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Formulation and Development of Skincare Products for Oily Skin

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ABSTRACT

Different skin types require different routines and products to improve and maintain skin health. Oily skin in particular has a hyperactive sebaceous gland that overproduces sebum, contributing to a greasy appearance and a higher acne prone risk. To improve the state of oily skin, a cleanser, exfoliator, day cream, and evening cream were formulated and developed with low toxic, plant-derived ingredients, to moisturize and hydrate oily skin in order to reduce sebum production. Two cleansers were produced to have a gel-like consistency and mild foaming properties to remove any dirt and excess oils accumulated on the skin, without overly stripping the skin of natural oils. A physical exfoliator was devised to improve skin texture and appearance by removing dead skin cells and excess oils. Two moisturizers were developed to hydrate and protect the skin from environmental elements during the day and aid in the skin's renewal process at night. Further toxicological and microbial data are needed to ensure the safety of each product before consumer use.

TABLE OF CONTENTS

LIST OF TABLES

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Chapter 1

Introduction

People are constantly finding ways to enhance their beauty through different products, routines, and lifestyles. Makeup application is one of the easiest and quickest ways to alter one's appearance. Foundation, concealer, and powder products are efficient tools to hide imperfections, scarring, and/or acne. These products are tools for a flawless appearance, but flawlessness can never be achieved without starting from the base these products are built upon, which is the skin. Improving skin health is achieved by overall body wellness and implementing a skincare routine, with products created for the skin type and problems that need to be addressed. By improving skin health, makeup will become a tool to enhance the skin, instead of concealing it.

In order to implement a proper skincare routine with necessary products to improve skin health, it is essential to know different skin types and their respective needs. Skin is usually categorized as either normal, combination, dry, or oily. Normal skin is eudermic or well balanced. It is able to retain moisture and hydration with a standard level of sebum production. People with normal skin types have more flexibility in choosing which products to use in order to achieve a mattified or dewy appearance to the skin. Combination skin is a mixture of different skin types. Typically, the T-zone which encompasses the forehead, nose, and chin, is either normal to oily, while the cheeks are normal to dry. Due to different properties under combination skin, it is essential that people with this skin type approach their skincare routine in a dualistic way to cater to the regions of the face that require different needs.

Dry skin is a result of a disturbed skin barrier caused by the lack of epidermal proteins and lipids[1]. As a result, skin loses its ability to retain moisture. This skin type prefers cream or milk cleansers that lack heavy lathers to prevent additional dryness. Routine exfoliation is needed to remove dry patches of the stratum corneum, oldest layer of skin, to ensure products are penetrating to deeper skin layers. After cleansing, moisturizers reinforce the skin's natural barrier function by preventing water loss, thereby increasing water content[2]. Dry skin prefers heavy creams and ointments that seal in moisture and provide protection from environmental factors that can further dry the skin.

Oily skin often looks greasy or shiny because the skin overproduces oils. The sebaceous gland, associated with the skin and hair follicle, is responsible for producing sebum, a natural moisturizer composed of a mixture of lipids[3]. Skin becomes overly shiny when the sebaceous gland overproduces oils, which can be attributed to genetics, age, time of year, and location. Sebum overproduction can also be an indicator that the skin is dehydrated. Hydration refers to the water content of the skin, thus making a hydrator an agent that increases water content. On the contrary, moisturizers are agents that prevent water loss by providing a barrier for the skin to seal in hydration. When the skin's natural moisturizer sebum is overproduced, it is a signal that the skin is trying to retain the little water content it has. The misunderstanding of excess oils contributes to the misconception that oily skin does not need to be moisturized. In actuality, oily skin needs proper hydration and moisturization to contribute to the reduction of sebum production.

Compared to dry skin, oily skin needs water-based hydrators and thin, fast absorbing oils and moisturizers that resemble the skin's natural sebum. In addition to proper moisturization, oily skin needs to be thoroughly exfoliated to prevent overproduced sebum from clogging pores

which, if untreated, can result in acne[3]. Chemical exfoliants that use acid and enzymes can be used to remove old skin cells on oily skin, as well as physical exfoliants which are more abrasive. The natural lubrication of oily skin adds a protective layer that dry skin lacks, making dry skin more susceptible to damage when using physical exfoliants.

The goal of this thesis project was to formulate and develop four different skin care products for oily skin, with nontoxic, plant-derived ingredients, designed to promote skin health and wellness. A cleanser, exfoliator, morning moisturizer, and evening moisturizer were created to be used in conjunction with each other as a whole routine. Often times, consumers with oily skin have trouble finding products that work because they are either too stripping of natural oils, causing the skin to produce even more sebum, and/or they avoid oils all together which ceases to address the hydrating and moisturizing needs of oily skin. Due to products on the market not catering to demands of oily skin, each product was formulated with health and wellness as the main priority. To achieve this, safe ingredients were used to provide the necessary hydration and moisture to the skin. Topically applied products that penetrate and absorb into the skin have potential to adversely affect different parts of the body. In order to avoid adverse effects, ingredients of low toxicological risk were used. Due to the recent shift in consumers wanting more plant-derived and natural ingredients in personal care items, they were incorporated into each product. Though natural is not always synonymous to safe, the availability of plant-derived low toxic ingredients is robust. With the use of all products in conjunction, it is hypothesized that the production of oils will decrease from the balance of hydrating and moisturizing ingredients catered to oily skin in each product.

Chapter 2

Formulation

Each developed product consisted of an aqueous and lipophilic phase mixed to form an emulsion. Emulsions are formed when two immiscible liquids are stirred, forming microscopic dispersions of droplets with a diameter of 0.5-100 um in another liquid[4, 5]. The two phases remain separated by the formation of a film or globule by the liquid of lighter density. Upon addition of work when the two phases are stirred, the surface area of the lower density liquid increases, resulting in an increase of the interfacial tension of the phase boundary[6]. Emulsions are often thermodynamically unstable because the surface energy term is higher than the entropy term shown in Equation 1, resulting in positive free energy. Addition of emulsifiers stabilize emulsions by reducing interfacial tension and aid in the dispersion of the internal phase[6].

Equation 1: Gibbs Free Energy Equation

$$\Delta G = \gamma A - T\Delta S$$

ΔG - Free energy of an emulsion
γ - Interfacial tension
A - Interfacial surface area
T - Temperature
ΔS - Entropy of mixing

Most emulsifiers are amphiphilic, containing both hydrophilic and lipophilic properties that allow for the interaction of both phases, and are accessed using the Hydrophile-Lipophile Balance (HLB) system. The assigned HLB number describes the size and strength balance of the hydrophilic and lipophilic components of the emulsifier[7]. HLB numbers aid in determining which emulsifiers should be used for different mixtures, based on solubility. Water in oil (w/o)

emulsions have a mixture majorly composed of oil, so the corresponding emulsifier needs to be oil soluble. Conversely, oil in water (o/w) emulsions are aqueous in character and require water soluble emulsifiers. Table 6 presents the typical range of HLB numbers for different uses. The system operates on a scale between 0-20. HLB numbers less than 10 are more lipophilic in nature, whereas numbers greater than 10 are more hydrophilic in nature. The nature of the emulsifier determines the stability of the end product.

Table 1: Range of HLB numbers for different uses.

HLB Number	**Use**
4-6	W/O emulsifier
7-9	Wetting agent
8-18	O/W emulsifier
13-15	Detergent
10-18	Solubilizer

Main Ingredients

Some of the few essential ingredients for most products were aloe vera, jojoba oil, and mulberry extract. Aloe vera (*Aloe barbadensis)* is a plant that produces an anti-inflammatory gel used for wound healing and burn wound scarring[8]. The multitude of polysaccharides, lipids, and amino acids derived from the gel have been seen to induce proliferation and increase wound repair[9]. In conjunction to wound repair, aloe vera improves the skin's appearance and feel.

Studies have found aloe vera to increase collagen and hyaluronic acid production, leading to reduced wrinkle depth and an increase in moisture retention[10]. Aloe vera also contains antimicrobial agents, that are acne fighting. When used in conjunction with tea tree oil, acne lesion count, severity, and scars caused by moderate vulgaris acne reduced[11]. This plant derived gel serves as a hydrator, increasing water content in the skin; thus, aloe vera was incorporated into each product.

Jojoba oil (*Simmondsia chinensis* oil) is very similar to the skin's natural sebum, making it a great moisturizer. After the skin is cleansed and excess sebum is removed, jojoba oil will act as the moisturizer, signaling to the skin that it does not need to produce more oils. When topically applied, it has a more localized effect by remaining on the surface and providing a barrier for the skin[12]. By remaining in contact with the skin's surface, it acts as an anti-inflammatory agent and has been seen to increase wound repair in keratinocytes and fibroblasts while maintaining low cytotoxicity[13, 14]. Jojoba is also a carrier oil for essential oils, which increases antimicrobial activity when used in conjunction with each other[15]. For the cleansers, exfoliant, and moisturizers, jojoba oil will act as a moisturizing and conditioning agent for the skin.

Mulberry (*Morus alba)* is a traditional Chinese edible plant that has shown antioxidant, antibacterial, and antifungal properties. Mulberry extract is a source of anthocyanins and neocholorgenic acid, both of which are responsible for scavenging free radicals and reactive oxygen species, making them a useful antioxidants[16, 17]. Free radicals damage the skin by causing oxidative stress, resulting in skin-aging in the form of wrinkles and discoloration[18]. Not only does mulberry extract protect and defend the skin from free radicals, it can also reverse the discoloration caused by oxygen species, by exhibiting anti-tyrosinase activity that inhibits

melanin or skin pigment formation[19]. The root bark of the mulberry plant contains mulberrofuran G and albanol B that inhibit bacteria such as *Staphylococcus epidermis*[20]. This bacterium is a typical skin and acne lesion inhabitant that is known for contributing to the inflammation apparent in acne[21]. These properties make mulberry extract a great ingredient to improve the skin's appearance, especially oily skin which is more prone to acne.

Facial Cleansers

Table 2: List of ingredients and their respective weight in Facial Cleanser 1. Aqueous phase is highlighted in blue. Emulsion phase is highlighted in green. Oil phase is highlighted in yellow.

	Ingredient	Weight (g)
Aqueous Phase	Water	66.37
	Glycerin	3.00
	Aloe Vera	4.00
Surfactant Phase	Potassium Cocoate	10.00
	Sodium Cocoyl Glutamate	10.00
Oil Phase	Jojoba Oil	2.00
	Vitamin E (dl-α tocopherol)	1.80
	Polyisobutene	4.40

Cleansers are intended to remove dirt, oils, dead skin cells, and pollutants from the skin. Due to oily skin overproducing sebum, it requires a facial cleanser that can effectively remove excess accumulated oils. For this reason, each facial cleanser was formulated to be a gel-like cleanser rather than a cream. Gel cleansers have mild to high foaming properties, whereas cream cleansers avoid lathers. The choice of a more lathering cleanser was to ensure the removal of dirt and sebum from the face. For each cleanser, mild surfactants were used in order to keep the skin balanced and not too stripped of natural oils, which if done, could result in unwanted oil

production. In Facial Cleanser 1 (FC1), surfactants potassium cocoate and sodium cocoyl glutamate were used. Each are plant-derived from coconut oil. For conditioning properties, jojoba oil and vitamin e were incorporated into FC1 to balance the cleansing properties with more moisturizing ingredients.

Table 3: List of ingredients and their respective weight in Facial Cleanser 2. Aqueous phase is highlighted in blue. Emulsion phase is highlighted in green. Oil phase is highlighted in yellow.

	Ingredient	Weight (g)
Aqueous Phase	Water	2.00
	Glycerin	15.00
	Aloe Vera	2.00
Surfactant Phase	Sulfosuccinate	4.00
	Polyglucose	4.00
Oil Phase	Jojoba Oil	2.00
	Gel Maker	0.29
	Vitamin E (dl-α tocopherol)	2.00

Facial Cleanser 2 (FC2) was also developed to remove dirt and oils from the skin without leaving it too stripped. In comparison to FC1, FC2 was made to be more viscous, with higher stability. To achieve this, surfactants sulfosuccinate and polyglucose were used. Sulfosuccinate is a secondary oil in water emulsifier, as well as an anionic surfactant that is compatible with nonionic surfactants like polyglucose. Gel Maker was added as the primary emulsifier and a thickening agent. For additional thickening properties, the aqueous phase from FC1 to FC2 reduced from 72% to 61%, with an 88% decrease in water content. To compensate for the loss of water, more glycerin was used. Glycerin is a humectant that attracts water from the air to the skin, thus hydrating the skin. In cleansers, glycerin prevents the skin from drying out.

Exfoliator

Table 4: List of ingredients and their respective weight in Scrub 1. Aqueous phase is highlighted in yellow. Surfactants are highlighted in light orange. Oil phase is highlighted in deep orange. Ingredients highlighted in red were added after emulsification.

	Ingredient	Weight
Aqueous Phase	Water	79.5
	Glycerin	11.4
	Propylene Glycol	6.8
	Citric Acid	6.8
	EDTA	1.1
	Xanthan Gum	2.3
	Mulberry Extract	5.7
Surfactant Phase	PEG-7	6.8
	Polyglucose	11.4
	Sulfosuccinate	4.5
	Potassium Cocoate	4.5
Oil Phase	Ceteareth-20	6.8
	Cetearyl Alcohol	9.1
	Jojoba Oil	6.8
	Sweet Almond Oil	6.8
Cool Down Phase	Coffee	22.7
	Willow Bark Extract	11.4
	Jojoba Protein	11.4
	Fragrance	11.4

Exfoliants are used to remove dead skin cells from the stratum corneum, the oldest layer of the skin. They are suggested to be used after the skin is cleansed from dirt and sebum to allow for the proper removal of dead skin. Physical exfoliants typically contain surfactants, conditioning agents, abrasive particles, and thickeners. This exfoliant (E1) was designed to be

thick in consistency, with lathering abilities, and to be used in following the cleanser. After use, skin was intended to feel smoother with an improved appearance in discoloration over time.

The surfactants and conditioning agents used in the facial cleansers and moisturizers were also used for the exfoliant. In addition to the other surfactants used, PEG-7 was also incorporated due to its foam boosting and thickening properties. PEG-7 also serves as a mild emollient that aids in moisturizing and smoothing of the skin. Ceteareth-20 has an HLB of 15-17, making it a o/w emulsifier. This was added to ensure stability of the o/w emulsion.

Coffee grounds were used as the abrasive agent due to their insolubility in water, unlike sugars and salts. This property gives the consumer more flexibility and time during exfoliation because the abrasive particles will not dissolve during their skincare practice. This also prevents the consumer from using an excessive amount of product for exfoliation. To further improve the skin's appearance, mulberry extract and citric acid were added. Citric acid contains alpha-hydroxy acids or AHA's that are chemical exfoliants[22]. To suspend the coffee grounds into the scrub, xanthan gum was added, due to its thickening properties.

Moisturizers

Table 5: List of ingredients and their respective weight in Moisturizer 1. Aqueous phase is highlighted in purple. Oil phase is highlighted in hot pink. Ingredients highlighted in light pink were added after emulsification.

	Ingredient	Weight (g)
Aqueous Phase	Water	136.08
	Aloe Vera	136.08
	Glycerin	22.68
Oil Phase	Shea Butter	22.68
	Jojoba Oil	36.29
	Grapeseed Oil	31.75
	Castor Oil	22.68

	E-wax NF	36.29
Cool Down Phase	Cucumber Extract	2.27
	Green Tea Extract	2.27
	Fragrance	2.27
	Willow Bark Extract	2.27

Each moisturizer was developed with high moisturizing and conditioning properties with the intention of being used during the fall and winter months. Moisturizers are categorized into two main groups of lotions and creams. The main difference between these two are their water and oil content. Lotions are o/w emulsions, higher in water content compared to creams, making lotions less viscous and greasy. Creams can be o/w emulsions, with up to 50:50 oil to water ratios, or even w/o emulsions where the oil phase is the majority component. Because of this, creams tend to be more moisturizing and with the potential to be greasier. Both moisturizers were formulated to be o/w emulsions, with a 65% aqueous phase, in order to have both lotion and cream-like properties.

Moisturizer 1 (M1) was created as a daytime cream, intended to provide hydration, moisture, and protection, with a non-greasy feel. In order to protect the skin from harsh elements during the winter months, thick emollients such as shea butter and castor oil were incorporated. High skin penetrable and water absorptive oils, such as jojoba, were also used for balance. The emulsifier used was emulsifying wax NF, which is a combination of cetearyl alcohol and polysorbate. Cetearyl alcohol is an oil in water emulsifier, HLB 15.5, with moisturizing properties derived from coconut and other vegetable oils. Polysorbate is an oil in water emulsifier, HLB 16.7, that acts as a dispersing agent.

Table 6: List of ingredients and their respective weight in Moisturizer 2. Aqueous phase is highlighted in purple. Oil phase is highlighted in hot pink. Ingredients highlighted in light pink were added after emulsification.

	Ingredient	Weight (g)
Aqueous Phase	Aloe Vera	29.77
	Water	70.88
	Sorbitol	45.36
	Licorice Extract	14.18
	Mulberry Extract	14.18
	Cucumber Extract	8.51
	EDTA	1.42
Oil Phase	Cream Maker Blend	22.68
	Mango Butter	16.87
	Red Raspberry Oil	14.18
	Meadowfoam Seed Oil	14.18
	BHT	0.14
	Moisture REG	14.18
	Vitamin E (dl-α tocopherol)	8.51
Cool Down Phase	Fragrance	8.51

Moisturizer 2 (M2) was created as an evening cream. Night creams are more often moisturizing than those intended for daytime use, to aid in the skin's renewal process during sleep. To assist this natural process, sorbitol, licorice, and mulberry extracts were added to M2. Sorbitol is a skin conditioner that counters moisture loss, helping skin to stay hydrated throughout the duration of sleep. Licorice and mulberry extracts contain agents that help improve skin discoloration and reduce signs of aging skin[16, 17, 18]. Like M1, M2 also contained a mixture of thick emollients, such as mango butter, and skin penetrable emollients, such as meadowfoam seed and red raspberry oil. For stability, Cream Maker Blend was used as the emulsifier. Cream

Maker Blend is a 50:50 ratio mixture of emulsifiers glyceryl monostearate and PEG-100 stearate. The final HLB number of this blend is 11.2, making it a viable o/w emulsifier option.

Chapter 3

Methods

Facial Cleanser

Ingredients in the Aqueous, Oil, and Surfactant Phases listed in Tables 2 and 3 were combined separately. Aqueous and Surfactant Phases were added together and heated to 50°C with constant stirring. Oil Phase was added to the combined phase over heat. The mixture was cooled with constant agitation.

Exfoliant

Ingredients in the Aqueous, Oil, and Surfactant Phases listed in Table 4 were combined separately. Aqueous and Oil Phases were heated separately to 65°C until all components were melted. The Surfactant and heated Oil Phases were combined and mixed thoroughly over heat. The combined phase was cooled for 5-10 minutes and added to the Aqueous Phase. Liquid components in the Cool Down Phase were combined and added to the scrub base. Coffee grounds were slowly added and mixed into the scrub until evenly distributed.

Moisturizers

Ingredients in the Aqueous, Oil, and Cool Down Phases listed in Tables 5 and 6 were combined separately. Aqueous Phase was heated to 65°C and Oil Phase was heated to 80°C until all components were melted. Oil Phase was added to Aqueous Phase after cooling to 65°C. The combined phase was hand mixed every 5 minutes until completely cooled and desired viscosity was achieved. Cool Down Phase was added and stirred in until thoroughly incorporated.

Chapter 4

Results

Due to the policy regarding the regulation of cosmetics by the FDA, I was able to personally test each product for preliminary final property results. Each product except FC1 was tested for at least one month before results were concluded.

As FC1 and FC2 were developed as mild cleansers, they were tested in the morning. Potassium cocoate and sodium cocoyl glutamate were used to stabilize FC1. Potassium cocoate has an HLB number of 20, making it completely aqueous in character[23]. Thus, the combination of this aqueous surfactant and sodium cocoyl glutamate was not lipophilic enough to stabilize FC1 as an o/w emulsion, causing phase separation, making FC1 nonviable for complete testing. Even as an unstable emulsion, FC1 was still able to lather and cleanse the skin without over drying it. To improve cleanser stability, FC2 was made with a primary and secondary o/w emulsifier, Gelmaker and sulfosuccinate respectively. The incorporation of both into FC2 resulted in its stability without phase separation. Similar to FC1, FC2 was also mild in nature as intended, leaving a clean feel to the skin without dryness after use. The additional thickness to FC2 resulted in it lasting longer than FC1, that was less viscous in consistency.

Exfoliant E1 was a stable o/w emulsion, due to the use of cetearyl alcohol and ceteareth-20. E1 lacked foaming properties, which was attributed to the use of mild surfactants with heavy ceteareth-20. After use one to two times a week, E1 left the skin very soft and smooth, improving the texture.

After cleansing and routine exfoliation, M1 was applied in the morning while M2 was applied in the evening. The use of emulsifying wax and Cream Maker Blend in M1 and M2 respectively stabilized both o/w emulsions. M1 was fast absorbing and non-greasy to touch after

use. As a winter moisturizer M1 was effective at providing hydration and moisture during the day. M2 was more moisturizing and spreadable compared to M1. This was attributed to additional conditioning agents, such as sorbitol and Moisture REG, which are a combination of emollients and skin conditioning agents. M2 was also thicker as a product alone and on the face, making it less suitable for daytime wear. In the morning, after using M2 the night before, the skin was very hydrated, even after washing. This was also attributed to sorbitol and Moisture REG ingredients that avoid transdermal water loss by reinforcing the natural barrier of the skin.

Chapter 5

Conclusion

This project serves to improve the cosmetic and personal care product industry by providing examples of natural and plant-derived ingredients that improve the health of oily skin by catering to its needs of hydration and moisturization. By describing the formulation process of each product, scientists in this field, who use this information, will better understand the steps determining how and what to incorporate into skin care items for oily skin. In addition to contributing to the respective field, this project also aims to educate consumers on what ingredients to look for when seeking plant derived skincare items for oily skin, and their contribution to the overall product. This helps consumers better understand their oily skin needs and which ingredients and routines can assist in achieving their skin goals.

In addition to the formulation and developmental process, it is also essential in understanding how skin care products are modulated. The United States Food and Drug Administration (FDA) regulates cosmetics under the Federal Food Drug and Cosmetic (FD&C) Act. Section 201 defines a cosmetic as a product that is intended to cleanse the human body, make a person more attractive, or change a person's appearance after rubbed into, sprayed, poured, sprinkled, or applied to the human body. These products include moisturizers, makeup, and nail care items. Soaps intended to cleanse the skin are not considered cosmetics. However, soaps that are used solely for body cleansing, have characteristics consumers associate with a soap, and do not consist of mostly fatty acid alkali salts are regulated as cosmetics[24].

Only color additives are regulated by the FDA if they are used in cosmetics. Any ingredient can be used as long as they are safe for consumer use and unadulterated. This entails color additive violations, microbial and/or other contaminations. The FD&C Act does not require

cosmetics to be sterile, but a low count of aerobic microorganisms per gram are required[24]. All regulations and requirements of the FDA were followed during the initial formulation and development of each product.

Further studies of the developed skin care items are needed to ensure the safety of each product for consumers. Only ingredients of low toxicological risk were incorporated into each formula. However, the combination of different ingredients often result in different properties and reactions on and within the body. Toxicological tests are needed for each final product to ensure low adverse effects to the consumer. In addition, microbiology data is needed to meet the requirements of the FD&C Act.

Appendix A

Properties of Listed Ingredients

The manufacturer, MakingCosmetics, provided the description and property information for each ingredient.

Ingredient	Description	Properties
Aloe vera *(Aloe barbadensis)*	Pure liquid derived from Aloe leaves. Preserved with sodium benzoate, potassium sorbate, and citric acid.	Hydrator and soothing agent. Improves the appearance of aging skin.
BHT	Butylated hydroxy-toluene	Prevents rancidity of fats and oils by neutralizing free oxygen radicals. Extends shelf life.
Castor oil *(Ricinus communis)*	Vegetable oil derived from the *Ricinus communis* plant.	Emollient, lubricant, and moisturizer that softens and adds shine to the skin.
Ceteareth 20	Mixture of cetyl and stearyl alcohols. Number 20 is representative of the number of ethylene oxide residues. HLB value: 15 - 17	Stabilizes oil in water emulsions.
Cetearyl alcohol	Combination of cetyl and stearyl alcohol. Derived from coconut and other vegetable oils. HLB: 15.5	Non-gelling thickener with emollient and moisturizing properties.
Citric acid	Produced by the fermentation of carbohydrates in citric fruits.	Enhances activity of antioxidants and preservatives. Smoothing, anti-aging properties from natural alpha hydroxy acids.
Cream maker blend	Combination glyceryl monostearate and PEG-100 stearate. Glyceryl monostearate derived from soy oil. HLB Value: 11.2.	Emulsifying agent for oil in water emulsions.
Cucumber extract *(Cucumis sativus)*	Contains 20% extract dissolved in water and glycerin, preserved with phenoxyethanol.	High concentration of potassium, sulfur, and minerals. Skin emollient and softener.

EDTA	Ethylenediaminetetraacetic acid tetrasodium salt	Chelating agent. Preservative that enhances antioxidants.
E-wax NF	Combination of cetearyl alcohol and polysorbate.	Oil in water emulsifier and dispersing agent.
Green tea extract *(Camellia sinensis* extract*)*	Contains 5% of extract dissolved in water & glycerin and preserved with potassium sorbate & sodium benzoate.	Antioxidant agent with anti-aging properties.
Gel maker	Combination of sodium acryloyldimethyl taurate copolymer, isohexadecane, and polysorbate 80.	Gel thickener. Forms cold oil in water emulsions.
Grapeseed oil *(Vitus vinifera* oil*)*	Cold pressed oil from grape seeds.	Fast absorbing skin emollient. Skin conditioner.
Glycerin	Polyhydric sugar alcohol derived from palm oil.	Humectant, emollient, and lubricant. Solvent for water-insoluble ingredients.
Jojoba oil *(Simmondsia chinensis* oil)	Organic liquid wax from *Simmondsia chinensis* seeds.	Moisturizer and emollient. Retains moisture by preventing transdermal water loss.
Jojoba protein	Hydrolyzed proteins enzymatically extracted from the jojoba plant.	Reduces appearance of aged skin.
Licorice extract (G*lycyrrhiza glabra* extract)	Combination of licorice root extract, glycerin and water, preserved with phenoxyethanol.	Antioxidant properties that improves damaged skin.
Mango butter	Butter obtained from the kernels of mango fruits (*Mangifera indica*).	Acts as an emollient and moisturizer to treat dry, damaged skin.
Meadowfoam seed oil *(Limnanthes alba)*	Lipids & sterols derived from meadowfoam seed oil.	Non-greasy moisturizer with high water absorptivity.
Moisture-REG	Combination of cetyl stearate, isostearyl isostearate, cetyl alcohol, potassium cetyl phosphate, and stearic acid.	Moisturizer that reduces transepidermal water loss. Forms a protective barrier on the skin's surface.
Mulberry extract *(Morus alba* extract)	Contains 20% extract dissolved in water and glycerin, preserved with phenoxyethanol.	Improves uneven skin tone. Antioxidant.

PEG-7	Ethoxlyated polyethylene glycol ester made from glycerin & coconut oil. HLB: 11.	Surfactant and foam booster. Skin conditioner.
Polyglucose	Decyl glucoside. Non-ionic surfactant derived from coconut fatty alcohols and glucose from corn starch.	Foam stabilizer that improves the conditioning effect of cationic surfactants.
Polyisobutene 250	Combination of isoparaffin and propane-2-methyl-homopolymer.	Emollient that reduces water loss. Improves the spreading of creams.
Potassium cocoate	Derived from coconut oil fatty acids.	Cleansing agent.
Propylene glycol	1,2-propanediol metabolized to lactic acid in the body. USP grade.	Humectant that reduces water loss in the skin. Increases skin permeability, allowing products to penetrate the outer layers.
Red raspberry seed oil *(Rubus idaeus* oil)	Cold-pressed oil from the kernels of red raspberries.	Water-retaining skin emollient. Skin penetrable.
Shea butter *(Butyrospermum parkii)*	Plant fat of the nuts of the African Karite tree.	Source of vitamins A and E. Soothing emollient that protects the skin from environmental factors. Improves the appearance of aging skin.
Sodium cocoyl glutamate	Surfactant derived from coconut oil.	Cleansing agent.
Sorbitol	Polyhydric alcohol derived from a wheat dextrose solution.	Skin conditioner and hydrator. Viscosity agent.
Sulfosuccinate	Disodium laureth sulfosuccinate derived from coconut oil.	Anionic surfactant and secondary oil in water emulsifier.
Sweet almond oil *(Prunus amygdalus dulcis* oil)	Natural oil pressed from the seeds of the sweet almond tree.	Skin penetrable emollient. Softens and conditions skin.
Vitamin e (dl-alpha tocopherol)	Pure undiluted vitamin E synthetically derived.	Antioxidant that soothes skin and stabilizes oils by preventing rancidity.
Willow bark extract *(Salix alba* extract)	Contains 20% of extract from the bark of the willow plant, dissolved in water and glycerin, preserved with phenoxyethanol.	Mild cleanser with toning properties. Natural salicylic acid component that helps improve acne.

Xanthan gum	Natural gum derived from *Xanthomas campestris.* Consists of glucose, mannose, and glucuronic acid.	Non-gelling thickener and viscosity agent. Stabilizes emulsions.

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Honors and Awards:

- Provost Award - 2016
- Dean's List – Fall 2016 – Fall 2019
- Annual Biomedical Research Conference for Minority Students Travel Award – 2017
- Summer Undergraduate Research Fellowship - 2018
- Society of Toxicology Pfizer Undergraduate Travel Award - 2019

Washington University in St. Louis – Energy Environmental and Chemical Engineering Department
Supervisor: Jay R. Turner
Job: Summer researcher
Dates: May – August 2017

Rutgers University – Pharmacology and Toxicology Department
Supervisor: Marion Gordon
Job: Summer researcher
Dates: May – August 2018, May – August 2019

Penn State University – Chemical Engineering Department
Supervisor: Janna Maranas
Job: Research assistant
Dates: September 2018 – May 2020

Professional Memberships

- American Chemical Society
- The American Society for Pharmacology and Experimental Therapeutics
- Society of Toxicology

Presentations:

- **Durante, D**; Prathibha, P; Turner, JR, Engineered Buffers Can Reduce Traffic-induced Air Pollution Impacts, Annual Biomedical Research Conference for Minority Students (ABRCMS), Phoenix, AZ, 2017.
- **Durante, D**; Prathibha, P; Turner, JR, Engineered Buffers Can Reduce Traffic-induced Air Pollution Impacts, The Leadership Alliance National Symposium, Connecticut Convention Center, 2017.
- **Durante, D**; Hahn, R; Zhou, P; Gordon, M, Comparing Therapies to Improve Ocular Sulfur Mustard-Induced Injuries, SURF program, Rutgers University, 2018.
- **Durante, D**; Hahn, R; Zhou, P; Gordon, M, Comparing Therapies to Improve Ocular Sulfur Mustard-Induced Injuries, RiSE Symposium, Rutgers University, 2018.
- **Durante, D**; Hahn, R; Zhou, P; Gordon, M, Comparing Therapies to Improve Ocular Sulfur Mustard-Induced Injuries, Society of Toxicology Annual Meeting, Baltimore, Maryland, 2019.
- **Durante, D**; Hahn, R; Zhou, P; Gordon, M, Restasis Treatment to Improve Corneal Healing Post Sulfur Mustard Exposure, Annual Biomedical Research Conference for Minority Students (ABRCMS), Anaheim, CA, 2019.

Extracurricular Activities

- Loving Our Curly, Kinky, and Straight Hair (L.O.C.K.S)
    - Social Media Chair – 2017 – 2019
    - President – 2019 – 2020
- Mentor for the Millennium Scholars Program – 2018 - 2020