

GROUP

34

Design Symposium



Context/Background

Soap is a product that results from the mixture of fats and oils in lye, heated sodium hydroxide solution, through a process called saponification.

Saponification is the chemical process that creates soap, which is when triglycerides (oils) are reacted with lye. Lye can include either sodium hydroxide or potassium hydroxide, to generate glycerol and a fatty acid salt, which is the soap. Lye that contains sodium hydroxide is used for harder soaps, while potassium hydroxide is used for liquid soaps.

For this design project, over 30 groups of 4 students were tasked with designing and creating a bar of soap that would be put on display and judged at a symposium. These groups had to decide what components to put in their soap that would make others want to purchase it. Each group was only allowed to use 500 grams of oil in their total mixture and had to decide what properties their soap should have, which could be altered by the types of oils used. The goal was to create a pleasant smelling, low cost and well-functioning bar of soap within a couple of weeks.

Design of Soap

Composition

- The oils chosen were Crisco, ghee and coconut oil
- Focused on producing a well-rounded soap
- Lavender essential oil used to give a lavender scent
- Avoided using expensive items



Appearance

- Used two molds (A bar soap holder and glass cup)
- Have two different available shapes (Bar and puck shape)



Design of Packaging

- Used construction paper as the material for packaging
- Wanted an environmentally friendly design
- Will have an opening on the top so that people can smell the soap before purchasing it
- The design includes information such as the name of the soap, name of group, ingredients, etc.
- Simplistic design



The luscious lavender bar soap is guaranteed to provide a level of cleansing unlike anything you have ever seen before. Frubble Bubble™ is dedicated to producing the best organic and hand-made bars of soap on the market and with our only secret ingredient being love, you won't believe it's not magic!

INGREDIENTS

Glycine Max (Crisco), 100% Organically Distilled Eau (Water), Cocos Nucifera (Coconut Oil), Ghee, Sodium Hydroxide), essential oil blend (Lavender, Peppermint, Spearmint)



"FRONT VIEW (LOGO)"

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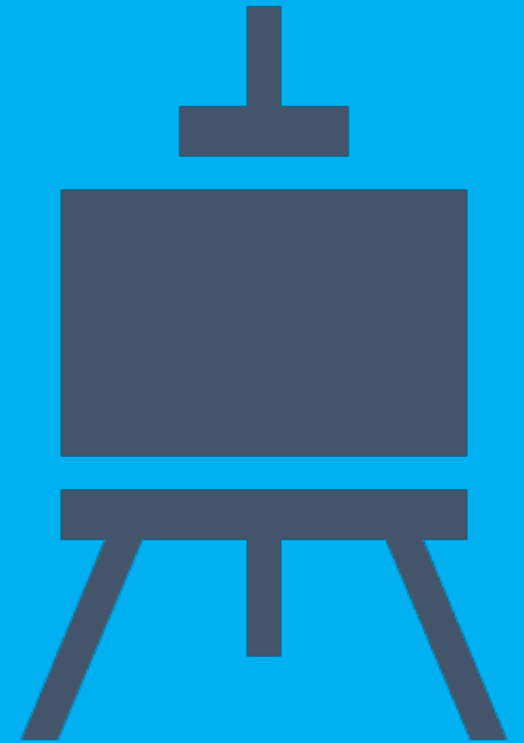
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"BACK VIEW"

Design Criteria and Constraints

- The products we used were ghee, coconut oil and Crisco oil. These oils produce a harder, more lathery and creamy soap that also acts as a great moisturizer
- The product quality of our soap is excellent because the soap was hardened quickly and very easy to cut into even pieces, therefore, it was created to sustain a fall, so it would not break
- The soap was cut into pucks and a rectangle. These are the most common shapes of soap so they would be more familiar to customers
- We used the cold process because we were only given the right equipment for cold process, not hot process. Using hard oils allowed a shorter hardening time.
- We decided from the start that we wanted our soap to smell nice and soothing. We decided upon lavender. We chose a blend of Lavender, Peppermint, and Spearmint that we all enjoyed.
- We created a well-rounded soap, even with the constraints we had to follow.



Why We Chose Specific Materials

Crisco Oil:

- Increased the Hardness of our soap

Coconut Oil:

- Increased the Creamy Lather of our soap

Ghee:

- Increased Creamy Lather and Hardness of the soap

Lavender, Spearmint, Peppermint Scent:

- Lavender reduces anxiety
- Spearmint and Peppermint reflect Winter, and the festival of Christmas.



Mold Selection

We used two molds: A bar soap holder and a glass cup. The soap that was molded out of the bar soap holder weighed the most, at 145g. The soap that came out of the glass cup was cut into successively smaller pieces.

These two molds were readily available to us and were very economical. No extra money had to be spent on customizing a specific mold. The shapes we got are very easy to hold and are compact, which is why we chose these molds.



Packaging

To package the soaps, we used eco-friendly construction paper. It came in different colors and is completely biodegradable and recyclable. It is perfect with our soap because construction paper is not disintegrated by the soap, unlike some other materials.

Our packages are like small pouches that the soap is put into and can easily be taken out of. On the front side, our logo was pasted along with the mass of the soap in grams. Behind it, the list of ingredients was pasted along with a paragraph describing the soap.



Other

- Sustainability is becoming increasingly important in today's society due to the rising awareness of the environment and the desires of environmentally friendly products.
- When producing this soap, one of the main objectives was attempting to create an inherently safer and sustainable product by applying these concepts.
- Firstly, this bar of soap is designed to be simplistic and uses minimal extra components. This was done to prevent excess waste from being produced during the production of the soap, such as dye packaging.
- Also, the packaging of the soap primarily uses environmentally friendly material, being construction paper. Once the soap is removed from the packaging, the package can be recycled.
- Finally, in order to have a safer design, 5% super fat was used in the soap, meaning that only 95% of the required sodium hydroxide was used so that all the sodium hydroxide reacts and is not leftover.



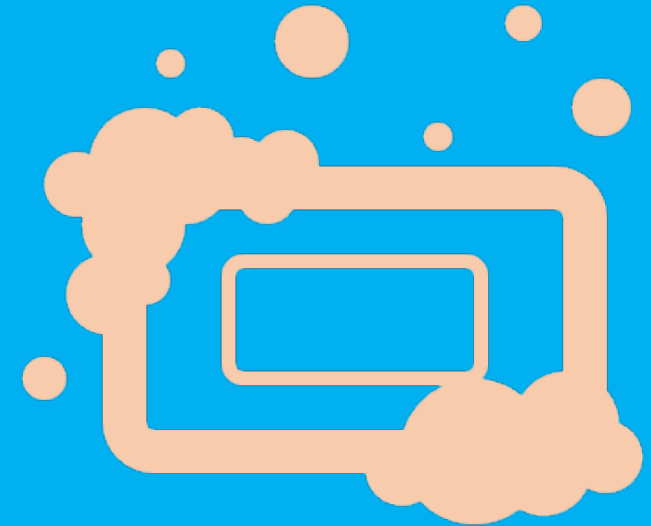
Raw Data Affiliated to Ingredients

The main ingredient in our soap, Crisco, contributed the majority of the hardness and creamy lather. Coconut oil and ghee made up the rest of our soap as far as oils go. Coconut oil helped increase the hardness, cleansing a large amount, and creamy lather. Ghee helped to increase the hardness, cleansing, but mostly creamy lather. Sodium hydroxide was used as the lye to solidify the soap via saponification. Water was used to create the lye solution that was mixed into the oil mixture. It was recommended by Prof. Aucoin to put 38% of the total mass of oils as the mass of water. The mixture of essential oils did not affect the properties of the soap at all, but created a delicious aroma.

Oils	Oil Properties								
	SAP (NaOH)	SAP (KOH)	Hardness	Cleansing	Bubbly Lather	Creamy Lather	Conditioning	Density	Cost
Coconut Oil, 76 deg	0.183	0.257	79	67	67	12	10	0.92	1.63
Ghee, any bovine	0.162	0.227	55	15	15	40	22	1.01	1.67
Crisco, old	0.137	0.192	26	0	0	26	70	0.81	0.42
Avocado Oil	0.133	0.186	22	0	0	22	70	0.92	1.86
Olive Oil	0.135	0.19	17	0	0	17	82	0.92	0.6
Sesame Oil	0.134	0.188	15	0	0	15	83	0.92	1.77
Corn Oil	0.137	0.192	14	0	0	14	84	0.92	0.27
Grapeseed Oil	0.129	0.181	12	0	0	12	88	0.92	0.86
Sunflower Oil	0.135	0.189	11	0	0	11	87	0.92	0.28
Canola Oil	0.133	0.186	6	0	0	6	91	0.92	0.21

Options and Iterations

- Various ideas and iterations were considered during the production of the bar soap, such as the type of oils, molds, and others.
- For the appearance of the soap, the initial idea was using a silicone mold in the shape of a wrench and pouring the mixture in it to produce wrench shaped bars of soap. However, this idea proved to be too costly
- As for the fragrance, it was decided that lavender essential oil would be used to give the soap a lavender scent; however, other options considered included lemongrass, mint, and cedarwood.
- The objective of designing this soap was to produce a well-rounded hand soap, meaning that all the focus was not put into one certain property of the soap, but instead, all the features were targeted.
- The oils used were Crisco, ghee and coconut oil due to these soaps having high values for all the targeted properties, which are hardness, cleansing, bubbly lather, creamy lather, and conditioning.
- Canola oil was also considered as it had the highest value for conditioning compared to the other provided oils; however, this oil lacked in every other property and thus was not chosen.



Soap Calculator: As Designed vs. As Made

For our soap, we wanted to mainly focus on hardness, creamy lather, and cleansing. To get these values as close as we could on the range that we chose, we sacrificed bubbly lather and conditioning. We chose the focused upon properties to be as high up on the scale as we could, but not quite at the top.

Hardness	Cleansing	Bubbly Lather	Creamy Lather	Conditioning
43.65157258	17.76129	17.76128504	25.89028754	46.82842346
29-54	12-22	14-46	16-48	44-69
44	18	24	36	52

The 3rd row shows the recommended values, which were given to us by Prof. Aucoin. The bottom row is the targets we were hoping to get. The 2nd row is what we actually got using solver. Notice how the hardness and cleansing values are close to what our targets were, while bubbly lather and conditioning are not as much. Sacrificing some of our creamy lather value to get hardness and cleansing to be on point was ok with us, since it was still quite high on the range, whereas conditioning and bubbly lather are not.

Our soap fits into the qualities that we wanted perfectly. It could be slightly harder, but is still hard enough and doesn't fall apart. It's creamy lathering is very good as it lathers up when using it like a standard bar of soap very quickly.

Soap Calculator: As Designed vs. As Made - Continued

This table shows the amount of oils we had to use on a 100g basis. These are the values we used, and ended up giving us the designated qualities.

Oils	Quantity (g)
Coconut Oil, 76 deg	21.803456
Ghee, any bovine	21.019797
Crisco, old	57.176747

Economics

Materials

Calculations:

$$\left[\left(\frac{285g}{\frac{0.91g}{ml}} * \frac{0.42\$}{1 \text{ ml Crisco}} \right) + \left(\frac{105g}{\frac{1.01g}{ml}} * \frac{1.67\$}{1 \text{ mL Ghee}} \right) + \left(\frac{110g}{\frac{0.92g}{ml}} * \frac{1.63\$}{1 \text{ ml Coconut}} \right) + \left(72gNaOH * \frac{14.93\$}{500g NaOH} \right) + 0.15 \text{ (Essential Oil)} \right]$$

[divided by 465g product]

= \$0.01325/g finished soap

This is the calculation for the raw materials. This is Crisco, Ghee, Coconut Oil, Sodium Hydroxide, and Essential Oils respectively. The summation of the cost of raw materials divided by the amount of product we are selling gives the total cost/weight.

Our packaging is construction paper, which is both eco friendly and economic. It costs us approximately \$0.02 per package.

Profit - Margins

Our goal is to keep our profits reasonable. This allows us to provide our product to the consumer for a price that can't be beat, while we still pocket a decent amount of money from it. For that reason, we decided to charge 66% more than the raw materials cost; giving us a profit of 66%. The following table shows the price point for each bar of soap.

Losses

We accounted for the losses within the first calculation, instead of dividing by the total amount of product we produced, the total amount of product that is being sold is divided. This allowed us to account for any losses easily and allow us to not lose any money.

This way, we aren't losing any money from any pieces left unsellable, or any weight adjusting on the soap.

Economics Continued

	Raw Materials Cost:	Profit:	Total Market Price:
70g	\$0.95	\$0.60	\$1.55
85g	\$1.15	\$0.75	\$1.90
145g	\$1.94	\$1.31	\$3.25

This table shows the cost breakdown for each of our 5 bars of soap. The labour is 25% of the raw materials cost, the amount of \$ we are rounding up, the total market price, and our profit, which is labour and roundup added together.

Ingredients List

- Coconut Oil/ huile de noix de coco/Cocoes oleum
- Crisco Oil/huile de crisco/crisco oleum
- Ghee
- Sodium Chloride/chlorure de sodium/vita super terram
- Lavender Essential Oil/Huile essentielle de lavande/ *Lavandula angustifolia*

