 2010, pg 40). Further investigation

could be done to determine how much post-consumer content is in the bottles that Monin uses for their liquid sugar. This would help narrow down on how much energy is used and how much GHG is emitted. The more post-consumer content used to manufacture the new plastic resin the less energy required and the less greenhouse gases (GHG) emitted (Franklin Associates, 2010, pg 55). Each pound of resin creates about 12 1L bottles (NAPCOR, 2013).

$$\frac{5 - 31 \text{ million BTU}}{1000 \text{ lb of resin}} \times \frac{1 \text{ lb}}{12 \text{ 1L bottles}} \times \frac{1 \text{ L bottle}}{135 \text{ sugar packages}} = \frac{3.086 - 19.1358 \text{ BTU}}{\text{sugar packet}}$$

$$\frac{800 - 2700 \text{ lb GHG}}{1000 \text{ lb of resin}} \times \frac{1 \text{ lb}}{12 \text{ 1L bottles}} \times \frac{1 \text{ L bottle}}{135 \text{ sugar packages}} = \frac{0.4938 - 1.6667 \text{ lb GHG}}{1000 \text{ sugar packets}}$$

Paper waste is a huge issue around the world. Paper makes up a significant percentage of waste in landfills, around 26%, the decomposition of paper produces methane and deforestation leads to an increase in GHG emissions (Green Press Initiative, 2013). The production of 1 ton of paper is approximately 11 thousand KWh and produces approximately 6000 pounds of CO₂ equivalent (Green Print, 2013).

$$\frac{11,000 \text{ KWh}}{1 \text{ ton}} \times \frac{3412.14163 \text{ BTU}}{1 \text{ KWh}} \times \frac{1 \text{ ton}}{2000 \text{ lbs}} \times \frac{1 \text{ lb}}{1000 \text{ sugar packets}} = \frac{18.7667 \text{ BTU}}{\text{sugar packet}}$$

$$\frac{6000 \text{ lb GHG}}{1 \text{ ton}} \times \frac{1 \text{ ton}}{2000 \text{ lbs}} \times \frac{1 \text{ lb}}{1000 \text{ sugar packets}} = \frac{3 \text{ lb GHG}}{1000 \text{ sugar packets}}$$

Both paper and plastic represent a significant share of the packaging market, 30% and 38% respectively (Dexia, 2009, pg 3). While both the pulp and paper and plastic industry are considered to be quiet energy intensive and high emitters of GHGs I'd conclude that the plastic bottles used for the liquid sugar still have a smaller footprint then the paper packages for the packaged sugar. Using plastic bottles scores slightly lower on the energy required and significantly lower on GHGs emitted. In addition it moves the responsibility of recycling to back-of-house which ensures a higher rate of compliancy.

3.2 Wastage Reduction

In the survey of clients at UBCFS locations we found that the average number of patrons took 3-5 packages of sugar for their beverage and that where available they generally also used 3-5 pumps of the liquid sugar (Survey of UBC Food Service Clients, February 25, 2013). Since one pump of liquid sugar is roughly equivalent to one package of sugar switching to liquid sugar does not seem to increase or decrease the amount of sugar used.

That being said the survey does lead us to believe that people are more inclined to grab extra sugar packages as 34 people said that they take a lot of packages of sugar to go (Survey of UBC Food Service Clients, February 25, 2013). These extra sugar packets may end up being thrown or used at a later date. As this is not possible with the liquid sugar containers, I'd conclude that liquid sugar does encourage less wastage and theft of sugar.

3.3 Manufacturers Footprint

The company, called Monin, which produces the liquid sugar, has a couple of environmental programs in place to reduce their footprint. All product bottles and packaging materials that they use are recyclable (Monin, 2013). There are recycling programs in place at their facilities, warehouses and offices (Monin, 2013). In addition they have implemented a "Syrup to Bees" program where unsellable syrup is sent to a beekeeper in Florida to be used as bee feed (Monin, 2013).

I had hoped to be able to contact and get information directly from the sugar manufacturers as to the environmental footprint of their manufacturing process but failed to do so. While this information is important to get a complete picture many companies may be unwilling to delve too deep into their process and many may not have concrete numbers in terms of energy used, GHG emissions and other factors that affect their environmental impact.

3.4 Conclusion

In the end we would conclude that the liquid sugar is more environmentally friendly. However it doesn't have that much of a lead on the single serving packages. Liquid sugar does have slight advantages in that the packaging is more environmentally friendly, reduces wastage of sugar and the producer has some interesting programs in place to promote environmental sustainability.

4.0 SOCIAL IMPACT

An assessment on the social impact of UBCFS's decision is incredibly important, as the community can ultimately call for the rejection of an initiative. There are three social factors that we can focus on in our assessment: community popularity, maintenance, and theft control.

To assess the social impact of the switch to liquid pump, we have conducted a survey at three coffee shops on the UBC Campus. Two of which are using the granulated sugar packages and one at the UBC Loop Cafe, one of the outlets on campus that currently uses liquid sugar. To see the full results of the survey, please see Appendix E.

4.1 Community Popularity

From our survey, nearly 70% of students answered that they have never heard about liquid sugar pumps. However, the 70% of people, after explaining the concept to them, would like to try the liquid sugar pump due to its intriguing idea. We can conclude that students, despite never seeing or hearing about liquid sugar, would be open to trying something new and receptive to the switch.

Another reason students were open to trying liquid sugar is due to the pump mechanism. Nowadays, people are living in a much more fast-paced living environment and the liquid sugar pump mechanism enables people to quickly pump some sugar into their coffee and leave the coffee counter. The extra time saved may not amount to much, but it still is enough to draw interest from students to try the liquid sugar. We were able to come to this conclusion from our survey, as students who already use liquid sugar at the UBC Loop Café say they prefer to use the liquid sugar despite reporting that they do not find a difference in taste.

4.2 Maintenance

When looking at the impact of the liquid sugar on community, we must also keep in mind the change in maintenance that the switch to liquid sugar introduces. When conducting our survey, we observed that the self-service stations were messy and covered with spilt sugar. The café staff must constantly clean the spilt sugar to maintain a clean environment for customers, but no matter how frequently the station is cleaned, the next customer would often create a mess again.

The introduction of liquid sugar pumps have reduced the time required to be spend on maintaining and cleaning the self-service counters. The pumps rarely leave any leftover sugar on the self-service stations. When we did a site visit, we found that the pump was precise and any leftover sugar would only be left on the pump mechanism and not the counter top. The reduced mess would mean that cleaning the counters would be required less frequently.

We were able to interview two staff members at the Loop Café who were able to provide insight to the maintenance of the self-serving stations. They were indeed able to reduce the frequency of cleaning the self-serving stations to every thirty minutes (Sabiha, personal communication, March 30, 2013). Not only did the cleaning happen more infrequently, but it was “less of a pain” (Rowe, personal communication, March 30, 2013) and it reduced the amount of trash produced as well (Rowe, personal communication, March 30, 2013).

4.3 Theft Control

Theft is a common issue associated with food and beverage locations that have self-service counters. This includes the theft of condiment packets, paper napkins, and individual coffee creamers that can easily be stuffed into purses or pockets. This is a serious issue, as shops have to ensure that the granulated sugar is readily available and would often spend more money to order more sugar than is really needed.

From the survey, we were able to confirm that many people do take out packaged sugar to go. Around 65% of people take 1-2 additional packages to go. It is a possibility that people like to “take out” packaged sugar to store at home, but we did not feel it would be appropriate to ask students if this was their motive and if we did not feel we would have gotten an accurate answer anyway. Theft can be easily controlled using liquid sugar pumps instead of single serving sugar packages. A liquid pump bottle, despite its portability, is 1L in volume (see Appendix B) and is too large to put inside a purse. If someone were to attempt to take a bottle to go, it would be very obvious and someone will see and stop them. UBCFS would be able to reduce and even eliminate the occurrences of pilfering by switching to use liquid sugar pumps.

4.4 Conclusion

From the three areas of assessment: community popularity, maintenance and theft control, we were able to observe that people were open to trying liquid sugar, it was easier to maintain and it can reduce theft. From this data, we conclude that using liquid sugar pumps are a better choice for customers, employees, and owners.

5.0 CONCLUSIONS AND RECOMMENDATIONS

After investigating the economic, environmental and social impacts caused by switching from packaged granulated sugar to liquid sugar, we observe that the liquid sugar is more environmentally friendly, the pump mechanism is appealing to both students and staff and the liquid sugar bottles would reduce theft. However, rolling liquid cane pumps out to all of UBCFS locations is very costly, as the cost of one pump of the liquid cane sugar would cost 6.3 times as expensive as one package of granulated sugar.

We feel that the high cost associated with the switch would prevent UBCFS from being able to economically sustain this initiative. We recognize that this switch would help the campus become more environmentally friendly, and it is a sustainable initiative that the community on campus would support, so we recommend a few ways UBCFS can reduce the additional costs of switching to liquid sugar.

Our first recommendation is to dilute the liquid sugar, so that there is more volume but less actual product that UBCFS purchases. If the sugar was diluted to 1.5 times its volume, the cost per pump will be \$0.0567, which is a 33% decrease in price:

$$\frac{\$11.50}{1.5 \times 1000mL} \times \frac{7.4mL}{1 \text{ pump}} = \$0.0557 \text{ per package}$$

Another recommendation is to increase the cost of hot beverages to offset the cost of sugar. We recommend increasing the cost per beverage as opposed to charging for the usage of sugar packages because we feel that to introduce a cost to each package of sugar would not be well received and potentially increase the chance of pilfering. With the recent elimination of HST, UBCFS can consider increasing the cost of a beverage by 7%, which after GST, would be the cost of a beverage plus HST.

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APPENDIX A

Sugar Tubes vs. Other Sugar Sachets

Sugar Tubes Item	ST Description/Item	ST Case Size	ST	ST No Logo	ST No Logo		FS & OTHER BRAND		
			Price 2010	Price 2011	per kg	per pk	per kg	per pk	
UBC Raw FS 007*	Food Services Logo	2800 pks or 10kg	\$ 42.00	\$ 44.00	\$4.40	\$0.016	\$ 5.27	\$0.018	Rogers brand
UBC White FS 008	Food Services Logo	2800 pks or 10kg	\$ 40.00	\$ 40.00	\$4.00	\$0.014	\$ 2.95	\$0.010	GFS brand
UBC Raw Sage 009	Sage Logo - Raw	2800 pks or 10kg	\$ 42.00	\$ 44.00	\$4.40	\$0.016	\$ 5.94	\$0.019	Sugar Stix Demerara
UBC White Sage 010	Sage Logo - White	2800 pks or 10kg	\$ 40.00	\$ 40.00	\$4.00	\$0.014	\$ 4.89	\$0.014	Sugar Stix
UBC Raw Cate 011	Wescadia Raw	2800 pks or 10kg	\$ 42.00	\$ 44.00	\$4.40	\$0.016	\$7.29	\$0.034	FairTrade
UBC White Cate 012	Wescadia White	2800 pks or 10kg	\$ 40.00	\$ 40.00	\$4.00	\$0.014			

GFS & OTHER BRANDS

Item Code	Description	Pack Size	Brand	Cost/Cs	per kg	per pk
3238997	SUGAR PLANTATION RAW PAK	1000 pks or 3.5kg	ROGERS	18.45	\$5.27	\$0.018
3562567	SUGAR WHITE PORTION 3.5g TFC	2000 pks or 7kg	GFS	20.68	\$2.95	\$0.010
9007657	SUGAR STICK WHITE	2000 pks or 5.6 kg	SUGAR STIX	27.39	\$4.89	\$0.014
3553237	SUGAR STICK RAW DEMERARA	2000 pks or 6.5 kg	SUGAR STIX	38.64	\$5.94	\$0.019

Organic FairTrade Cane sugar tubes

Item Code	Description	Pack Size	Brand	Cost/Cs	per kg	per pk
26702	unrefined 5gr cane sugar sticks	2090 pks or 4.8g	FairTrade	72.92	\$7.29	\$0.034

APPENDIX B

UBC Food Services
 Cost Comparison - Sugar Tubes vs. GFS/Rogers & Sugar Stix
(pricings don't include customized logo)

Product	Annual Usage/CS	Total KG	Total Pk	GFS/Rogers (kg) Total Cost	Sugar Stix (kg) Total Cost	Sugar Tubes (kg) Total Cost	GFS/Rogers (pk) Total Cost	Sugar Stix (pk) Total Cost	Sugar Tubes (pk) Total Cost
Sugar Raw Ptn	176	616	176000	#####	#####	#####	\$ 3,168.000	\$ 3,344.000	\$ 2,765.71
Sugar Wht Ptn	113	791	226000	#####	#####	#####	\$ 2,260.000	\$ 3,164.000	\$ 3,228.57

APPENDIX C

UNIT	PRICE	PRICE	# OF	# OF	
	PER	PER	PER		
MONIN SWEETENERS	CASE	EACH	CASE	UNITS	CASES
Liquid Sugar 1 Liter	4	\$11.50	\$46.00		
Sugar Free Sweetener 1 Litre	4	\$12.00	\$48.00		
Honey 1 Liter	4	\$12.75	\$51.00		

APPENDIX D

Cost per package calculations:

$$\frac{\text{Total cost (raw)} + \text{Total cost (white)}}{\text{Total number of packages}}$$

1. Liquid Cane Sugar

$$\frac{\$11.50}{1000\text{mL}} \times \frac{7.4\text{mL}}{\text{package}} = \$0.0851 \text{ per pump}$$

2. GFS & Rogers

$$\frac{\$3168 + \$2260}{176000 + 22600} = \frac{\$5428}{402000 \text{ packages}} = \$0.0135 \text{ per package}$$

3. Sugar Stix

$$\frac{\$3344 + \$3164}{176000 + 22600} = \frac{\$6508}{402000 \text{ packages}} = \$0.0161 \text{ per package}$$

4. Sugar Tubes

$$\frac{\$2765.71 + \$3228.57}{176000 + 22600} = \frac{\$5994.28}{402000 \text{ packages}} = \$0.0149 \text{ per package}$$

5. Organic Fair Trade Cane Sugar

$$\frac{\$0.034}{5.4\text{mL}} \times \frac{7.4\text{mL}}{\text{package}} = \$0.047 \text{ per package}$$

Number of packages per budget calculations:

$$\frac{\text{Total cost (raw)} + \text{Total cost (white)}}{\text{Cost per pump of liquid sugar}}$$

1. GFS & Rogers

$$\frac{\$5428}{\$0.0851 \text{ per pump}} = 63,783 \text{ pumps}$$

2. Sugar Stix

$$\frac{\$6508}{\$0.0851 \text{ per pump}} = 76,475 \text{ pumps}$$

3. Sugar Tubes

$$\frac{\$5994.28}{\$0.0851 \text{ per pump}} = 70,438 \text{ pumps}$$

4. Organic Fair Trade Cane Sugar

$$\frac{\$0.034}{5.4\text{mL}} \times \frac{7.4\text{mL}}{\text{package}} \times 402000 \text{ packages} \times \frac{1 \text{ pump}}{\$0.0851} = 220,096 \text{ pumps}$$

APPENDIX E

Survey 1:

- Locations:
 - o Starbucks in the Village & at the Student Union Building (no liquid sugar)
- Number of people surveyed: 54 people.

Questions Asked:

1 Have you heard about liquid sugar?

- a. Yes (7) b. No (47)

2. Have you heard about syrup pump?

- a. Yes (47) b. No (7)

3. How many packaged sugar do you put in your drinks (ex. coffee, tea etc...)?

- a. 0-2 (14) b. 3-5 (30) c. 5-7 (6) d. More (4)

4. Do you recycle after the package?

- a. Yes (14) b. No (35) c. Sometimes (5)

5. Would you like to try liquid sugar if it's available in this (survey) location?

- a. Yes (50) b. No (4)

6. Do you take packaged sugar to go?

- a. Yes (54) b. No (0)

7. If yes, how many do you take?

- a. A lot (4-6) (35) b. A few (19)

Survey 2:

- Location: The Loop Café at the Centre for Interactive Research on Sustainability (with liquid sugar)
- Number of people surveyed: 13 people

Questions:

1. Have you heard about liquid sugar?
 - a. Yes (12)
 - b. No (0)
2. Would you prefer liquid sugar pump or packaged sugar?
 - a. Liquid (10)
 - b. Packaged (2)
3. Can you tell a difference taste between liquid sugar and packaged sugar?
 - a. Yes (3)
 - b. No (10)