

AN INVESTIGATION INTO GREEN LAUNDRY PRODUCTS FOR UBC VANCOUVER RESIDENCE

Bahar Pezeshg, Don Han, Gurmehak Kaur Sandhu, Isabelle Piche

University of British Columbia

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Bahar Pezeshg
Don Han
Gurmehak Kaur Sandhu
Isabelle Piche

University of British Columbia
Applied Science 261
Tutorial Section: T1C
Tutorial Instructor: Dr. Carla Paterson

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ABSTRACT

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By

Bahar Pezeshg, Don Han, Gurmehak Kaur Sandhu, Isabelle Piche

At the University of British Columbia (UBC), Student Housing and Hospitality Services (SHHS) is responsible for the housing of more than 8,000 students, faculty and staff. Laundry services are available in each residence at UBC’s Point Gray Campus in Vancouver. SHHS is looking for products that are environmentally friendly and will align with UBC’s commitment to the Water Action Plan (WAP) and the Sustainability Plan to introduce into residence laundry rooms and campus mini-marts.

This report compares three laundry detergents: *Tide*[®] as the benchmark brand that is commonly used by students and *eco-max*[®] and *Live for Tomorrow*[™] are the two green alternatives. The focus group for the investigation is students living in Place Vanier and Totem Park, the two first-year residences on campus. A student survey was conducted in these two residences and it is assumed that the results from this survey are indicative of the opinions of the majority of students. A performance test was completed to evaluate the functionality of the three products and compare the results. For the triple bottom line assessment, peer-reviewed journal articles were used to gather information about the environmental, economic and social aspects of these green laundry detergents. The use of both primary and secondary data allow for a complete analysis of green laundry detergents.

Based on the results of the student survey, the performance test and the environmental impact of the three detergents, it is recommended to make *Live for Tomorrow* available to students, faculty and staff living in residence on UBC's Vancouver campus. Overall, this brand performed better in environmental, economic and social terms compared to the two other brands investigated.

TABLE OF CONTENTS

ABSTRACT.....	ii
TABLE OF CONTENTS.....	iv
LIST OF ILLUSTRATIONS.....	vi
GLOSSARY.....	vii
LIST OF ABBREVIATIONS.....	viii
1.0 INTRODUCTION.....	1
2.0 METHODS OF INVESTIGATION.....	2
3.0 ENVIRONMENTAL IMPACT.....	4
3.1 TOXICITY.....	4
3.2 THIRD PARTY CERTIFICATION.....	6
3.3 PACKAGING.....	7
3.4 PERFORMANCE IN COLD WATER.....	7
4.0 ECONOMIC IMPACT.....	8
4.1 BENCHMARK BRAND: TIDE.....	9
4.2 GREEN OPTION 1: ECO-MAX.....	9
4.3 GREEN OPTION 2: LIVE FOR TOMORROW.....	10
4.4 FURTHER CONSIDERATIONS.....	10
5.0 SOCIAL IMPACT.....	12
5.1 CONSUMER PERFORMANCE.....	12
5.2 LOCAL SOURCING AND LABOUR STANDARDS.....	14
5.3 AVAILABILITY.....	14

5.4 AWARENESS OF SUSTAINABILITY	14
5.5 HEALTH CONSIDERATIONS	15
6.0 CONCLUSION AND RECOMMENDATIONS	16
REFERENCES	17
APPENDIX A: SURVEY QUESTIONS.....	19

LIST OF ILLUSTRATIONS

Tables

Table 1: Common Detergent Ingredients, Potential Environmental Impacts and Preferable Alternatives.....	5
Table 2: Detergent Ingredients and Benefits or Detrimental Effects.....	10
Table 3: Three Landry Detergents and their Associated Costs	9

Figures

Figure 1: <i>eco-max</i> before and after photos	13
Figure 2: <i>Live for Tomorrow</i> before and after photos.....	14
Figure 3: <i>Tide</i> before and after photos	14

GLOSSARY

Acid Rain:

Rain which contains a higher level of OH (hydroxide) ions and reduces the pH of the water, which may cause damage to both organisms and infrastructure.

Eutrophication:

A process by which a body of water becomes rich in dissolved nutrients, diminishing oxygen levels and a water body's ability to support forms of aquatic life.

Hypoallergenic:

Designed to reduce or minimize the possibility of an allergic response by containing relatively few or no potentially irritating substances.

LIST OF ABBREVIATIONS

EPA	Environmental Protection Agency
SHHS	Student Housing and Hospitality Services
UBC	University of British Columbia
WAP	Water Action Plan

1.0 INTRODUCTION

As part of UBC's Strategic Plan, the university's commitment to sustainability is outlined in the Sustainability Plan (UBC, n.d.). One of the ways to increase sustainable practices on UBC residences is through the use of green laundry detergents in campus laundry rooms. SHHS requested a triple bottom line assessment of a benchmark brand of laundry detergent as well as green alternatives. After the identification of these alternatives, there is a possibility of selling the detergents in vending machines in laundry rooms and also in campus mini-marts.

The purpose of this report is to provide SHHS with recommendations for what brand of detergent to use and whether or not having the detergent available is viable in terms of environmental, economic and social impacts. The recommendations made are the product of research into different laundry detergents available commercially today and the conclusions produced take into consideration all branches of the triple bottom line assessment.

The detergents investigated are as follows: *Tide* (Coldwater Acti-Lift), *eco-max* (Natural Lavender) and *Live for Tomorrow* (2X concentrate). All of these products are liquid laundry detergents that are available to consumers in various stores throughout the Lower Mainland. *Tide* is the benchmark brand used in this investigation; based on feedback from the survey, 89% of respondents chose this brand as the one they prefer. We decided to choose green alternative detergents that were also in liquid format for two reasons. Firstly, there would be fewer variables involved to account for during the performance test and secondly, the majority of students use liquid detergent so they may be hesitant to convert to a powder format. Other factors that influenced our choice of alternative detergents were the location of production and the price since these were indicated as having a larger weight of importance to SHHS.

2.0 METHODS OF INVESTIGATION

The triple-bottom line analysis was used to assess green laundry detergent against a benchmark brand. This analysis takes into account the environmental impact, economic impact and social impact to ensure the assessment fully encompasses the effect of using green laundry detergent in UBC Residence. The focus group for our investigation is students living in first-year residences: Totem Park and Place Vanier. This group was chosen because it represents over 3,000 students who live on residence at UBC and this provided a large pool of students who have similar conditions with regards to doing laundry. The laundry rooms in these residences are comparable, as well as the access students have to laundry detergent. Currently there is laundry detergent available in the three campus mini-marts (located in Place Vanier, Totem Park and Gage Towers) and also at Save-On-Foods, Shoppers Drug Mart and other stores located on campus.

For primary investigation, we conducted a survey of students living in the first-year residences. The survey was completed online and was anonymous. The sample size of the population was 83 students. Besides their answers, we do not know anything about the participants in the survey and therefore cannot be sure that they truly represent the diversity of the population. The questions asked in the survey can be found in Appendix A. It was important to survey these students as they are part of the population that would be affected by the introduction of green laundry products. Their input was useful to know what they value and take into consideration when choosing a laundry detergent. We also visited The Soap Dispensary located in Vancouver to gather general information about laundry detergents. The owner Linh Truong gave recommendations and insight into different products, including some made locally.

A performance was performed using the three laundry detergents to determine the functionality of the products. This was done by staining three pieces of cotton cloth with red wine, chosen for its notoriety in difficulty to remove from clothes. These cloths were then washed with other regular laundry and the before/after pictures give some indication to the performance of the detergents. The same machine was used for each load to reduce the variability of conditions.

For secondary sources, we read peer-reviewed articles about the chemistry of laundry products and comparisons between green laundry products and more traditional brands. We also looked at UBC's Water Action Plan and Sustainability Plan to ensure the products we chose to investigate would align with these documents.

3.0 ENVIRONMENTAL IMPACT

For the environmental aspect of the triple bottom line analysis, several indicators were used to assess the laundry detergents. The toxicity of the detergents was examined, as well as if the products are third party certified. Since UBC's WAP does not have a specific section regarding laundry detergent usage, it is difficult to judge whether or not these products are in compliance with the plan. However, the Sustainability Plan does include some goals which would be connected to UBC residence and in turn, laundry rooms in those residences. Also, the packaging of the detergents evidently have an environmental impact. Lastly, the performance tests of the three detergents were conducted using cold water. The performance of the detergent in cold water is a key factor since not using hot water in washing machines is beneficial with respect to energy conservation.

3.1 TOXICITY

A concern associated with some ingredients in laundry detergents is their toxicity and the effect on aquatic organisms. These ingredients can persist in the environment and cause eutrophication* of fresh water. The main cause of eutrophication is phosphate-based laundry detergents. Phosphorous is an essential nutrient for plant growth and it is also the "limiting nutrient" for the growth of blue-green algae in inland waterways. In recent years, phosphate has been replaced by zeolite in detergents to mitigate the effects of detergents on the aquatic environment. Ingredients in laundry detergents may also cause fresh water to become acidic and depending on where that water ends up, it could have an effect similar to that of acid rain*

*This term and all subsequent terms marked with an asterisk can be found in the glossary on p. vii.

(Laundry Consulting, n.d.). The concentration of an ingredient in a detergent is used to measure the degree of its toxicity.

In laundry detergents, the main ingredients are surfactants, builders, bleaches, colorants, optical brighteners and solvents (Frydendall, E., 2009) The majority of these ingredients are not present in large enough concentrations to cause great environmental impact and this is largely due to regulations that have been put in place to protect the environment (EPA, 1999). Table 1 has some of these ingredients listed along with the common concerns associated with them and possible alternatives. While the potential environmental impacts may not seem to directly impact humans, it is important to remember the indirect consequences as well. Table 2 lists the ingredients of the three laundry detergents investigated and either the benefits or detrimental effects associated with each brand.

Table 1: Common Detergent Ingredients, Potential Environmental Impacts and Preferable Alternatives

Ingredient	Potential Environmental Impact	Preferable Alternative
Surfactants	Toxic to aquatic organisms because they affect metabolism, reproduction and growth of organisms	Biodegradable surfactants with straight carbon chain compounds
Builders	Eutrophication of fresh water	Non-toxic or low toxicity varieties
Bleaches	If made of sodium hypochlorite, can create hazardous gases, damage fibers and produce excess lint (a potential fire hazard).	Detergents that do not contain bleach
Colorants	Some may be carcinogenic	Non-carcinogenic varieties, or elimination of this ingredient altogether

Table 2: Detergent Ingredients and Benefits or Detrimental Effects

Brand	<i>Tide</i>	<i>eco-max</i>	<i>Live for Tomorrow</i>
Ingredients	Water, Alcoholethoxy sulfate, Alcohol sulfate, Linear alkylbenzene sulfate, Sodium fatty acids, Diethylene glycol, Propylene glycol, Diquantemium ethoxy sulfate, Borax, Polyethyleneimine ethoxylate propoxylate	Water, Plant-based surfactants, Food-grade sodium citrate water softening agent, Food-grade cellulose thickener from plants, Food-grade potassium sorbate preservative, Food-grade citric acid	Deionized water, Xanthan gum, Cocamido-propyl betaine, Alkyl polyglucoside, Sodium carbonate, Borax, Potassium sorbate
Benefits or Detrimental Effects	Linear alkylbenzene sulfate can have a harmful effect on aquatic life (McAvoy, Eckhoff, & Rapaport, 1993)	Hypoallergenic, not tested on animals, non-toxic	Biodegradable, not tested on animals, non-toxic, phosphate-free (Eco-max, n.d.)

3.2 THIRD PARTY CERTIFICATION

For a laundry detergent to be considered green and be eligible for third party certification, the ingredient list must follow the guidelines of the Environmental Protection Agency (EPA) in the United States, or Environment Canada’s Federal Environmental Quality Guidelines. These agencies ensure compliance with the regulations and serve to provide the public with safe products (EPA, 1999). Both *eco-max* and *Live for Tomorrow* are *EcoLogo*[®] certified, while *Tide* does not have this designation. *EcoLogo* standards are very clear and open to public. It takes 12-18 month to process the information and *EcoLogo* only certify the top 20% of products available in the market (EcoLogo, n.d.). *EcoLogo* standards address multiple environmental attributes through the entire life cycle of the product. These products also must meet certain performance requirements. After a standard is finalized, any manufacturer that demonstrate compliance the stringent requirements is eligible for *EcoLogo* certification.

3.3 PACKAGING

The packaging of the detergents has an environment effect. While *Tide*'s bottle is made of 25% or more post-consumer recycled plastic, it does not fare well in comparison to the other brands. *Live for Tomorrow* is a glass bottle and therefore is more durable. Also, students can refill the same container and therefore it should theoretically last longer. The third bottle, from *eco-max*, is a plastic container and is clearly marked with a recyclable sign. Also, the specific products of *Tide* and *eco-max* tested were not concentrated solutions and therefore require more packaging than *Live for Tomorrow*, which is 2X concentrate. This last brand will be selling an 8X concentrate solution within the next year, further reducing the packaging required.

3.4 PERFORMANCE IN COLD WATER

Another factor which affects the environmental impact of laundry detergents is the performance in cold water. If laundry is done using cold water, the main benefit is saving energy which, instead of being used to heat up the water, can be utilized elsewhere. Thus having a product that performs well in cold water is an important attribute and will be further discussed in section 5.1 of this report.

4.0 ECONOMIC IMPACT

The key factor to consider when looking at the economic side of this triple bottom line analysis is the cost of the product. To account for the total cost of the product, the fixed costs are considered to be equal for the three brands. This assumption is made because it was difficult to obtain data from the three companies about their operational costs such as rent, manufacturing machinery, etc. The variable costs take into account the cost of the raw materials, labor, and transportation. Again, data about the cost of raw materials and labor were not accessible therefore the principle indicator used is the transportation cost. For this cost, the comparison is between the cost of shipping a 10kg package from the production location of the three detergents to UBC's campus to give a baseline indication of the relative transportation cost.

In this section, the focus is to consider two brands of green laundry products and compare them to the benchmark brand in economic terms. The greatest proportion of the students surveyed indicated the laundry detergent they choose is 60-80% determined by the price. This shows that budget constraints are of chief importance to first-year students. Table 3 below displays the three brands of laundry detergents with their associated costs. Interestingly, both of the green options have a lower cost per load than the benchmark brand which contradicts the popular belief of greener options being, in a strictly monetary sense, more costly. Both the cost per litre and the cost per load are given for ease of comparison, depending on which indicator is preferred.

Table 3: Three Laundry Detergents and their Associated Costs

Brand	<i>Tide</i> (Coldwater Acti-Lift)	<i>eco-max</i> (Natural Lavender)	<i>Live for Tomorrow</i> (2X Concentrate)
Production Location	Georgia and Virginia, USA	Oakville, Ontario, Canada	Port Moody, BC, Canada
Transportation cost (\$/kg)	\$22.78	\$13.94	\$6.06
Initial Cost (\$/L)	\$5.41	\$5.33	\$7.94
Refill cost (\$/L)	N/A	N/A	\$5.50
Number of advertised loads	52	50	60
Cost per load (\$/load)	\$0.35	\$0.32	\$0.25 (for first bottle) \$0.17 (for refills)

4.1 BENCHMARK BRAND: TIDE

As the most popular brand of laundry detergent for first-year students, *Tide* has proven its performance to its consumers. However, compared to *eco-max* and *Live for Tomorrow*, it has the highest cost per load at \$0.35. People are often hesitant to opt for greener choices in their everyday lives due to the presumption that they more costly but here is evidence to the contrary. Since *Tide*, produced in south-eastern USA, is imported to Canada and then distributed to vendors, the transportation costs are incorporated in the consumer cost.

4.2 GREEN OPTION 1: ECO-MAX

eco-max is the second least expensive brand of the three at \$0.25 per load. *eco-max* provides free shipping via Fedex Ground services to major cities for purchases over \$50.00 and thus transportation costs can be considered as incorporated in the consumer cost. If SHHS wants to further look at bringing *eco-max* to UBC, the bulk quantities transported would qualify for the free shipping. This brand is also available at several locations in the Metro Vancouver area. If chosen as a viable option, *eco-max* could be delivered to campus in the ready-for-shelves format

that is available in stores either directly from Ontario, or from a local store. There are ten stores within 10 km of UBC which carry Eco-Max products, so students looking for greener alternatives do not have to travel far.

4.3 GREEN OPTION 2: LIVE FOR TOMORROW

As the most inexpensive brand for cost per load of the three options, *Live for Tomorrow* is an attractive choice from an economic standpoint (see Table 3). It is produced locally Port Moody which reduces the transportation costs involved. Discussion with the owner of the Soap Dispensary Linh Truong led to talk of a discount if a bulk amount of this product is bought. Specifically, there are 20L containers (\$100 for each container) that could be delivered to UBC and placed in laundry rooms in residences so students do not have to travel to Main Street when a refill is needed. This possibility of refills is another advantage of this product. For a 1.89L bottle of detergent, which costs \$15.00 for a first time purchase, the refill price is \$10.40. Since it was determined that price is the biggest factor for first-year students purchasing laundry detergent through the survey feedback, this makes *Life for Tomorrow* the best option economics-wise.

4.4 FURTHER CONSIDERATIONS

There was discussion of potentially installing vending machines in laundry rooms to sell these products to students. This possibility would require an investigation into the feasibility of installing the machines in the laundry rooms or nearby, and the logistics of keeping the items in stock. The products mentioned above come in sizes that range from 1-3L containers and the space limitations are important to consider when looking at this option. For this investigation, the

option of selling the products in the campus mini-marts was considered and therefore the bottle sizes reflect what is typically used by a first-year student.

5.0 SOCIAL IMPACT

The remaining aspect of the triple bottom line analysis is the social impact. Based on the survey results, the majority of first-year students put more importance to the price of the detergents they buy rather than the social impact of the brand they purchase. To be successfully implemented, the green laundry alternative to the benchmark brand must be a viable option in terms of appealing to students, who will be the principle consumers of the detergents. Various factors play a role in the success of a product, including the performance of the product, brand loyalty and product recognition (Gleim et al., 2013). This section will explore different sides of the social impact: the consumer performance, local sourcing, labour standards involved in the production, availability of the product and the awareness of sustainability.

5.1 CONSUMER PERFORMANCE

Since both consumer demand and satisfaction are driven by the performance of the product, we tested the three detergents and got the following results. *Tide* performed better when compared with *eco-max* and *Live for Tomorrow* for the removal of the wine stain applied to a cotton cloth. Between the two green alternatives, *Live for Tomorrow* did better than *eco-max*. No difference was noted with regards to the softness and fragrance of the cloth. More testing is required to judge the long-term effect of the detergents on fabrics. The three figures below show the before and after pictures of the three cloths used in the performance test.



Figure 1: *eco-max* before and after photos
Source: Bahar Pezeshg photo.



Figure 2: *Live for Tomorrow* before and after photos
Source: Bahar Pezeshg photo.



Figure 3: *Tide* before and after photos
Source: Bahar Pezeshg photo.

5.2 LOCAL SOURCING AND LABOUR STANDARDS

Live For Tomorrow is Port Moody-based company and falls within the 150 mile radius of UBC and is expected to abide by BC Employment Laws set by Ministry of Labour and Citizens Services, BC (BC Ministry of Labor, 2013) whereas *eco-max* is Ontario based company and is expected to abide by Employment Standards set by Ontario Ministry of Labour (Ontario Ministry of Labour, n.d.). *Tide* is an international company and it is unknown what labour standards govern their production. The probability that at least some part of the production process of laundry detergent is in developing countries is quite high and thus it is difficult to assess if fair employment practices are ensured during the entire production process.

5.3 AVAILABILITY

Both the green products could be made accessible to students in UBC Residences via the mini-marts and residence vending machines. The logistics of implementing vending machines in laundry rooms requires further investigation to determine its feasibility. Since both the green alternative brands are commercially available today, they come in different sizes that are compatible for student consumers. During discussion with the owner of The Soap Dispensary, the possibility of having large quantities of the product brought to UBC was mentioned and if SHHS decides to move forward with this proposal to bring in green laundry detergent to UBC residences, further discussions would be required and potentially fruitful.

5.4 AWARENESS OF SUSTAINABILITY

Both of the green detergents have the potential to raise awareness of sustainability. The products are already branded to show their sustainable qualities by having prominent logos and

succinct points covering their features. To promote sustainability in residence, the products could be introduced during events like AIM to Sustain in Place Vanier and Totem Park. The packaging of the bottles show that they are recyclable, which will reduce landfill waste. *Live for Tomorrow* encourages the three R's (Reuse, Reduce and Recycle) by providing cheaper refills and this could further benefit students if refill stations were provided in various residences.

5.5 HEALTH CONSIDERATIONS

Since the toxicity of the green detergents is lower than for *Tide*, they pose less of a health risk to consumers. Both of the green products also offer hypoallergenic* varieties of laundry detergent for consumers with sensitive skin or other sensitivities. *Live for Tomorrow* does not contain any added scents or perfumes and *eco-max* contains natural essential oils which are suitable for people who cannot use certain detergents that contain parfums.

6.0 CONCLUSION AND RECOMMENDATIONS

Based on the three categories assessed in the triple bottom line analysis, it is recommended that *Live for Tomorrow* is the brand of green laundry detergent that should be made available to students living in residence on the UBC Point Gray campus. Compared to *Tide* and *eco-max* detergents, *Live for Tomorrow* is a winner in all three categories: environmental impacts, economic impacts and social impacts. The benchmark brand, which was the most popular choice of the students surveyed, contains some ingredients which are potentially harmful to the environment, is the most expensive and is not locally produced. While *eco-max* is a third party certified product, it is slightly more expensive than *Live for Tomorrow* and is produced in Ontario which does not fulfill the desirable condition of having a locally-produced detergent. Therefore, the best option is *Live for Tomorrow* as it has the elements that are preferred: third party certified, cheaper than the leading benchmark brand, locally produced while not sacrificing anything in terms of performance.

Since the scope of this investigation was focused on students living in first-year residences, it is recommended to further investigate the opinion of a larger sample size of residents on campus. This would allow for more information on the popular opinion about green laundry detergents and whether or not making them available to students would make more of them switch to greener alternatives. It would be beneficial to have the participants in the survey use different products and provide feedback on the performance of the detergents. Hopefully there will soon be green laundry detergent available to students living in residence and UBC can take one step more towards achieving its sustainability goals.

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APPENDIX A: SURVEY QUESTIONS

Question 1: What year of your studies are you in? (1,2,3,4)

Question 2: Where do you buy your laundry detergent? (Save-On-Foods, Shoppers Drug Mart, Safeway, UBC Village, Mini-marts in residences, off campus)

Question 3: Which brand of laundry detergent do you prefer? (Tide, Purex, Gain, Cheer)

Question 4: How much does the price of the product affect your choice of laundry detergent? (0-19%, 20-39%, 40-59%, 60-79%, 80-99%, 100%)

Question 5: How important is buying a green laundry detergent to you or how often do you buy green laundry detergent? (0%, 1-24%, 25-49%, 50-74%, 75-99%, 100%)

Question 6: How much extra are you willing to pay for a 1.5L bottle of laundry detergent? (\$0, \$1-4, \$5-9, \$10-14, \$15-19, \$20 and above)

Question 7: Would you prefer to buy a locally made product over your current choice of laundry detergent if the performance is the same? (Y/N)