

# THE CLEAN CONDITION

## **Group 10**

Anna Arrecis

Hiba Altaf

Raymond Lin

Michael Metcalfe-Smith

# HISTORY OF SOAP MAKING

- Modern day soaps are specialized for a specific use and are sodium or potassium fatty acid salts produced in saponification reactions through the hydrolysis of fats
- During the roman and medieval eras, soap was a general term used to describe any cleansing agent meant for bathing or household cleaning. It was initially made by boiling animal fats with wood ashes and water
- During the 12<sup>th</sup> century the English began producing soap for commercial use and it is during this time period that specialized soaps started to immerge. Soaps for specific purposes became more common.
- In the year 1791, French Chemist Nicolas Leblanc discovered a process for the manufacture of soap where he transformed common salt ( $\text{NaCl}$ ) into an alkali (soda ash).
  - Since alkali is a crucial part of any soap this discovery allowed for the manufacture of large quantities of inexpensive soap
- During WW1, is when soap as we know it came into existence. German scientists created synthetic detergent to be used in soap instead of animal fats.
- During the 1930s, the mass of production of commercial soap began in the United States.



# MODERN MARKET FOR SOAP PRODUCTS

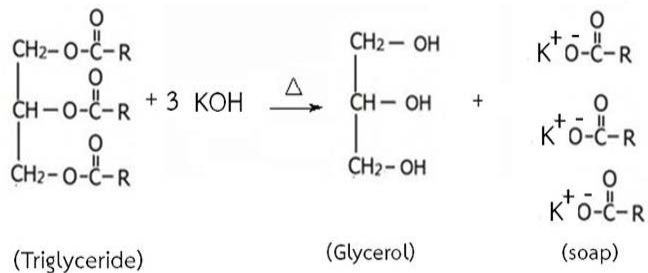
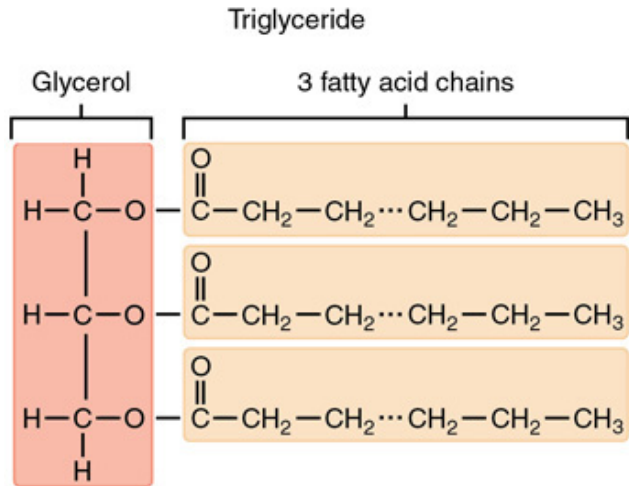


- Soap market is mainly split into the applications of soap products (household, commercial) and the type of soap product. Types of soap products include moisturizing, antibacterial and deodorant, hypoallergenic, and more.
- Top players in this industry include USA Organic, Dr. Woods, Nubian Heritage, Dove, Clearly Natural, South of France, Dr. Brinner's, Clinique, One with Nature and Bath and Body Works.

# CHEMISTRY BEHIND SOAP MAKING

Soap is made by the process of reacting a triglyceride with a strong base such as sodium hydroxide (NaOH) or potassium hydroxide (KOH).

- Triglyceride contains a glycerol molecule attached to 3 fatty acids.
  - Fatty acids are long carbon chains attached to a carboxyl group.



When the triglyceride molecule reacts with a strong base, the ester bond will break, and the fatty acid will receive a partial negative charge which attracts the sodium or potassium cation from the base.

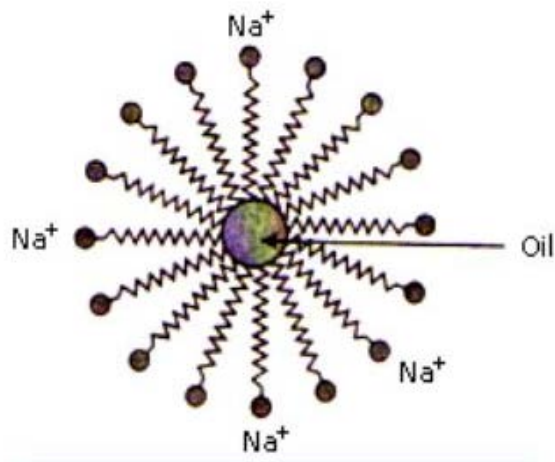
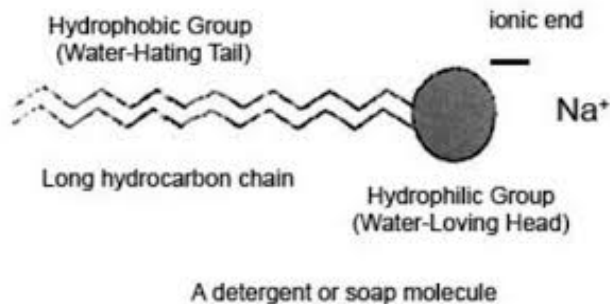
- This is called saponification

Whether the fatty acids are saturated or unsaturated will affect the qualities of the soap

- If the fatty acids are saturated:
  - The soap will be more firm
  - The soap will have a creamy lather
- If the fatty acids are unsaturated:
  - The soap will be softer
  - The soap will have a fluffy lather

To avoid a greasy or corrosive soap, the base is super fatted.

# CHEMISTRY BEHIND THE FUNCTION OF SOAP



Soap has hydrophobic and hydrophilic components

- Hydrocarbon tail is hydrophobic and non-polar
- The head (salt) is hydrophilic and polar

The tail attracts grease and oil because of its hydrophobic nature

The non-polar portion of the molecule can also break up other oil molecules

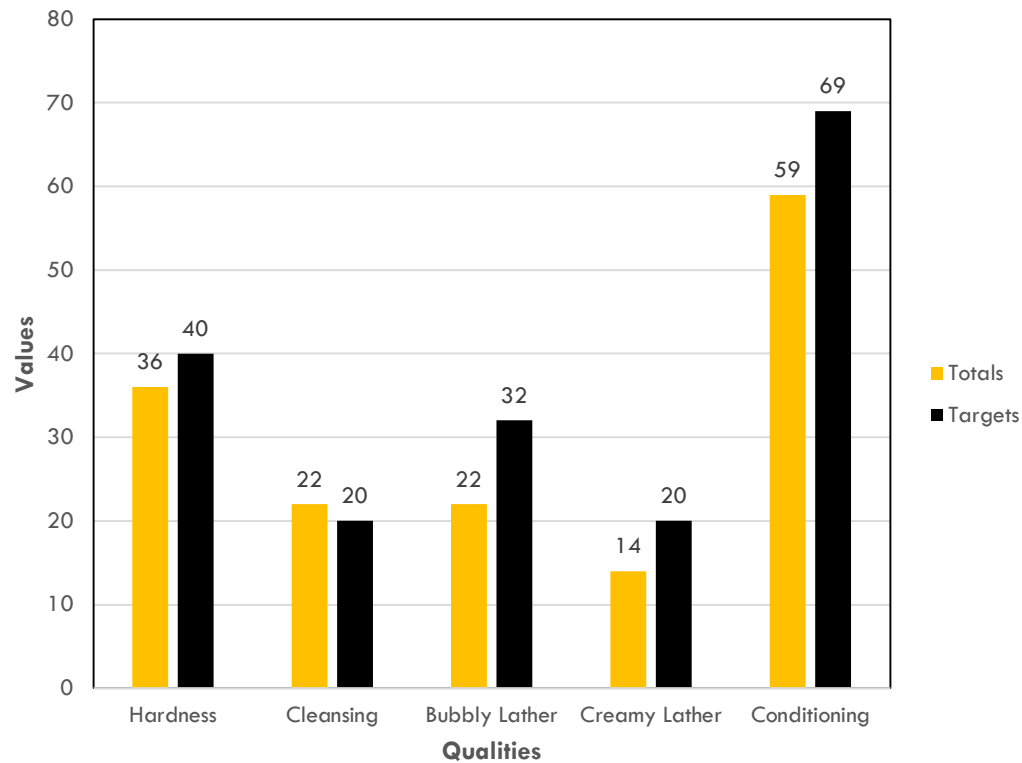
The head allows it to interact with water

Soap acts as an emulsifier

- Emulsifiers can spread a liquid into another immiscible liquid
  - This means it can trap dirt and dispose of it

# SOAP CALCULATOR

Clean Condition Quality Target Values and Actual Values



We decided to focus our soap on cleanliness and conditioning. The targets were hardness, cleansing, bubbly lather, creamy lather, and conditioning.

Soap needs to be durable and long lasting, but also soft on skin. It was for this reason that hardness was given a target of 40. To ensure the soap was affordable to make, lower values were assigned to the targets for bubbly lather and creamy lather.

# SOAP DESIGN

## Ingredients

Olive oil: 204.45g

Coconut oil: 165.99g

Sodium hydroxide (lye): 74.42g

Water: 190g

Grapeseed oil: 129.56g

Essential grapefruit oil: 5.0g



- Coconut oil was used because it raises the soap's **cleansing** ability and reduces inflammation of the skin.
- Olive oil gives soap its **moisturizing** properties. In addition, it acts as an antioxidant, repairs damage to skin, and prevents wrinkles.
- Grapeseed oil is a source of **conditioning** and **hardness** for the soap. This oil is especially beneficial for people with sensitive skin.
- Grapefruit oil was added to give a more desirable scent for users. It also helps **treat acne** and benefits **oily skin**.
- Creamy and bubbly lather we not especially targeted to maintain a reasonable cost for the ingredients and focus on our target values





# ACNE TREATMENT

## Acne Benefits

Clean Condition was designed to treat acne and scarring that resulted from acne

## Essential Grapefruit Oil

- Fights against bacteria
  - A study comparing 5 essential oils showed that essential grapefruit oil is most effective in fighting macrobacteria
- Helps maintain skin
- Contains vitamin C which plays a role in the formation of collagen
  - High collagen levels can heal scars
- Grapefruit oil helps treat oily skin
  - An oil produced by the skin called sebum is integral to acne formation
  - Grapefruit oil reduces formation

## Olive Oil

- Contains Vitamin A and Vitamin B
  - These vitamins together are excellent for fighting acne
- Can dissolve sebum

## Grapeseed Oil

- Has the ability to tighten the skin, reducing the appearance of blemishes (Palmitoleic Acid)
- Contains linoleic acids which can relax acne and prevent future outbreaks
- Contains stearic acid which removes dirt and excess sebum



# CLEANSING AND CONDITIONING POWER

## **Conditioning**

### Olive Oil

- Acts as an antioxidant, which prevents oxidation.
- Contains vitamins A, D, E, and K. Vitamin E helps with skin conditions like eczema and psoriasis.
- Moisturizes skin and keeps it hydrated to keep body from producing more oil. This prevents pores from becoming clogged with sebum (oil).
- Contains squalene, which helps hydrate the skin.

### Grapeseed Oil

- Cleans pores and balances oil production to prevent acne breakouts.
- Contains stearic acid, which has cleansing properties that remove dirt, sweat, and excess sebum from skin
- Contains palmitoleic acid, which can enhance skin elasticity to prevent wrinkles

## **Cleansing**

### Coconut Oil

- Triglycerides in coconut oil provide long lasting moisture to the skin.
- Produces rich and foamy lather when used in soaps and provides high cleansing

# RISK ASSESSMENT AND SAFETY PRECAUTIONS

- The **MSDS** (Materials Safety Data Sheet) for each ingredient should be obtained. The Safety Data Sheet ensures proper storage and handling of each material along any hazards and first aid measures.
- It is necessary to use a 5% **superfat**, meaning only 95% of the calculated mass of lye should be used. This is to ensure all the lye ( $\text{NaOH}$ ) reacts and there is no left over.
- **Protective equipment** including lab goggles, a lab coat, and gloves should be used to prevent any accidental contact with skin.
- If the lye mixture happens to **contact eyes or skin**, thoroughly wash eyes or skin with cold water.
- Before using the soap, ensure that whoever is using soap is not affected by its ingredients. People who have an **allergic reaction** to any of the ingredients or are **sensitive to smell** should be aware of this.



# METHODOLOGY

## Procedures

1. Clean up workspace by ensuring there are no liquids on the surfaces of tables. Put on a lab coat, goggles, and gloves.
2. All equipment should be thoroughly cleaned to ensure there are no impurities in the mixture as the soap is being created. (Optional: put covers or newspapers over tables to make cleaning up easier.)
3. Measure required amounts of each ingredient in separate cups or containers.
4. Slowly pour lye into water, while stirring the mixture. The person pouring should be standing and facing away from the fumes. After all the lye has been poured into water, let the mixture cool.
5. In a separate bowl add oils together and stir until the mixture is smooth.
6. Slowly pour the lye mixture into the oil mixture. Stir until there is trace.
7. Pour mixture into mold and wrap any openings with plastic wrap.



# COST OF CREATING OUR SOAP AND PRICING WE CHOSE

Ingredients	Cost for soap (\$)	Amount (g)	Price per gram (\$)
Olive Oil	1.30	204.45	0.006
Coconut Oil	2.94	165.99	0.0163
Grapeseed Oil	1.21	129.56	0.0086
Sodium Hydroxide	2.21	74.42	0.02986
Essential Grapefruit Oil	0.90	5.00	0.1524
<b>Total Cost</b>	<b>8.56</b>		

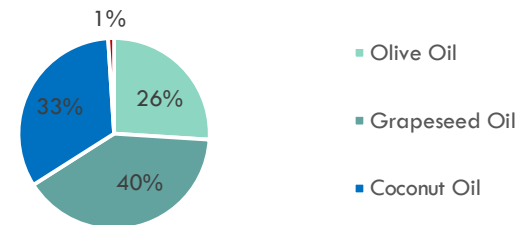
For a 113.80-gram bar of soap:

	Cost (\$)
Ingredients	1.95
Selling Price	5.00
Cardboard Box	0.50
Film and Design	0.25
<b>Net Profit</b>	<b>2.30</b>

# OUR SOAP PROPERTIES

Oils	Percentage	Quantity (g)
Coconut Oil, 76 deg	33%	165.99
Ghee, any bovine	0%	0
Crisco, old	0%	0
Avocado Oil	0%	0
Olive Oil	40%	199.44
Sesame Oil	0%	0
Corn Oil	0%	0
Grapeseed Oil	26%	129.56
Sunflower Oil	0%	0
Canola Oil	0%	0
Essential Grapefruit Oils	1%	0
Total	100%	500

**Oil Composition of Clean Condition**



# REFERENCES

Blood Orange Olive Oil. (n.d.). Retrieved from <https://www.galenagarlic.com/product/blood-orange-olive-oil/>.

Coconut Oil [on SALE] Top 10 Benefits For Face and Hair: Latest. (n.d.). Retrieved from <https://chiltanpure.com/product/coconut-oil-hair-skin-benefits-cooking/>.

GHS Corrosion Pictogram Labels. (n.d.). Retrieved from <http://www.safetyemporium.com/03603>.

Grapefruit Essential Oil 100% Pure Organic. (n.d.). Retrieved from <https://www.aromis.co/grapefruit-essential-oil>.

Gunnars, K. (2018, May 25). Grapeseed Oil - Is It a Healthy Cooking Oil? Retrieved from <https://www.healthline.com/nutrition/grape-seed-oil>.

Laboratory Rubber Gloves. (n.d.). Retrieved from <https://www.indiamart.com/proddetail/laboratory-rubber-gloves-16595471455.html>.

Radwag PMR High Temperature Option. (n.d.). Retrieved from <https://www.nevadaweighing.com/products/radwag-pmr-moisture-analyzer-high-temperature-option>.

Sodium Hydroxide (Lye): Ingredients, Functional. (n.d.). Retrieved from <https://skindewi.com/en/sodium-hydroxide-lye>.