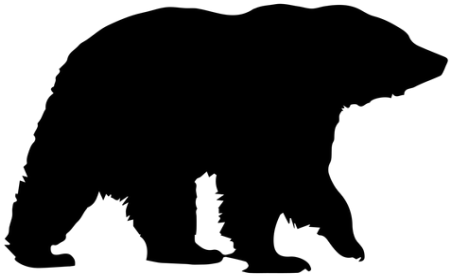
# Luxurious Lavender Soap

Group 24

# A Special Story of our Soap



You go out for a late morning walk in the forest, wearing your favourite hiking shoes, and embracing yourself in mother nature. As you find yourself trapped in the spirit of adventure you accidentally slip and fall down a steep slope tumbling down in a field of leaves and sticks. DOH! You find yourself in a pile of bear vomit!

You try and get home as quickly as you can only to realize that you have house guests coming over for a barbeque in less than ten minutes. Smelling like bear vomit sucks. No one wants to smell like bear vomit. We don't want you to smell like bear vomit.

So you use *Luxurious Lavender*, the best soap suited for the job.  It will eliminate the smell of bear vomit with the luxurious scent of lavender, while leaving a smooth feeling on your skin.

Oh, this soap is also used for general cleansing purposes, not just for bear vomit.

# Design Criteria:

- Hardness:
  - Medium hardness so it is not mauluable when wet but also not brittle when dry
- Cleaning:
  - Have a high cleaning potential so that it can clean house-hold dirt and grime without large effort from the user
- Lather:
  - Have sufficient bubbly lather for use in the bath
  - Also have a creamy lather so the conditioning effect can have full effect
- Conditioning:
  - Be able to condition dry skin so washing with hot water does not damage skin
- Appealing Qualities:
  - Have a pleasant scent and inviting design to increase user comfort
  - Also not contain any animal products to be vegan friendly

# Context

The objective of this project is to design a soap that is both unique and effective for the user.  The materials required for the production of soap is a lye solution (NaOH dissociated in water) combined with a specific combination of oils that make up the properties of the soap. This undergoes a chemical reaction called saponification where the triglycerides in the oils react with the lye solution and produce a fatty acid organic salt (which is the soap) and glycerol.

The work and research conducted for this project included determining the properties of the oils, the effect of oils on saponification, and the masses required of the oils and lye solution in order to create a soap off of a basis of 500 grams of oil used.

# Saponification Process

- Saponification is a fat is mixed with an alkali and produces a fatty salt and glycerol.
- The fat used is often a triglyceride in a liquid state, commonly a product of animal fat or vegetable oil. The alkali used is most often sodium hydroxide, which when mixed with a triglyceride creates a hard soap.
- This is an acid-base reaction that forms the organic salt-soap, where the acid is a fatty acid and the base is usually a strong alkali, a soluble base such as Caustic Acid (NaOH commonly known as Lye).
- **Organic Acid** (Triglyceride) + **Base Organic Salt** (Soap) + **Glycerol**
- In this process oils and Sodium Hydroxide are heated and mixed together, then the reaction occurs which creates the solid soap

## Coconut Oil

- Has a high cleaning property - 67
  - This contributes to our soaps commitment to being able to clean effectively
- Higher than average hardness factor - 79
  - This keeps the soap from becoming soft when exposed to water
- Appealing solid color white
  - The color white is often associated with cleanliness

## Crisco Oil

- Moderate hardness factor - 26
  - Keeps the soap from breaking or cracking when left in dry areas
- The conditioning value is above average - 70
  - This helps the soap to be able to condition skin and prevent damage
- Contributes to creamy lather - 26
  - This allows the conditioning values this oil provides to be effective

# Avocado Oil

- The soap has a high hardness - 22
  - Contributes to the soap's ability to lather quickly
- Avocado Also has health benefits:
  - Reducing heart pressure (Ortiz-Avila,)
  - Improved Mitochondrial function (Márquez-Ramírez, )
- A high conditioning value - 22
  - Assists in the soaps commitment to being able to protect dry skin

# Environmental Impact

- The soap was made without any ghee or bovine oils
  - These oils were replaced with coconut and crisco oils
- Creates and environmentally and conscious friendly soap
- This is also an appealing quality to most consumers

# Lavender Oil

- Pleasant Aroma, that is not overpowering
  - Provides a soft soothing scent
- Works well for both washing hands and clothes
  - Allows for any substance washed with the soap to stay smelling fresh and clean
- Creates a pleasant atmosphere for the consumer

# Corn Oil

- Results in a softer soap - 14
  - This causes the soap not to become brittle when it is left in dry areas
- Has a very high conditioning value - 84
  - Helps to maintain smooth healthy skin
- High creamy lather - 14
  - Allows the condition effects of the soap to be more effective

# Mold Selection

- The mold for our soap was chosen to be a Pringles container
  - Resulted in less waste from spills since all of the soap was poured into one container
  - Allowed for the soap to be cut into different sizes as need when the soap had hardened
  - Created a symmetrical round shape for the soap
    - Which easily fits in the palm of an adult hand for less likely hood of the soap being dropped
  - This type of mold was also cost effective
    - Allows for the soap to be sold at a lower price

# Packaging

- Wrapping of soap:
  - The brown parchment paper was chosen for the wrapping:
    - Provided a clean natural look
    - Inexpensive decreasing the price of the soap
    - Allowed for sent to escape so the lavender could be enjoyed before opened
- Label of the soap:
  - Purple coloring to represent lavender
  - Simple ingredients list
    - Appears less intimidating and more natural
  - Prices placed on it so there is no need for an extra label

# Iterations

- Option where lavender was not used:
  - Pros:
    - More cost effective
  - Cons:
    - The smell from the crisco oil would have not been pleasant
- Option where less coconut oil was used:
  - Pros:
    - Would be more cost effective and the soap would have more exotic color
  - Cons:
    - Would have much lower cleaning value
- Option where animal products where used:
  - Pros:
    - More cost effective and would have had higher cleaning value
  - Cons:
    - The soap could not be marketed with being animal friendly and would have had a diffrent more yellow color

# Soap Calculator

- Used to adjust the properties of the soap
- Used to change the oil quantities

| Oils | Percentage | Quanity (g) | SAP (NaOH) (g) | Hardness | Cleansing | Bubbly Lather | Creamy Lather | Conditionning |
|---|---|---|---|---|---|---|---|---|
| Coconut Oil, 76 deg | 30% | 151.14 | 27.66 | 23.88 | 20.25 | 20.25 | 3.63 | 3.02 |
| Ghee, any bovine | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crisco, old | 25% | 125.00 | 17.13 | 6.50 | 0.00 | 0.00 | 6.50 | 17.50 |
| Avocado Oil | 21% | 105.75 | 14.07 | 4.65 | 0.00 | 0.00 | 4.65 | 14.81 |
| Olive Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sesame Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Corn Oil | 21% | 103.11 | 14.13 | 2.89 | 0.00 | 0.00 | 2.89 | 17.32 |
| Grapeseed Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sunflower Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canola Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| lavender | 3% | 15.00 | 2.73 | | | | | |
| **Total** | 100% | 500 | 71.93 | 37.92 | 20.25 | 20.25 | 17.67 | 52.65 |

# Green Chemistry

Because no wax was added on our product, the use of parchment paper for the soap wrapping and the use of regular paper for the labeling enables the user to either recycle or compost the wrappings once removed from the soap. This will not harm the environment compared to other soap designs that incorporate plastic wrapping on their soaps.

In return, our soap leaves less of a carbon footprint, is more natural, and uses cheaper wrapping material for a more cost effective and environmentally friendly product.

# Price Breakdown

Cost of Materials:

Coconut Oil: $2.68

Crisco: $0.65

Avocado: $2.14

Corn: $0.30

Lavender: $8.45

NaOH: $2.15

Price per Gram:
Oils = $0.0284/g
NaOh = $0.0299/g
Total = $0.0583/g

Prices of Packaging = $0.04/bar

Profit Margin = 10%

There are two different sizes of soap. The heavier group has an average mass of 81g and the lighter soap group has an average mass of 61g.

Price (small bar) = 3.95
Price (large bar) = 5.60`

The range category of the small bars are 50g to 68g.
The range category of the large bars are 86g to 88g.
These categories will have their unique pricing so that the price of the soap is fair to consumers.

# Soap calculator: as designed vs as made

- Due to the accuracy of mass balances and the tools available in lab, our mass balances are not exactly the same as the ones acquired by our theoretical soap calculations
- Although this did not lead to any significant differences in the overall properties of our soap.
    - As we put great effort into making sure that the mass of the oils used was very similar to the mass of the oils used in the theoretical calculations

# Soap calculator: as designed vs as made

| Oils | Theoretical | Actual | Difference | Percentage (actual) |
|---|---|---|---|---|
| Coconut Oil | 151.14 | 151.30 | 0.16 | 30.21% |
| Crisco | 125.00 | 125.70 | 0.70 | 25.10% |
| Avacado | 105.75 | 105.80 | 0.05 | 21.13% |
| Corn | 103.11 | 103.00 | -0.11 | 20.57% |
| Lavender | 15.00 | 15.00 | 0.00 | 3.00% |
| **Total** | 500.00 | 500.80 | 0.80 | |

**Actual**

| Oils | Percentage | Quanity (g) | SAP (NaOH) (g) | Hardness | Cleansing | Bubbly Lather | Creamy Lather | Conditionning |
|---|---|---|---|---|---|---|---|---|
| Coconut Oil, 76 deg | 30.21% | 151.30 | 27.64 | 23.87 | 20.24 | 20.24 | 3.63 | 3.02 |
| Ghee, any bovine | 0.00% | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crisco, old | 25.10% | 125.70 | 17.19 | 6.53 | 0.00 | 0.00 | 6.53 | 17.57 |
| Avocado Oil | 21.13% | 105.80 | 14.05 | 4.65 | 0.00 | 0.00 | 4.65 | 14.79 |
| Olive Oil | 0.00% | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sesame Oil | 0.00% | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Corn Oil | 20.62% | 103.00 | 14.13 | 2.89 | 0.00 | 0.00 | 2.89 | 17.32 |
| Grapeseed Oil | 0.00% | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sunflower Oil | 0.00% | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canola Oil | 0.00% | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| lavender | 3.00% | 15.00 | 2.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | 100% | 500.8 | 75.74 | 37.94 | 20.24 | 20.24 | 17.70 | 52.70 |

**Theoretical**

| Oils | Percentage | Quanity (g) | SAP (NaOH) (g) | Hardness | Cleansing | Bubbly Lather | Creamy Lather | Conditionning |
|---|---|---|---|---|---|---|---|---|
| Coconut Oil, 76 deg | 30% | 151.14 | 27.66 | 23.88 | 20.25 | 20.25 | 3.63 | 3.02 |
| Ghee, any bovine | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crisco, old | 25% | 125.00 | 17.13 | 6.50 | 0.00 | 0.00 | 6.50 | 17.50 |
| Avocado Oil | 21% | 105.75 | 14.07 | 4.65 | 0.00 | 0.00 | 4.65 | 14.81 |
| Olive Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sesame Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Corn Oil | 21% | 103.11 | 14.13 | 2.89 | 0.00 | 0.00 | 2.89 | 17.32 |
| Grapeseed Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sunflower Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canola Oil | 0% | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| lavender | 3% | 15.00 | 2.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | 100% | 500 | 71.93 | 37.92 | 20.25 | 20.25 | 17.67 | 52.65 |

**Difference in Properties**

| Properties | Difference (Actual - Theoretical) |
|---|---|
| Hardness | 0.02 |
| Cleansing | -0.01 |
| Bubbly Lather | -0.01 |
| Creamy Lather | 0.03 |
| Conditioning | 0.05 |

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