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Beauty and the Beast: Plastic Pollution in the Personal Care and Cosmetics Industry

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Abstract

This paper explores the history of plastic in the beauty and cosmetics industry, and how this toxic material is irreparably harming our ecosystems resulting from nonrecyclable packaging and a lack of microplastic management. Properly managing harmful plastics found in personal care and cosmetics products (PCCPs) is essential for minimizing toxic wastewater in raw sewage, landfills, and the ocean, as discussed in reports such as "Plastics in Cosmetics" by the UNEP. Furthermore, this paper presents an argument for why the personal care and cosmetics industry should be included in the Toxic Substances Control Act (TSCA), which gives the EPA authority to regulate chemicals. Chapter 1 examines comprehensive data from sources such as reports on containers and packaging, and articles regarding the enormous amount of plastic waste generated by the cosmetics industry globally. Chapter 2 will delve into the history of this issue of plastic pollution and waste from the cosmetics industry, exploring bioplastics and mainly petroleum-based plastic's role in the evolution of personal care and beauty products. Chapter 3 lays out the legal discipline regarding the Toxic Substances Control Act and the Federal Food, Drug, and Cosmetics Act in order to propose that microplastics require more stringent levels of management, and thus all PCCPs should fall under the regulation by the Toxic Substances Control Act. Chapter 4 utilizes several examples of companies who have publicly acknowledged the environmental harm from plastic packaging, demonstrating the sustainable contributions that plastic-free and recyclable packaging have on our natural resources. Finally, Chapter 5 draws from previous discussions on the cosmetic industry's reliance on plastic to develop policy recommendations regarding the implications of the associated harmful waste.

Keywords: pollution, plastic waste, cosmetics, beauty, environmental sustainability, microplastics, environmental policy

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Introduction: Why is Plastic Pollution in Cosmetics an Issue Worth Studying?

Our modern world has quickly seen plastic pollution become one of the most devastating environmental epidemics in history. Microplastics can be found in just about every type of surrounding environment, from marine ocean habitats to our own homes. These types of pollutants can cause serious repercussions on the wellbeing of humans and ecosystems, specifically marine species that are damaged with irresponsible plastic management and disposal. Numerous studies have been conducted to analyze leading courses of plastic pollution at both the "macro" and "micro" levels, ranging from discarded plastic packaging and containers to plastic microbeads found in several types of personal care and cosmetics products. As a whole, our planet's ecosystem services are becoming permanently impacted with the damaging effects of pollution backup. Narrowing into a lens focused primarily on human behavior and consumption, we see up close how plastics truly run our lives. Just about every person's daily routine will involve some sort of personal care and cosmetics product, or PCCP. Our skin is our body's largest organ, so why would we want to bring harmful toxins or microplastics into contact with it? This paper expands on this question by examining the history behind plastic in the beauty and cosmetics industry, and how this toxic material is irreparably harming our ecosystems resulting from nonrecyclable packaging and a lack of microplastic management. Despite these issues being a universal issue amongst PCCP users, the field of sustainability in cosmetics is not given as much attention and discussion as sustainability in other realms. Only in recent years has there been a growing interest regarding the field of sustainability in the cosmetics industry, especially from consumers, cosmetic industries and organizations, and academics from environmental disciplines. For example, when the responsibility to live a more "green" or eco-friendly lifestyle is placed on consumers, it may seem more obvious to change habits related to groceries, clothing, or travel. However, this trend of

environmental and health awareness has begun to influence consumer behavior within the cosmetics field, as consumers are more and more interested in natural ingredients, sustainable packaging, and other green elements in cosmetics. [1] Our society is also witnessing more community-based and grassroots involvements in the development of clear strategies and initiatives for accelerating sustainability efforts in the personal care and cosmetics industry. For example, many organized groups and organizations, such as the British Beauty Council's Sustainable Beauty Coalition, continue to actively encourage and strengthen collective efforts. Yet there is still a large responsibility on the producers of these cosmetic to disclose the exact ingredients within the product itself, as well as to correct market items as sustainable with the disclosure of how the item was packaged, manufactured, and regulated before reaching the hands of any consumer. As this paper will discuss more in detail, there are a plethora of components within the personal care and cosmetics industry that are in dire need of a modern-day evolution in how they can continue production in a climate-positive and environmentally conscious fashion. In general, sustainability in beauty and personal care must comprise of recyclable packaging, decreased use of single-use plastics and components, consciously curated ingredients, environmentally sound manufacturing techniques, and an overall small carbon footprint production from beginning to end of the creation process.

Properly managing harmful plastics found in personal care and cosmetics products (PCCPs) is essential for minimizing toxic wastewater in raw sewage, landfills, and the ocean. Chapter 1 lays out quantitative data on global cosmetics pollution, encompassing packaging waste

[1] Amberg, Nora, and Csaba Fogarassy. "Green Consumer Behavior in the Cosmetics Market." *MDPI*, Multidisciplinary Digital Publishing Institute, 30 July 2019, https://www.mdpi.com/2079-9276/8/3/137.

and nonbiodegradable plastics within products themselves, such as microbeads or glitter elements. Chapters 2-4 explore the historical, legal, and economic dimensions of this issue, bringing attention to the evolution of plastics in cosmetics and how cosmetics companies have been more recently trying to implement and market more sustainable business practices. Furthermore, these chapters will utilize specific case studies of companies who have publicly acknowledged the environmental harm from plastic packaging, and illustrate their approaches to this global issue which demonstrate the sustainable contributions that plastic-free and recyclable packaging has on our natural resources. Finally, Chapter 5 will draw specifically from Chapter 3 regarding the Toxic Substances Control Act and the Federal Food, Drug, and Cosmetics Act in order to propose that microplastics require more stringent levels of management, and thus all PCCPs should fall under the regulation by the Toxic Substances Control Act. Chapter 5 will essentially promote this argument and propose several new policy recommendations for cosmetics regulation., encompassing the themes illustrated within each chapter.

Chapter 1: Statistics on Global Cosmetics Pollution

Personal care and cosmetics products, or PCCPs, refer to a wide variety of items commonly found in most department and drug stores, such as perfumes, deodorants, and facial makeup preparations.[2] However, it is important to note that the term "personal care product" is not defined by law, and some products, such as ointments and lip balms, are regulated as drugs through the FDA. Further, due to some personal care products, such as dandruff shampoo, falling under both categories of cosmetics and drugs, this entails that there are different regulations to conform to,

[2] "Are All 'Personal Care Products' Regulated as Cosmetics?" 2021. U.S. Food and Drug Administration. FDA. Accessed November 29. https://www.fda.gov/industry/fda-basics-industry/are-all-personal-care-products-regulated-cosmetics.

and thus cosmetics products are not subject to FDA premarket approval authority. The beauty and cosmetics industries are at an all-time high with increases in overall consumption and product marketing. Along with economic booms in consumer behavior, there are several problems that follow along with this increase in PCCPs. Since their initial appearance in cosmetics several decades ago, plastics have become more widely applied in different cosmetic and personal care formulations. The skincare industry alone contributes heavily to plastic pollution, with many tubes, tubs, and bottles being difficult to recycle. In addition to plastic packaging and other hard to recycle components of cosmetic products, other items such as individually wrapped sheet masks (which often comprise of an aluminum and plastic pouch, the mask, and sometimes another plastic sheet) act as a single-use plastic nightmare.[3] According to a report by the United Nations Environment Programme (UNEP), microbeads and other plastics are more commonly used as ingredients in PCCPs than we may think, with percentages ranging up to 90% in different products. [4] Additionally, this report details how in 2012 the global PCCP industry was valued at $433 billion US dollars, thus it is important to recognize the significant levels of total emissions resulting from this source of pollution. This UNEP report also mentions that a total amount of 4360 tons of microplastic beads were used in 2012 across all European Union countries. The resultant damages to Earth's ecosystem services are another important area of focus when it comes to increases in PCCP consumption. Ecosystem goods and services, often referred to as ecosystem services (ES) can be defined as the benefits people obtain from ecosystems, including provisioning services,

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[3] Wilson-Powell, Georgina. 2021. *Is It Really Green?: Everyday Eco Dilemmas Answered*. New York, NY: Dorling Kindersley.

[4] "Plastic in Cosmetics Factsheet." n.d. UNEP. https://wedocs.unep.org/bitstream/handle/20.500.11822/21754/PlasticinCosmetics2015Fa%20ctsheet.pdf?sequence=1&%3BisAllowed=.

regulating services, cultural services, and supporting services. Human beings are dependent on ecosystem services, as they themselves are integral parts of ecosystems and impact the intensity of linkages between ecosystem services and human well-being. [5] Upon considering how harmful plastic components, whether in a microbead ingredient form or exterior packaging form, can lead to serious repercussions on the health of the environment, it is also important to consider how the manufacturing practices for these plastics in PCCPs also take a toll on our Earth.

The modern lifestyle of consuming and producing PCCPs is embedded with plastic use. This becomes a serious concern when the irresponsible and unethical disposal of plastic waste in any habitat is recognized as plastic litter. [6] Many studies have been conducted globally, such as the Millennium Ecosystem Assessment, to see the how humans are dependent on ecosystem services, finding that approximately 60% of the ecosystem services examined are being degraded or used unsustainably. Ecosystem services can be divided into four categories – provisioning, regulating, cultural and supporting services. To try and fully comprehend how detrimental PCCP packaging and other plastic components are to the environment, we can frame their impact within each type of ecosystem service.

[5] Reid et al., Walter V. 2005. Ecosystems and Human Well-Being: Synthesis: A Report. Washington, D.C.: Island Press. http://www.millenniumassessment.org/documents/document.356.aspx.pdf

[6] Kumar, Rakesh, Anurag Verma, Arkajyoti Shome, Rama Sinha, Srishti Sinha, Prakash Kumar Jha, Ritesh Kumar, et al. 2021. "Impacts of Plastic Pollution on Ecosystem Services, Sustainable Development Goals, and Need to Focus on Circular Economy and Policy Interventions." *Sustainability* 13 (17): 9963. https://doi.org/10.3390/su13179963.

Figure 1. EnviroAtlas Ecosystem Services Benefit Categories. EPA. (2022)[7]

First, provisioning services can further be defined as any type of benefit to people that can be extracted by nature, such as vegetables and livestock being available to us as direct products. Marine wildlife, including many fish and land animals caught and sold for human consumption have been seriously harmed from the complications of plastic being in and around the sea. As microscopic plastic bits and pieces enter these animals' digestive tracts, they often infiltrate the marine food chain and work their way up to larger and larger predators before reaching humans.

Secondly, processes that collectively work together to make ecosystems clean and functional, such as decomposition and climate regulation, are regulating services. However, when

[7] Epa, U. S., and ORD. 2018. "Ecosystem Services - EnviroAtlas." https://www.epa.gov/enviroatlas/ecosystem-services-enviroatlas-1.

plastics and harmful chemical components of PCCPs that pollute landfills, oceans, and soil critically restrict these regulating services from transpiring. As the global market is continuously growing and evolving, plastic PCCP ingredients and packaging often require high production volumes, allowing for potential emissions of plastics into the environment via wastewater to remain a serious concern for the environment. Therefore, regulating services such as decomposition and climate regulation are severely impacted, as many microplastics that eventually break off into microscopic fragments of secondary microplastic do not break down in the Earth. Further, as non-renewable resources such as oil, gas and coal are the fossil-fuel building blocks of plastics, increases of these carbon-intensive activity only aid in the disruption and destruction of climate regulation and other regulating services.

Third, as humans continue to interact with and alter the environment to guide cultural and intellectual advancement in society, these types of recreation processes fall under cultural services. The ecosystems that have provided flora and fauna for generations to prosper in are also facing trauma with the abundance of single-use plastics utilized by PCCPs. Yet, numerous species and habitats are going extinct for the sake of cosmetics productions and the necessary plastics that originate as a result. Upon considering how aesthetic appreciation and tourism of natural sites are vital components of cultural services, it's easy to see how these services are put in a compromising position as both marine and land habitats are being damaged by plastic waste buildup and harmed wildlife.

Lastly, supporting services comprise of the underlying processes that allow the Earth to fundamentally sustain basic life forms, such as photosynthesis and the water cycle. Historically, the ocean has played the vital role of sequestering more than 50% of carbon dioxide emissions

from the atmosphere as a result of human-related activities.[8] Recent evidence from a study completed at the Ocean University of China has shown that plankton in our oceans are ingesting considerably higher quantities of microplastics.[9] As the manufacturing and processing of plastics only continues to rise with consumer demands, the impact of microplastics on basic life forms, such as plankton in the oceans, will also continue to have negative effects on their growth and photosynthesis. Furthermore, according to Zero Waste Week data, the global disposal of cosmetics packaging and containers account for up 70% of the whole industry's carbon emissions.[10] This in turn harmfully impacts the Earth's natural processes, and negatively contributes to the primary occurrence of greenhouse gas emissions.

Therefore, the aforementioned services would not exist without ecosystem supporting services. In relation to these services, plastic waste exposed to nature creates environmental stressors as a result, including changes to ocean acidification levels, air quality and over exploitation of marine resources. Plastic pollution is of significant concern for all forms of life, especially since the leakage of plastic wastes into terrestrial and marine ecosystems is rapidly occurring, and there are still major proposals to made in changing the management of these wastes. This is where regulation and monitorization or plastic waste plays a vital role in preventing further

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[8] Bauman, Brooke. 2019. "How Plastics Contribute to Climate Change »." Yale Climate Connections. August 20, 2019. https://yaleclimateconnections.org/2019/08/how-plastics-contribute-to-climate-change/.

[9] Zhang, Cai, Xiaohua Chen, Jiangtao Wang, and Liju Tan. 2017. "Toxic Effects of Microplastic on Marine Microalgae Skeletonema Costatum: Interactions between Microplastic and Algae." *Environmental Pollution (Barking, Essex: 1987)* 220 (Pt B): 1282–88. https://doi.org/10.1016/j.envpol.2016.11.005.

[10] "Zero Waste Home Guide." 2020. Zero Waste. April 30, 2020. https://www.zerowaste.com/zero-waste-home-guide/.

damage to marine ecosystems and inhibiting harm to natural ecosystem services. According to 2018 data regarding the total number of tons of packaging generated and discarded, including percentages of those which end up in landfills, it has been reported that approximately 55.4% of glass containers and a staggering 69% of plastic containers and packaging were landfilled annually. [11] Glass and plastic packaging are more commonly used for personal care and cosmetics products, and are often incorrectly disposed of, leading to increases in marine litter and plastic pollution. Globally, there are an estimated 51 trillion microplastic particles in our seas, many of which can be found in a personal care or cosmetic product. Microplastics in the environment can be encountered in two different forms. The first is categorized as being primary microplastics which are directly released into the environment in the form of small particles – such as microbeads, which fall under voluntary additions to personal care and cosmetic products. Secondly, these plastics might fall under the category of secondary microplastics, whereby they originate from the degradation of larger plastic items into smaller plastic fragments once released into marine environments – such as a plastic bag, container, or other packaging component. The UNEP #CleanSeas campaign has reported that these products can contain as much plastic as the packaging it comes in. [12] It has been established that plastic use is ubiquitous in all sectors of society, specifically including personal care and cosmetics products. One article focused on PCCPs as a source of environmental contamination highlights a densely populated Chinese city, Macao, where the levels of microplastics found in sediment samples were amongst the highest reported in

[11] "Containers and Packaging: Product-Specific Data." 2021. EPA. Environmental Protection Agency. Accessed November 29. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific-data.

[12] 11th Hour Racing. 2020. "United Nations Environment Program Clean Seas Campaign." 11th Hour Racing. 11th Hour Racing. September 22. https://11thhourracing.org/projects/united-nations-environment-program-clean-seas-campaign/.

the world. It had been estimated that this territory alone may release over 37 billion microbeads per year into the environment via wastewater treatment plants.[13] On a global scale, the World Economic Forum (WEF) has reported that the total annual production of plastic has increased from 1.7 million tons in 1950 to 359 million tons in 2018 and is expected to reach 1,124 million tons per year by 2050.[14] This report also provides significant details on how – because plastics are also replacing many other forms of packaging – between 2000 and 2015, the share of plastic packaging as a share of global packaging volumes has increased from 17% to 25% in the overall global plastic packaging market.

[13] Bashir et al., Saidu M. 2021. "Personal Care and Cosmetic Products as a Potential Source of Environmental Contamination by Microplastics in a Densely Populated Asian City." Frontiers. June 4. https://www.frontiersin.org/articles/10.3389/fmars.2021.683482/full#B61.

[14] World Economic Forum. 2016. *The New Plastics Economy: Rethinking the Future of Plastics.* Cologny: World Economic Forum.

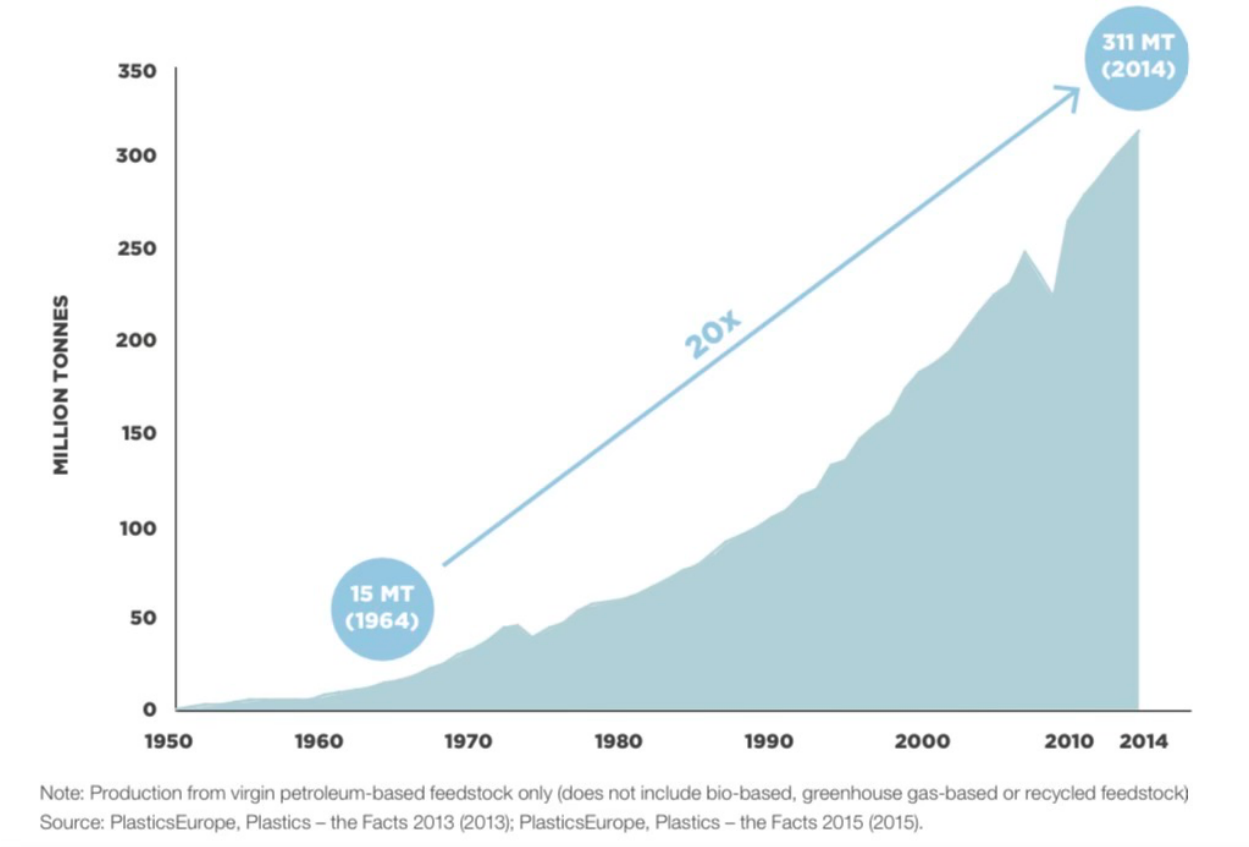

Figure 2. Growth in Global Plastics Production 1950-2014. World Economic Forum. (2016)[15]

With approximately 120 billion units of packaging produced annually by the global cosmetics industry, this fact proves to be a significant element of overall of global plastic production. Furthermore, the World Economic Forum has also estimated that 32% of single use packaging, which also encompasses numerous personal care and cosmetic packaging components that are disposed of immediately after the product is opened, readily escapes collection systems.[16] As

[15] "The New Plastics Economy Rethinking the Future of Plastics." 2016. Weforum.Org. 2016. https://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf.

[16] Boucher, Julien, and Guillaume Billard. 2019. "The Challenges of Measuring Plastic Pollution." *Field Actions Science Reports*, no. Special19: 68–75. https://journals.openedition.org/factsreports/5319.

statistics are further analyzed in regard to personal care and cosmetics products, it is also essential to explore the different perspectives of environmentalists, beauticians, students, consumers, etc. that are specifically researching or handling these types of products and are thus involved in the greater international issue of plastic pollution in PCCPs. For example, one conducted study explored the awareness of plastic microbeads in personal care products amongst three groups comprised of environmental activists, trainee beauticians, and university students in South West England.[17] Each of the groups were asked for responses to questions regarding how they believed presented samples of microbeads worked in PCCP products, what happens to them once they have been used, where do they end up disposed after use, what are your thoughts about these products now, and with your new knowledge on microbeads what do you think can be done to reduce or eliminate their use. As the different participants were shown the quantity of microbeads and spoken to about their uses and disposal processes regarding individual high-street personal care products, qualitative analysis by the researchers demonstrated that there is a large lack in visibility and immediacy for this type of environmental issue amongst more common consumers – in this case being the beauticians and students. Essentially the participants within this study represent a much larger majority of the general world population when it comes to fully understanding the underlying environmental issue related to microbead and irresponsible plastic disposal with personal care and cosmetic products. Something else significant about this study was that the environmentalists who also participated in this research commented on the perception of false advertising and the misrepresentation of many "environmentally friendly" products. These

[17] Anderson, A. G., J. Grose, S. Pahl, R. C. Thompson, and K. J. Wyles. 2016. "Microplastics in Personal Care Products: Exploring Perceptions of Environmentalists, Beauticians and Students." *Marine Pollution Bulletin* 113 (1–2): 454–60. https://doi.org/10.1016/j.marpolbul.2016.10.048.

environmentalists recounted that it was only until they joined with other like-minded individuals and fully grasped the visible issue at hand that they became more empowered to act on it.

Chapter 2: The Ugly History of Beauty Products with Plastics

Modern day plastic packaging has been esteemed for its durability and stability among its commercial success. However, when the accumulating damages to human health and environmental degradation are taken into consideration, it becomes apparent that necessary changes to plastic regulation in personal care products are urgently needed. The global cosmetic packaging market was valued at $30.37 billion USD in 2019 and is projected to reach $39.32 billion USD by 2027. This pivotal role played by cosmetic packaging in the global market makes it even more important to understand the history plastic has played in this evolution. The very first forms of packaging and containing liquids or items was a primate need by many in the Mesolithic, or middle stone, age. This would have more than likely been accomplished with the use of cups bowls, or bags made from natural materials such as leaves, animal skin, gourds, bark, or shells. Later packages for the purpose of carrying liquid or quantities of plants or berries were fashioned from bone, wood, twigs, or grasses. The history of cosmetics is often attributed to ancient Egypt. Further ancient civilizations, such as Iraq in 2000 BCE, where perfumes were commonly used and pigmenting for the eyes and lips were made from various minerals and stored in shells. Ancient Egyptian professionals took their work in manufacturing cosmetics seriously, and the finest natural ingredients and most trusted production methods were utilized. Because the science behind Egyptian cosmetics and other PCCPs were considered so advanced, the Oxford English Dictionary attributes the English word “chemistry” (derived from “alchemy” as rooted in Kemet, the ancient name of Egypt in the Egyptian language. These historical products served several purposes,

especially hygienic and health advantages.[18] For example, ancient Egyptian deodorants were made and used in a similar fashion as perfumes, with one method involving a cream paste comprised of ostrich egg, nuts, tamarix and several other ingredients to be applied to one's arms, torso, and legs for a scent-free deodorant.[19] Furthermore, the need for many toiletry items that first made an appearance in Ancient Egypt was often a result of environmental factors such as the desert sun and Nile floodwaters during inundation.[20] For example, these types of environmental factors produced a need for facial-eye protection. This "eye-paint" or eyeliner was used when working in the flooded lands, and the creation of eye paint cosmetic pallets in Predynastic Egypt may be attributed to the start of preceding kohl cosmetic artifacts.

Personal care and cosmetics products such as this were often stored in an ornate assortment of handcrafted jars, bowls, bottles, and some would be expected to be paired with cosmetic spoons as applicators. Cosmetic vessels also comprised of hieroglyphically inscribed kohl tubes and spoons, which were often formed into stylized shapes related to ancient Egyptian ideologies. There has also been evidence that Native Americans created small containers woven from basketry materials, such as pine needles, to serve a similar function for storing personal care and cosmetics products. Many Native American cultures were leaders in developing and storing many tools and products available on the market today. For example, North American Indians have medicinal purposes for more than 2,500 plant species, and many native cultures created a common skin

[18] Amberg, Nora, and Csaba Fogarassy. "Green Consumer Behavior in the Cosmetics Market." *MDPI*, Multidisciplinary Digital Publishing Institute, 30 July 2019, https://www.mdpi.com/2079-9276/8/3/137.

[19] Mark, Joshua J. 2017. "Cosmetics, Perfume, & Hygiene in Ancient Egypt." *World History Encyclopedia*. https://www.worldhistory.org/article/1061/cosmetics-perfume--hygiene-in-ancient-egypt/.

[20] Selk, Mike. 2018. "The Evolution of Cosmetics Packaging." Liquipak. January 23, 2018. https://www.liquipak.com/the-evolution-of-cosmetics-packaging/.

application that involved mixing group plants with water to create a sun-protection cream, or sunscreen as we might call it today. Sunflower oil, wallflower, and aloe vera sap have all been attributed to products that aid in protection from the sun. By the early 20th century, modern personal care and cosmetic products were being created. Lipstick was introduced in 1915 in cylindrical metal tubes, and other items that focused on convenience and eliminating excess tools began to appear, such as roll-on deodorant in 1952 and mascara wands in 1958, which eliminating the need for applying mascara with a brush.[21]

By the 20th century, there was the discovery and pervasive use of petroleum. Petroleum-based plastics are artificial organic polymers, obtained from natural gas or oil, and can be utilized in just about every aspect of contemporary life.[22] Petroleum-based plastics are used globally for a variety of purposes, and are notorious for being a primary form of plastic production. Global petroleum-based plastic production reached approximately 322 million tons in 2015, which is an immense difference in comparison to the 1.7-million-ton estimate for 1950. An additional note of importance about petroleum-based plastics is the fact that despite their widespread use across the globe, they cannot naturally break down due to their basic structure and composition. For this reason, it is important to understand the difference between plastics that claim to be "biodegradable" (being decomposed by living organisms) and those that can "degrade" (physically breaking into pieces). Even plastics that claim to be biodegradable last in the natural environment for years or decades, and the rate at which they break down can depend on environmental factors

[21] Jain, N., & Chaudhri, S. (2009). History of cosmetics. Asian J Pharm, 3(3). DOI: 10.4103/0973-8398.56292

[22] Suman, Thodhal Yoganandham, Wei-Guo Li, Shaji Alif, Valappil Rahman Panangala Faris, Duvvuru Joshua Amarnath, Jun-Guo Ma, and De-Sheng Pei. 2020. "Characterization of Petroleum-Based Plastics and Their Absorbed Trace Metals from the Sediments of the Marina Beach in Chennai, India." *Environmental Sciences Europe* 32 (1). https://doi.org/10.1186/s12302-020-00388-5.

such as temperate and exposure levels to ultraviolet (UV) light. Petroleum-based plastics can come in several types of synthetic forms in today's market, such as low-density polyethylene (LDPE), polypropylene (PP) and polyvinyl chloride (PVC). These types of plastics all come with their own unique properties and make up various types of everyday items. For these reasons it is important to recognize the recycling symbols (typically numbered 1-7) on items to aid in recycling them properly.

Figure 3. Plasgran "Guide to Plastic Recycling Grades", 2015[23]

Plastic mass manufacturing can be accredited to the time at the advent of World War II. During this time, natural rubber was in short supply and extensive research was being developed to look for synthetic alternatives. New applications began to be produced utilizing large scale manufacturing of polyethylenes in the late 1970s, including the expansion into personal care products. [24] However, this mass production has also led to our modern issue of petroleum-based plastics making up over half of all marine litter, with the majority being microplastics. Microplastics are exactly as they sound, created because of larger plastics degrading into smaller and smaller fragments which can bypass wastewater treatment due to their nature of being less than 5 mm in length. Patents for early microbeads in personal care products began in the late 1960s, but it wasn't until the 1990s when they were considered an innovative source of personal care production. Due to their miniscule size and pervasiveness, microbeads are virtually impossible to extract from water sources and the environment. When plastic particulates derived from PCCPs enter the environment, they are persistent insofar that they can be distributed across multiple ecosystems and can be transported across different food chains. Once they find their way into the sea, PCCP microplastics it is not easy to discern them from microplastics of different sources and polymer types. [25] Plastic polymers are used as ingredients in PCCPs for a variety of purposes, including exfoliation, film formation, and viscosity controlling.

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[23] PLASgran. 2015. "Plasgran Guide to Plastic Recycling Grades." https://plasgranltd.co.uk/wp-content/uploads/2015/07/Plasgran-Guide-to-Plastic-Recycling-Grades.pdf.

[24] Perschbacher, Ellen. 2021. "History and Evolution of the Microbead." International Joint Commission. Accessed November 29. https://www.ijc.org/en/history-and-evolution-microbead.

[25] Leslie, H. A. 2014. Rep. Review of Microplastics in Cosmetics. Accessed July. https://www.resource-recovery.net/sites/default/files/leslie_plastic_ingredients_in_cosmetics_2014.pdf.

POLYMER	EXAMPLES OF FUNCTIONS IN PCCP FORMULATIONS
Nylon-12 (polyamide-12)	Bulking, viscosity controlling, opacifying (e.g. wrinkle creams)
Nylon-6	Bulking agent, viscosity controlling
Poly(butylene terephthalate)	Film formation, viscosity controlling
Poly(ethylene isoterephthalate)	Bulking agent
Poly(ethylene terephthalate)	Adhesive, film formation, hair fixative; viscosity controlling, aesthetic agent, (e.g. glitters in bubble bath, makeup)
Poly(methyl methylacrylate)	Sorbent for delivery of active ingredients
Poly(pentaerythrityl terephthalate)	Film formation
Poly(propylene terephthalate)	Emulsion stabilizing, skin conditioning
Polyethylene	Abrasive, film forming, viscosity controlling, binder for powders
Polypropylene	Bulking agent, viscosity increasing agent
Polystyrene	Film formation
Polytetrafluoroethylene (Teflon)	Bulking agent, slip modifier, binding agent, skin conditioner
Polyurethane	Film formation (e.g. facial masks, sunscreen, mascara)
Polyacrylate	Viscosity controlling
Acrylates copolymer	Binder, hair fixative, film formation, suspending agent
Allyl stearate/vinyl acetate copolymers	Film formation, hair fixative
Ethylene/propylene/styrene copolymer	Viscosity controlling
Ethylene/methylacrylate copolymer	Film formation
Ethylene/acrylate copolymer	Film formation in waterproof sunscreen, gellant (e.g. lipstick, stick products, hand creams)
Butylene/ethylene/styrene copolymer	Viscosity controlling
Styrene acrylates copolymer	Aesthetic, coloured microspheres (e.g. makeup)
Trimethylsiloxysilicate (silicone resin)	Film formation (e.g. colour cosmetics, skin care, sun care)

Figure 4. UNEP, "Plastics in Cosmetics Fact Sheet", 2015[26]

With these nonbiodegradable and potentially harmful microplastics, a recommendation for action may be to phase out and eventually ban microplastics from PCCPs. Human activity has significantly impacted the pressures of plastic pollution and the climate crisis, which is evident through the vast travels undergone by microplastics in nature. As of 2020, it had been reported in the journal *One Earth* that microplastics were found in every snow sample taken from Mount

[26] UNEP. 2015. "Plastic in Cosmetics." Unep.Org. 2015. https://wedocs.unep.org/bitstream/handle/20.500.11822/21754/PlasticinCosmetics2015Factsheet.pdf?sequence=1.

Everest. [27] This excessive span of microplastics should shed light on the frightening reality that many of human's day-to-day PCCPs, perhaps used only for a few weeks, will be around longer than those who use them.

Plastic packaging is another attribute of pollution in the cosmetics industry that has undergone its own evolution. The high dependence on plastics by well developed nations, such as the United States, tends to exemplify today's excessive consumerist behavior. Therefore, much of this material consumption and resulting disposal becomes plastic waste. When it comes to personal care and cosmetics products specifically, every average household is bound to have at least one item contained in plastic packaging, such as shampoo bottles, aerosol deodorants, shower gel, eye shadow, hair coloring, insect repellant or skin moisturizer. Cosmetics products themselves have ancient origins and storing them has evidently become just as important as producing them. Cosmetic packaging has progressed from being based solely on usability with materials such as terracotta clay pots, granite vases, ivory cases, and glass and metal containers. With the industrial revolution, cosmetic packaging began to evolve further with the first product made of plastic in 1862. This alternative form of cosmetic packaging was a pivotal change from using packaging for the purposes of preservation and preventing contamination, because now *plastic* packaging could be used to communicate brand identity – with instructions for use, ingredients, and specific brand labels. By the mid 1920s, the United States specifically began to emerge as a prolific producer and consumer of personal care and cosmetics products. At this time the personal care industry began to join the plastics bandwagon along with other industries expanding into this new area of packaging. This explosion in plastic usage stemmed from the material's ability to contain,

[27] Clifford et al., Heather. n.d. Rep. Reaching New Heights in Plastic Pollution—Preliminary Findings of Microplastics on Mount Everest. Vol. 3. One Earth. https://doi.org/10.1016/j.oneear.2020.10.020.

preserve, and transport products more easily. An important point of study regards retaining the benefits of plastic products, while simultaneously reducing the quantity of plastics in the environment. As described in *Plastics and the Environment*, "the benefits resulting from the use of plastics are not *directly* linked to the emission of plastic debris to the environment or to degradation of the environment," thus it is still possible to retain the benefits of these products and accurately determine the best management measures to introduce.[28] For these reasons, the most effective solutions to aid in this plastic packaging epidemic would include minimizing the release of plastics into the environment to subsequently reduce the accumulation of microplastics in ecosystems. As was briefly discussed in the Introduction, ecosystem services would also benefit from alternative methods of packaging and less pollution runoff. As previously established, many forms of plastic packaging and layers of nonbiodegradable material only contribute to increases in water consumption, deforestation, and harm brought primarily to marine ecosystems. Despite cosmetics packaging having undergone, and continuing to undergo, its own evolution of containing, preserving, and transporting products, it is essential to understand that oftentimes more visually appealing and easier methods of packaging are not a necessity.

[28] R M Harrison, and R E Hester. 2019. *Plastics and the Environment*. Issues in Environmental Science and Technology. Cambridge, UK: Royal Society of Chemistry. https://search-ebscohost-com.avoserv2.library.fordham.edu/login.aspx?direct=true&db=nlebk&AN=1982936&site=eds-live.

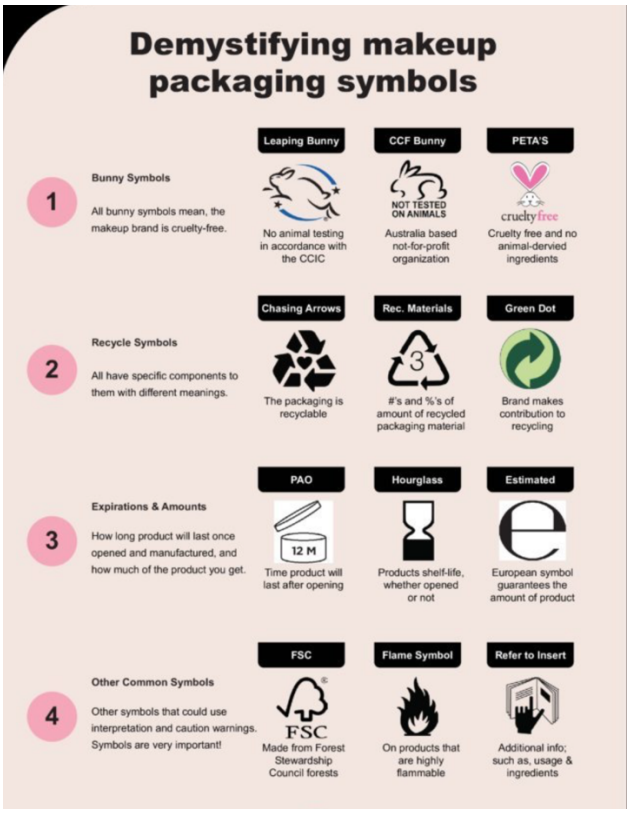

Figure 5. Red Apple Lipstick "Demystifying Makeup Packaging Symbols"[29]

A number of today's PCCP brands have made strides to encourage consumers to buy from sustainably sourced and recycled materials, and to consider the overall life cycle of purchases. Certain labels, such as Rainforest Alliance Certified, ECOCERT, and Fairtrade maintain that their associated products are sustainably sourced as well.[30] Taking the time to read labels and replace short term cycle plastic items help to avoid dangerous microplastic particles, as well as minimize accumulation of microplastics in the environment from single-use plastic beauty items.

[29] Harper, Andrea. 2020. "What Do the Different Makeup Packaging Symbols Mean? - RAL Blog." Red Apple Lipstick. July 14, 2020. https://www.redapplelipstick.com/demystifying-makeup-packaging-symbols/.

[30] Erdmane, Annija. 2020. "How the Beauty Industry Is Feeding Plastic to You and the Planet ." Commercial Waste. August 27. https://commercialwaste.trade/how-the-beauty-industry-is-feeding-plastic-to-you-and-the-planet/.

Chapter 3: Controlling Toxic Chemicals in Cosmetics: A Legal Discipline

The Toxic Substances Control Act (TSCA) and the Federal Food, Drug, and Cosmetics Act (FDCA) are two primary pieces of legislation in the United States that provide the EPA with the authority over certain chemical substances and/or mixtures. The Toxic Substances Control Act of 1976 initially arose due to concerns in the late 1960s and early 1970s regarding a series of pesticide and worker-related chemical scares. However, in more recent years, it has become evident that there are "troubling gaps in the available knowledge on many widely used chemicals in commerce," thus the EPA has only been successful in requiring testing on a few hundred chemicals rather than the tens of thousands in the TSCA inventory. [31] As per the EPA's website the TSCA holds the responsibilities of maintaining their inventory as new chemicals are commercially manufactured or imported, requiring testing of chemicals where risks or exposures of concern are evident, and require (among others) compliance from those importing or exporting chemicals regarding certification reporting. [32]

The Federal Food, Drug, and Cosmetics Act was first enacted in 1938 after an untested pharmaceutical was put on the market and subsequently killed numerous patients. The FDCA tightened controls over drugs and food, included new consumer protection against unregulated cosmetics and medical devices, and also gave the federal government more ability to enforce such

[31] Senate. 2016. Oversight Hearing on the Federal Toxic Substances Control Act: Joint Hearing before the Subcommittee on Superfund, Toxics and Environmental Health, and the Committee on Environment and Public Works, United States Senate, One Hundred Eleventh Congress, First Session, December 2, 2009. Washington: U.S. Government Publishing Office. https://www.govinfo.gov/content/pkg/CHRG-111shrg20184/pdf/CHRG-111shrg20184.pdf

[32] "Summary of the Toxic Substances Control Act." 2021. EPA. Environmental Protection Agency. Accessed November 29. https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act.

regulations. [33] This act is implemented by the Food and Drug Administration and is administered by the FDA. According to the amended version of the FDCA today, the United States Code defines the term "cosmetic" as an "article intended to be rubbed, poured, sprinkled, sprayed on or introduced into the human body for cleansing, beautifying, promoting attractiveness or altering the appearance". [34] As previously mentioned in Chapter 1, the FDA makes several categorizations when it comes to personal care and cosmetics products as opposed to drugs and other elements covered under the FDCA. Though the phrase "personal care products" may be used broadly to cover a variety of items, there is indeed no legal definition for this term. This consequently may make it more difficult to accurately monitor and regulate their subsequent ingredients and report the safety of these products. Under the law products such as skin moisturizers, hair colors, and face washes are referred to as "personal care products", whereas other products such as skin protectants and antiperspirants are regulated as drugs. Due to the fact that cosmetics products fall outside the regulatory stature of receiving premarket approval by the FDA to ensure they are safe and effective, this responsibility is placed on cosmetic firms themselves. In recent years there have significant moves to action to amend the FDCA to bring more stringent regulation on cosmetics and their ingredients specifically. A proposed 2015 act referred to as the "Microbead-Free Waters Act of 2015" called for the prohibition against selling or distributing any rinse-off cosmetics that contained plastic microbeads. [35] This proposal notes that if enacted, terms would be added to the end of Section 301 of the FDCA act to include the definition of a plastic microbead and its intended

[33] "How Did the Federal Food, Drug, and Cosmetic Act Come about?" 2021. U.S. Food and Drug Administration. FDA. Accessed November 29. https://www.fda.gov/about-fda/fda-basics/how-did-federal-food-drug-and-cosmetic-act-come-about.

[34] 21 U.S. Code § 321

[35] Public Law 114–114 114th Congress. 2015. Vol. 161. HOUSE REPORTS: No. 114–371 (Comm. on Energy and Commerce). https://www.govinfo.gov/content/pkg/PLAW-114publ114/pdf/PLAW-114publ114.pdf

use, and that nothing in this act should be construed to apply with respect to drugs not also classified as cosmetics. Other global governments are also attempting to make strides in eliminating microbeads though. Within the past decade, the "Canadian parliament passed legislation to prohibit the manufacturing of microbeads", and the "Australian Microplastics Working Group was established to seek voluntary agreement" from industries to gradually phase out microbeads in PCCPs. [36]

This call to continuously impose harsher regulatory standards for cosmetics is clearly a global phenomenon. For example, cosmetics products in Australia must follow the definition for cosmetic under the Industrial Chemicals Act 1989. Under this act, a 'cosmetic' is defined as a substance or preparation intended for placement in contact with any external part of the human body, such as changing its appearance or maintain it in good condition. [37] However, this definition does not specifically cover the outside physical appearance of cosmetic and personal care products. In a similar vein, countries such as Venezuela define cosmetics as products manufactured from natural or synthetic substances to be used on the surface of the human body. One underlying global similarity when it comes to defining cosmetics is that while many countries define cosmetics to conform to necessary purposes for use and ingredient lists, there is no specific mention of the use of microbeads as an ingredient, or plastics used to contain the product. There must be more stringent and definitive regulatory standards in place for how countries classify their cosmetics when it comes to plastic components. This would allow for more accurate representations of

[36] Lam, CS., Ramanathan, S., Carbery, M. et al. 2018. A Comprehensive Analysis of Plastics and Microplastic Legislation Worldwide. Water Air Soil Pollution 229, 345. https://doi.org/10.1007/s11270-018-4002-z

[37] Lintner, Karl. 2009. *Global Regulatory Issues for the Cosmetics Industry (Personal Care and Cosmetic Technology)*. 1st ed. William Andrew Publishing.

pollutive actions taking place and would thus give countries a more effective chance to take the natural environment into consideration in manufacturing and consuming cosmetics.

Narrowing in on the United States once again, it would be a useful approach to the plastic pollution epidemic to propose that microplastics require more stringent levels of management, and all PCCP and corresponding ingredients should subsequently fall under the regulation by the Toxic Substances Control Act, and be required to have FDA approval under the Federal Food, Drug, and Cosmetic Act. The cosmetics industry is currently not included in the Toxic Substances Control Act (TSCA), as cosmetics manufacturers are only required to test chemicals for human safety, not environmental protection. There have been recent proposals made, however, to require cosmetics manufacturers to register their facilities, products, and ingredients with the FDA, which could assumedly include the harmful use of plastics and microbeads. Under the FDCA, the FDA determines whether a product is a cosmetic or drug based on its intended use. Intended use may established in several ways, including how the product might be perceived by a consumer through its reputation on the market, and any claims made on the product's labeling. Under this act, if a label or labeling of a cosmetics product marketed in the US contains any representations in a foreign language, all mandatory information under the FDCA must also appear in a foreign language, as well as English – as per the Personal Care Products Council Labeling Manual. [38] Sometimes firms try to bypass requirements correlated with a cosmetic product by marketing a cosmetic with a drug claim, or by marketing a drug as if it were a cosmetic. Additionally, under the FDCA, cosmetic products and ingredients are not required to have FDA approval before going on the market. Instead, the responsibility of assuring cosmetics products are not tampered with or

[38] The Personal Care Products Council Labeling Manual: A Guide to Cosmetic and OTC Drug Labeling and Advertising, Ninth Edition 2013, https://www.personalcarecouncil.org/labeling-packaging/

misbranded is placed on the firms as they are expected to comply with "good manufacturing practice (GMP). However, while there are currently guidelines set in place for adhering to good manufacturing practice, no regulations have set forth specific GMP requirements for cosmetics.

In the absence of comprehensive federal legislation with regards to plastic packaging and PCCPs, several states and jurisdictions in the United States have created their own laws and regulations affecting the manufacturing, use and disposal of packaging. Despite the federal government having jurisdiction over areas pertaining to the regulation of food, drug and cosmetic packaging, promotion of government procurement of recycled products, and issuing guidelines towards manufactures making environmental claims about their packaging, there are still provisions being adopted by states with regards to acceptable packaging requirements. For example, the federal government has procured the primary role of environmental protection through agencies such as the EPA when it comes to regulating and setting standards for issues such as municipal solid waste (MSW). Some states and localities have adopted laws and regulations that invest significant resources to build and manage solid waste disposal facilities, even considering conflicts over interstate shipment of waste. Furthermore, some states have made strides to mandate efforts such as recycling and packaging regulation despite the absence of federal jurisdiction in certain gray areas of legislation. For example, under the U.S. National Environmental Policy Act (NEPA), the FDA interprets this legislation as requiring the agency to evaluate the impact that clearance of a packaging material may have on the environment, such as cosmetics packaging.[39] However, despite this legislation utilizing a "systematic, interdisciplinary

[39] "Packaging and Environmental Legislation in the United States: An Overview." n.d. Packaginglaw.Com. Accessed April 18, 2022. https://www.packaginglaw.com/special-focus/packaging-and-environmental-legislation-united-states-overview.

approach…in planning and in decision-making", it does not require agencies to alter their actions based on the results of any related environmental assessments.[40] Another significant example of legislation passed that furthers states' efforts to mandate recycling efforts can be seen with California in 2021 with the banning of "chasing arrows" for non-recyclable plastic.

Figure 6. The Ugly Side of Beauty: The Cosmetics Industry's Plastic Packaging Problem (2022)[41]

[40] 42 U.S.C. §4321 et seq.

[41] Plastic Pollution Coalition. 2022. "The Ugly Side of Beauty: The Cosmetics Industry's Plastic Packaging Problem —." Plastic Pollution Coalition. January 25, 2022. https://www.plasticpollutioncoalition.org/blog/the-cosmetics-industrys-plastic-packaging-problem.

This essentially stems from the fact that, unfortunately, many cosmetics and personal care products use plastics other than types #1 and #2, as illustrated earlier in chapter 2. Many people utilizing the chasing arrow symbol and identify the number in the middle to know which type of plastic is being used and therefore how it should be properly disposed of. However, in 2021 California passed legislation that bans the chasing arrow label from plastics, because so much of those produced aren't truly recyclable. As this legislation states, it would "prohibit a person from offering for sale, selling, distributing, or importing into the state any product or packaging for which a deceptive or misleading claim about the recyclability of the product or packaging is made". Essentially, this legislation also provides that a product or packaging that displays a chasing arrows symbol is deemed to be a deceptive or misleading claim unless it can be proven that the product or packaging is recyclable in accordance with statewide recyclability standards.[42] This lack in cohesive cosmetics regulation at both federal and more local levels will be a primary proponent of the policy recommendations proposed in Chapter 5.

Further, with regards to this issue of plastic pollution within the personal care and cosmetics industry becoming a more widely discussed issue, it is also significant to understand how a lack of worldwide legislation and regulation has furthered this issue into an environmental justice concern. The environmental justice movement has prominently addressed how plastic pollution is an environmental injustice to vulnerable communities, and how this issue exploits the lack in local voice in policy making.[43] When studying the Environmental Justice Movement

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[42] "Bill Text - SB-343 Environmental Advertising: Recycling Symbol: Recyclability: Products and Packaging." n.d. Legislature.ca.Gov. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB343.

[43] Environment, U. N. 2021. "NEGLECTED: Environmental Justice Impacts of Marine Litter and Plastic Pollution." UNEP - UN Environment Programme. April 1, 2021. https://www.unep.org/resources/report/neglected-environmental-justice-impacts-marine-litter-and-plastic-pollution.

(EJM), it is necessary to view it in a larger framework than simply being harm thrust upon nature. Yes, environmental degradation is a fundamental dilemma regarding environmental injustice, but the Environmental Justice Movement focuses not just on environmental harm, but that 'harm' is experienced unequally by underrepresented and vulnerable communities. This movement is not solely about the markers of race, but encompasses a complex approach used to assess our environmental conditions and those systems we live in as a society. That production of harm as widespread as it is, is purposefully executed and brings into question matters of justice. When we think about environmental injustice, it is necessary to move beyond the environment as an idea. As an idea, it stems from the premise that it's solely about the harm that's done. People of color are disproportionately suffering - that suffering is not an unintended consequence of this system and instead leads to early death and poor quality of life. The types of plastic pollution being thrust upon these groups is done so unjustly, with no foreseeable plan of reversing any adverse effects. With regards to PCCP pollution specifically, these types of plastics only contribute to the already existing disproportion in how communities of color or low-economic standing are facing greater exposure to these pollutants, as well as the toxins that result from improper degradation of these materials.

Chapter 4: Integration of Sustainable Business Practices

The plastic footprint of the personal care and cosmetics industries has grown exponentially in recent decades and is only expected to expand further. As previously mentioned, the global (primarily plastic) packaging industry for PCCPs creates nearly $25 billion in sales. This makes sense when we consider the layers upon layers of packaging that even the smallest products might

come in. For example, buying something as small as a lip-gloss or concealer from a cosmetics store will usually be packaged in a plastic tube. The product will likely also include a plastic applicator or cap, be wrapped in a plastic film to protect it along with a carboard box - also with plastic stabilizing supports to keep the product in place. The box may then be wrapped in even more plastic detailing or covering for display protection. This exhaustive process of getting through plastic and otherwise single-use components for a single product is greatly excessive. This also does not take into account how many personal care and cosmetic stores and shops advertise their products with other single use wasteful items, such as plastic q-tips or plastic bottled makeup remover for shoppers to utilize. Thus, the issue of cutting down on plastic use or eliminating it all together continues to be a challenge for cosmetics companies. The true impact of plastic on atmospheric greenhouse gas concentrations is considerably greater than reports have previously suggested. [44] In the contest of plastic packaging such as that used for many PCCPs, there would be great environmental benefit for reducing these single-use non-essential plastics. Proponents of the circular economy model advocate for business structures that increase the usable lifespan of disposable items such as cosmetic packaging, and dramatically reduce the consumption of raw materials. As illustrated in the graph below, most of the plastic packaging circulating in our world today leave use the same year they are produced. This immense level of waste generated demonstrates how single-use and non-biodegradable plastics evidently end up in our environment for much longer than might be anticipated upon production. Additionally, because of this limited lifespan nature of much of the plastic packaging produced, to date virtually all thermal destruction of these materials has been done by incineration, with or without energy recovery. Furthermore,

[44] Hamilton et al., Lisa Anne. 2019. Plastic & Climate: The Hidden Costs of a Plastic Planet. Washington, DC: Center for International Environmental Law (CIEL). https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf

this environmental problem of plastic packaging instituting itself as the primary agent with the shortest product lifetime distribution also expands upon the complimentary issue of the nonrenewable resources that are being used up to create these temporary products. For this reason it becomes even more so important for businesses to assess their manufacturing practices, and to reconsider alternative practices in generating personal care and cosmetic packaging.

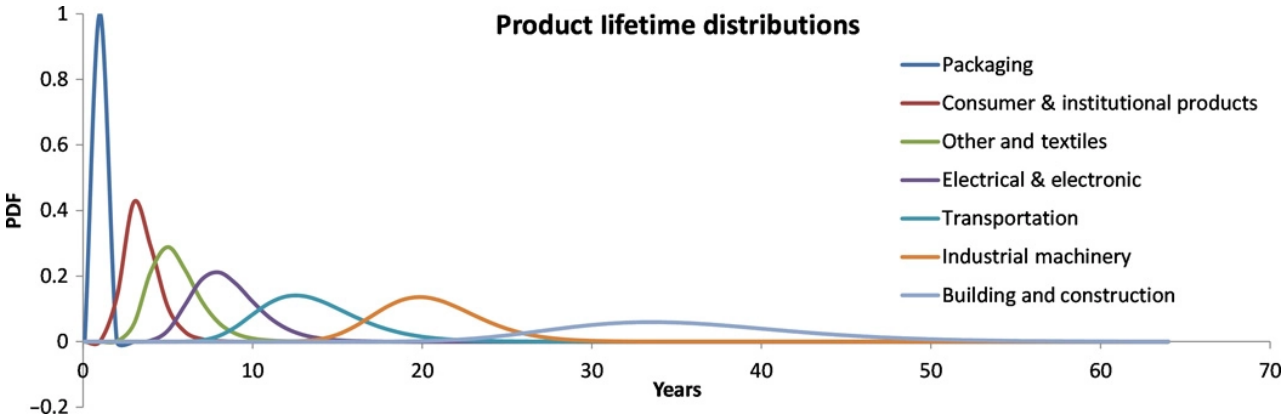

Figure 7. Product lifetime distributions, ScienceAdvances. (2017)[45]

It is not commonly known how many raw materials are used up to make everyday plastics that may last less than a day in a household. As described with more detail in *Plastics & Climate*: *The Hidden Costs of a Plastic Planet*, the plastic manufacturing involves a thermoplastic or resin in pellet form undergoing a series of molding processes to create final products. [46] These plastic

[45] Geyer, Roland, Jenna R. Jambeck, and Kara Lavender Law. 2017. "Production, Use, and Fate of All Plastics Ever Made." *Science Advances* 3 (7): e1700782. https://doi.org/10.1126/sciadv.1700782.

[46] Hamilton et al., Lisa Anne. 2019. Plastic & Climate: The Hidden Costs of a Plastic Planet. Washington, DC: Center for International Environmental Law (CIEL). https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf

manufacturing processes are dependent on the non-renewable natural resource of crude oil. In order to produce one pound of plastic, 22 gallons of water are required. It is increasingly apparent that water and other finite resources are keeping afloat the demand for consumer goods, and thus human behavior is impacting natural capital. The extraction of non-renewable resources should be minimized to avoid exceeding strategic levels of emissions and capital. Despite many brands claiming to be more environmentally conscious with the use of "bioplastics" for their products, it is important to keep in mind that the bioplastic industry is not necessarily much more environmentally friendly than other types of plastics. Although bioplastic is not necessarily biodegradable, they do reduce reliance on petroleum-based plastics which in turn leads to a reduction in greenhouse gas emissions and non-renewable resource depletion. Groups such as the Bioplastic Feedstock Alliance, a science-based stewardship, have made efforts to partner with consumer product industries that include cosmetics, and to increase awareness of the environmental and social performance of bio-based plastics.[47] However, recent reports have assessed that replacing petroleum-based plastics with bio-based plastics such as polylactic acid (PLA) is not advisable, as PLAs only degrade when subjected to specific external factors, such as high temperatures in industrial settings. As the bioplastics industry continues to grow in the PCCP sector, there have not been clear advantages of biodegradable polymers over nonbiodegradable materials in PCCPs.[48] As petroleum-based plastics take an immense toll on nonrenewable

[47] Cosmetics Europe. Environmental Sustainability: The European Cosmetics Industry's Contribution. https://cosmeticseurope.eu/files/3715/6023/8402/Environmental_Sustainability_Report_2019.pdf.

[48] Ammala A. 2013. Biodegradable polymers as encapsulation materials for cosmetics and personal care markets. *International Journal of Cosmetic Science* 35: 113–124.

resources such as oil and gas, bioplastics take a toll on the Earth as they take a progressively lone time to break down, not including any damage they may cause to marine life or ecosystems before reaching that point.

As mentioned in Chapter 2, backlash for contributing to environmental degradation is a primary catalyst for many cosmetics brands steering away from plastic packaging all together. There are numerous examples of large cosmetic companies that are promoting resource reduction as part of their sustainability plans. For instance, Proctor & Gamble stated in 2007 that it planned to reduce its energy consumption, water consumption, disposed waste, and carbon emissions by 20% by 2020. [49] Many product manufacturers have tried to use loopholes to avoid any deterrence to production of their products by simply switching from plastic particles to biodegradable plastic. Though this switch can be regarded for being more environmentally friendly, these biodegradable plastic particles still take a lengthy amount of time to break down and may still be consumed by marine life. With so much plastic waste being unrecyclable, such as aerosol containers and rigid plastic bottles, cosmetic brands such as Garnier and Lush have made it their company's mission to reduce their carbon footprint and encourage their customers to dispose of products responsibly. In partnership with TerraCycle, Garnier has created "The Personal Care and Beauty Recycling Programme" to encourage customers in across the UK to send in cosmetic wastes from any brand for recycling, such as plastic pots, flexible plastic tubes and beauty product packaging caps and pumps. This program states that once these personal care and cosmetic wastes are collected, the packaging is separated by polymer type, cleaned, and extruded into plastic pellets to make new

[49] Sahota, Amarjit. 2014. Sustainability: How the Cosmetics Industry Is Greening Up. Google Books. John Wiley & Sons. https://books.google.com/books?hl=en&lr=&id=W3GgAwAAQBAJ&oi=fnd&pg=PT10&dq=plastic+pollution+in+cosmetics+industry+books&ots=6OPzDjD8ch&sig=hbilYA8gjNNEcu3ltQY4926eoVA#v=onepage&q&f=false.

recycled products. [50] The Personal Care and Beauty Recycling Programme has already had huge success in recycling more than 72,000 items of beauty product packaging.

The U.K.-based beauty and personal care brand Lush shares a zero-waste philosophy throughout its entire business, with the utilization of "naked" products that come in solid forms. [51] Lush also states that their packaging-free products like shampoo bars and bath bombs are formulated by removing water content to create solid alternatives make up, and when pots, lids and bottles are necessary, they are made in 100 percent post-consumer plastic. Similar to the

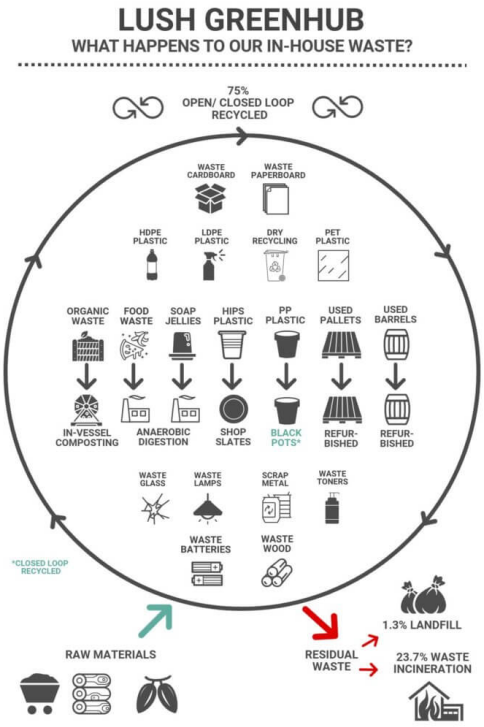

Figure 8. Lush "Lush Greenhub". (2021)[52]

[50] "The Personal Care and Beauty Recycling Programme." 2021. TerraCycle. Accessed November 29. https://www.terracycle.com/en-IE/brigades/garnier-ireland.

[51] Lush Fresh Handmade Cosmetics. 2021. "Our Packaging." Lush Fresh Handmade Cosmetics. Lush Fresh Handmade Cosmetics. March 29. https://www.lushusa.com/stories/article_our-packaging.html.

[52] "Go Circular." 2021. We Are Lush. November 25, 2021. https://weare.lush.com/lush-life/our-impact-reports/go-circular/.

Garnier recycling program, Lush has also created a recycling initiative to encourage its customers to return empty product pots to a store location, with the incentive of receiving a free face mask. For online orders, the company ensures consumers that products are packaged in biodegradable, recyclable, and compostable materials as well. Other prominent personal care and beauty industries such as Henkel and P&G alongside over 80 member companies have collectively formed the Alliance to End Plastic Waste, aimed at accelerating waste management and effectively manage plastic waste on a broader economic scale. [53] Smaller beauty brands have also contributed their part in creating an overlap between clean initiatives and sustainability initiatives. Brands such as Vapour Organic Beauty proudly formulates its products without the use of water and manufactures them in solar-powered facility that harnesses energy via skylights. Both large and small beauty brands have found different ways to harness the growing awareness that harmful beauty ingredients and packaging can be detrimental to the environment. In 2018 two large figures in the cosmetics industry, L'Oréal and Quantis, co-founded "Sustainable Packaging Initiative for Cosmetics" (SPICE), a sustainable packing initiative aimed at developing solutions to overcome the methodological challenges faced by cosmetics companies when it comes to measuring, tracking progress and communicating on the environmental footprint of their packaging. [54] This initiative is based in the idea that sustainable packaging is an essential component of a product's positioning. The guidelines set out in SPICE aim at raising awareness among consumers as well as producers, by providing credible packaging sustainability information. Through its outlined objectives, SPICE also encourages the development of more sustainable packaging through the

[53] "Alliance to End Plastic Waste." 2021. Alliance To End Plastic Waste. Accessed November 29. https://endplasticwaste.org/.
[54] "SPICE Cosmetics Packaging Claims Guidelines." 2020. https://www.oneplanetnetwork.org/sites/default/files/spice_quantis_loreal_cosmetic_packagin_claims_guidelines_2020.pdf

desire to make stronger claims using "Product Life Cycle Assessments" approach. A 2019 survey within these cosmetics packaging claims guidelines report that 68% of US consumers say they are more conscious of packaging materials and design than they were 5 years ago and 83% of consumers believe that designing reusable or recyclable products is extremely important for companies. This case study and related guidelines imposed by SPICE demonstrate that consumers are shifting in favor of more publicized sustainable packaging and efforts by cosmetics brands. This may be a very important indicator for more personal care and cosmetics brands that making and following through with claims of recyclable and reusable products, and packaging made with recycled content would lead to positive economic and environmental progress.

Plastic is so heavily embedded in modern society's supply chain that it will most certainly be a difficult and gradual process to get to a visible point where sustainable packaging is more widely renowned. Thus, it will take a concerted effort across companies of all sizes to make leeway in this plastic pollution problem. Regarding waste management, current personal care and cosmetic packaging is made essentially with petrochemical plastics and can be further distinguished in rigid packaging and flexible packaging.[55] Rigid packaging, which typically consists of bottles, pots, or caps, is generally recovered from waste, and separated from other plastics. This type of packaging can be easily transformed into scraps, be washed, and then used to produce new, recycled products. Flexible packaging on the other hand, typically consists of a single material or a multilayer system such as polymer films, paper, metallic foil cellulosic and bioplastic films. Multilayer packages are unique from rigid packaging in that they often consist not only of plastic, but also of aluminum

[55] Cinelli, Patrizia, Maria Beatrice Coltelli, Francesca Signori, Pierfrancesco Morganti, and Andrea Lazzeri. 2019. "Cosmetic Packaging to Save the Environment: Future Perspectives." *Cosmetics* 6 (2): 26. https://doi.org/10.3390/cosmetics6020026.

and paper. Due to a decent percentage of these lighter, flexible packaging items being contaminated with residual liquids or cream products, the recycling recovery of the single materials become effected. Therefore, much of the lifecycle of flexible packaging in comparison to that of rigid packaging is thus less sustainable. The increase in bio-based content and composability in both cosmetics and their packaging, as well as an overall more sustainable life cycle design, should be fundamental goals for improving full sustainability within the personal care and cosmetic market.

As previously mentioned in Chapter 3, there also needs to be stringent federal action taken alongside these companies, to advocate for products and packaging that is cleaner and safer towards the environment. One campaign titled "Beat the Microbead ", started by the Plastic Soup Foundation, shares guides with consumers on what microplastics are, why they are a problem, and why microbeads should be banned in everyday products. [56] This campaign states that with the restriction proposal by European Chemical Agency (ECHA), the public is now aware of more than 500 microplastic ingredients used in personal care and cosmetic products. Beat the Microbead has even been developed into an interactive app to allow for buyers to see if their cosmetics and personal care products contain plastic ingredients. As more and more businesses continue to integrate sustainable constructions into their identities and practices, the conduction of risk assessments will be a necessary compliment, especially for existing and proposed manufacturing locations and resources. This type of environmentally responsible sourcing and assessment can be accomplished in several different ways, including reducing synthetic ingredients, using renewable energy for manufacturing, and redesigning products to include less water in their composition.

[56] "International Campaign Against Plastic in Cosmetics." 2021. Beat the Microbead. May 18. https://www.beatthemicrobead.org/.

One method that many businesses have turned towards in finding cost-effective solutions to eliminate plastic packaging and still preserve product quality is to use alternative materials. Common materials that are being used for this purpose include glass, bamboo, metals, and bioplastics made from sugar cane. One Ocean Beauty is a prime example of a sustainable beauty brand that demonstrates a commitment to not only use "recycled" or "environmentally friendly" elements as many greenwashed brands have already attributed to themselves. Rather, One Ocean specifically details how they use natural molecules obtained from living marine microorganisms to formulate cruelty-free ingredients and zero-waste packaging to aid in conserving the oceans.

Chapter 5: Policy Recommendations for Cosmetics Regulation

Throughout the prior chapters, different aspects have been presented on the overall issue of plastic pollution in the personal care and cosmetics product industry. As previously discussed, there are several lenses that the public can fully understand the problems that arise due to plastic pollution in personal care and cosmetic products, as well as failures to properly regulate everyday products humans (and the environment) encounter. Within these previously described lenses, (i.e. quantitative statistics, cosmetic's history with plastic, legal frameworks, and the integration of sustainable business practices), it becomes immensely necessary that policy changes should be implemented to aid in developing challenges faced by producers, consumers, and our ecosystems.

Brand Compliance and Commitment to Go Green – Large and Small Scale. Individual acts of recycling or turning down a plastic bag after purchasing something will only be as effective as the changes made on a larger, corporate scale. Relating to ideas presenting by companies such as those detailed in Chapter 4, it becomes obvious that improvements need to be made regarding cosmetic companies' transparency with their customers about their products, their manufacturing,

and the labels they include on their products. As emphasized in the SPICE guidelines, cosmetic powerhouses should take responsibility for the claims they make to their consumers, especially when it comes to their ecological footprint. Even newer personal care and cosmetic brands, such as "Pleasing", have demonstrated the sustainability details of their packaging in each product description listed, such as which components are made from recycled materials or are biodegradable.[57] This is incredibly important when it comes to beauty or wellness, as customers deserve to be provided with full disclosure on processes and ingredients in a way that's clear. Thus, for my first policy recommendation, I would state that personal care and cosmetics companies owe it to their consumers to be transparent about the manufacturing processes taken to create their products. Furthermore, as briefly mentioned in Chapter 3, I would concur with recent proposals to Congress to require manufacturers to register their facilities, products, and ingredients with the FDA, which could assumedly include the harmful use of plastics and microbeads. It should also be mandatory for cosmetics brands to publicize their sustainability progress and communicate on the environmental footprint of their packaging – backed up with evidence. This would then aid in preventing further instances of "greenwashing" by companies, which is a "term that refers to a non-natural or non-ethical company branding and marketing itself as such", making it deceptive to the consumer and invalidating the company's brand.[58] As public concern over greenwashing has grown in recent years, there has also been research conducted to compliment these concerns over corporate social responsibility (CSR) and authenticity over environmental claims. For example, one study clams that companies often mislead their stakeholders through false claims

[57] "The Perfect Polish Set." 2021. Pleasing. Accessed November 29. https://pleasing.com/products/nail-polish-4-set.

[58] "The Necessity of Transparency for Beauty Brands." n.d. Web log. Tiyati. https://www.tiyati.co.uk/blogs/natural-beauty-articles/the-necessity-of-transparency-for-beauty-brands.

about their development and commercialization of green products, especially because environmental issues, such as rising air pollution, loss of food security and waste disposal, are paid more attention to than in previous years.[59] Companies can add 1% organic material to their product and the proceed to label it as green, natural, organic, etc. Performative statements from companies and governments about environmental consciousness go unfounded as many of the same groups continue to invest in fossil fuel and resource-depleting production methods, which in turn only deceives the public into thinking action is being taken when none is. By considering the potential impact of product ingredients on the natural environment, and being committed to achieve cleaner production of PCCPs, cosmetic producers could effectively eliminate packaging pollution and microplastics.

Public Education on Chemicals and Cosmetic Consumption. Without doubt, PCCP consumers and the general public deserve to understand and be educated on the full magnitude of their purchases on the environment, as well as themselves. Numerous large corporations have easily dismissed any improvements in their sustainable advancements or in taking accountability for their actions affecting citizens and the environment. This has been seen on even larger scales with EPA management of toxic chemical crises, where I would propose a "database denoting the chemicals that are being produced within any area inhabited by wildlife and humans…available to every citizen, as well as informed consent as to how those chemicals react to living things". [60] It is important for the public to also understand that the preprocessing of plastic waste decreases the

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[59] Freitas Netto, Sebastião Vieira de, Marcos Felipe Falcão Sobral, Ana Regina Bezerra Ribeiro, and Gleibson Robert da Luz Soares. 2020. "Concepts and Forms of Greenwashing: A Systematic Review." *Environmental Sciences Europe* 32 (1). https://doi.org/10.1186/s12302-020-0300-3.

[60] Frantzeskos, Olivia. n.d. Publication. It's Time for Big Companies to Clean Up Their Act: A Look into Why the United States Is Still Drinking Contaminated Water and Who's to Blame. Vol. 3rd. pgs. 22-30. https://issuu.com/fulr/docs/vol_3

levels of plastic waste ending up in landfills but is also determined by its chemical properties. This is a primary reason why recycling initiatives may be a positive call to action, but they are not long-term solutions. Rather than creating a larger need for new waste and simply deterring the creation of new waste are only temporary solutions. An effective proposal would therefore be to move towards little to no PCCP packaging at all, and when necessary, ensuring that packaging materials are biodegradable and filterable in water systems. Shopping programs have already been developed in this design, such as Loop. Loop is a waste-free shopping experience where customers pay a deposit for a product's stainless teel package, then when it is finished, it will be picked up, cleaned then refilled for another customer. As expressed through several case studies and examples mentioned in previous chapters, consumer demand for environmentally conscious, sustainably sourced products and packaging is at an all-time high, which will only push manufacturers and brands to follow through. Consumers can improve their own wellbeing and health of the environment by educating themselves on the production of the PCCPs, such as downloading the Beat the Microbead app (mentioned in Chapter 4) to avoid buying products that contain harmful plastics. Additionally, another useful component to consider in educating the public on the environmental harms associated with the relationship between personal care and cosmetic product and plastic is by simply asking where the public thinks there is a lack in this issue's visibility. As mentioned earlier in chapter 1, one study that demonstrates this potential effectiveness was conducted to explore the awareness of plastic microbeads in personal care products amongst three groups comprised of environmental activists, trainee beauticians, and university students in South West England. One component of this study's conclusion was to ask participants about their ideas for change, specifically regarding what they think can be done to reduce or eliminate the use of microbeads in personal care and cosmetic products. Many of the participants gave wide-ranging

answers, though ideas were expressed about the possible benefits and drawbacks of utilizing social media as a method to raise awareness amongst peers. While some believed it could be useful for the general idea of spreading information especially on platforms with large audiences, and even more specific PCCP-related sites like beauty blogs, as this would certainly be considered a benefit. However, a problem was also raised with this idea in that it is quite easy to ignore content on social media, especially when information presented to viewers doesn't exactly have any obvious or immediate effect on them. To amend this sort of issue, another possible policy recommendation might be to create a similar awareness for environmentally harmful plastic or chemical components, and to remind consumers about the harm that results from a lack of responsible disposal – in a fashion similar to anti-smoking labels. Smoking cessation programs are found in various countries and can be understood as a major public health campaign that introduced warning labels on cigarette packets. This is a valuable program as it potentially mirrors some of the damaging risks and behavior that result for consumers that are dedicated to purchasing that particular product. If this type of methodology were applied to different forms of personal care and cosmetics products - whether it be face creams, deodorants, or any other product that might be complete with layers of plastic packaging – this could be an effective way of warning consumers about the environmental degradation that will continue to occur as a result of improper recycling or just non-environmentally-conscious purchases. A symbol could perhaps be placed on the actual product itself that might be more specific to harm caused to marine ecosystems and human beings. For the overarching issue of environmental degradation as a result of plastic ingredients and improper waste disposal in the PCCP industry, a large portion of responsibility is placed on those who are already educated or knowledgeable of this issue when it comes to educating others. In the same case study mentioned prior, the beautician students believed that they were in the front line

in terms of educating the public and their own clients when it comes to sustainable shopping and understanding any harmful ingredients of PCCP products. Further, the environmentalists of this same study also demonstrated a responsibility to spreading this knowledge as to what they saw as the potential consequences to human health as microbeads entered marine food chains.

New PCCP Research and Development. Research and testing are continuously occurring with regards to cosmetics and personal care products. Cosmetics sustainability is a complex and multifaceted issue that cannot be evaluated without considering the environmental, social, and economic dimensions about product quality and performance. Further, the PCCP market is expected to grow with the infiltration and bolstering of cosmeceutical and multifunctional products, as well as an abundance of international brands. Advancement into the personal care and cosmetics market needs to focus especially on marketing products as sustainable, in both its ingredients and how it was sourced and produced. Further, keeping these green methods in mind, development into conveniently recyclable products is a necessity. Recycling is not always straightforward with cosmetic packaging, especially with most products shipped and stored in an assortment of boxes, bags containers and fillers with mixed materials. Even when these components can be separated, its often a hassle for recycling workers to handle, and many consumers are often unsure of how to properly manage their PCCP waste. For example, according to research carried out by the cosmetic brand Garnier, 56% of British consumers do not recycle their bathroom products because they find it tedious and a hassle. Because of this, several brands have released recycling guides to help make the effort easier. Additionally, it would be immensely useful to continue to encourage and development personal care and cosmetic products that ditch plastic components all together. Many brands have had success in this realm, such as Axiology, who has been esteemed for their cosmetic products encapsulated in plastic-free 100% zero waste

recycled paper, complete without any caps or tubes. Research and development into sustainable PCCP ingredients and functionality are only as useful as the packaging and sourcing methods that are evaluated as well. One significant way that further research and development of sustainable PCCPs can be accomplished is through larger brands encouraging ideas from smaller or more local collaborations. A prime example of this idea is Unilever's collaboration network, The Unilever Foundry, launching a new entrepreneurial challenge to invite "innovative scaleups, startups, and spinout companies" to present unique biodegradable and sustainable cosmetic ingredients or packaging solutions.[61] These ideas would go towards the Unilever beauty leadership and expert practitioners, and would inspire a new generation of technologies, ideas, and ingredients for the personal care and cosmetics industry. This challenge was announced in March of 2022, and places itself as an initiative that could be modeled by widely renowned PCCP companies for adopting more sustainable solutions and to encourage new visions for a broad range of producers.

Another essential element in fully grasping new research and developments within the personal care and cosmetics industry can be accomplished through community and grassroots involvement. A grassroots movement can be understood as one that utilizes individuals in a given district, region, or community as the basis for a political or economic movement.[62] Grassroots movements are typically identified through their use of self-organization and the encouragement of community members to contribute to the greater cause by taking action and responsibility within their own community. Since the early 1900s, grassroots movements have been widespread and in full force within the United States and other countries. Organizations such as Grassroots

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[61] Smith, Sophie. 2022. "Unilever Invites Startups to Partner on next Generation of Sustainable Beauty Products." TheIndustry.Fashion. March 9, 2022. https://www.theindustry.fashion/unilever-invites-startups-to-partner-on-next-generation-of-sustainable-beauty-products/.

[62] Gove, Philip Babcock (1961). Webster's Third New International Dictionary of the English Language, Unabridged. Cambridge, Massachusetts: Riverside Press.

Campaigns also exist to aid in the promotion and canvassing of progressive candidates, parties, and causes, through engaging everyday people in political action. [63] By the 1960s and 1970s, the rise in public concern over specific environmental matters, such as the toxic contamination of our air, water, land and food and the loss of natural ecosystem services and resources to development became a prominent focus for many political figures.[64] These concerns over various environmental threats only continued to lead to a vast and growing environmental movement of activists, supporters, organizations, and members. As previously discussed, there is still much to be amended and expanded upon with regards to federal jurisdiction worldwide. With organizations such as the British Beauty Council's Sustainable Beauty Coalition, comprised of industry experts, brand owners, and industry body representatives from across the beauty sector, these types of groups exist to actively work with government bodies while still encouraging and strengthening the personal care and cosmetic industry's sustainability initiatives and climate positive impacts. Moreso, online platforms and social media sites have demonstrated the capability to share local shops internationally that pride themselves in sustainable packaging and environmentally conscious material sourcing. One example of this type of small business is FD Market, located in Emmaus, Pennsylvania, who has amassed over 70 thousand followers on the social media platform TikTok. This company ships nationally across the United States and stocks products that are sustainable in substance, packaging, and sourcing, and even offers acts as a resource for how to

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[63] "Grassroots Campaigns » Our History." n.d. Grassrootscampaigns.Com. Accessed May 3, 2022. http://grassrootscampaigns.com/our-history/.

[64] Mihaylov, Nikolay L., and Douglas D. Perkins. 2015. "Local Environmental Grassroots Activism: Contributions from Environmental Psychology, Sociology and Politics." *Behavioral Sciences* 5 (1): 121–53. https://doi.org/10.3390/bs5010121.

use products like mouthwash tablets and shampoo bars properly. One specific advertisement of this type of brand is the ability for customers to come in with their own clean and empty jars, bottles or other containers and fill them with whatever product they might need, whether it be body lotion, leave in hair detangler spray, or toothpaste tabs. This type of shopping certainly has the potential to appeal to customer clientele from more widely known personal care and cosmetic brands, and to develop into a more common as it also encourages consumer participation.

Government Regulations – Amendments to Current Acts. Protecting the planet from plastic pollution must be a conjoined effort between market consumers, manufacturers, and most importantly, regulatory standards put in place by federal government bodies. For this reason, I would propose that amendments be made to the two primary legislative acts discussed in Chapter 3: The Toxic Substances Control Act (TSCA) and the Federal Food, Drug, and Cosmetics Act (FDCA). As previously discussed, each of these acts come with their own set of restrictions, or lack thereof, when it comes to personal care and cosmetic products. Firstly, it is imperative that federal governments promote the phasing out of microplastics in personal care and cosmetic products. Given the associated risks to human wellbeing and ecosystem health, bans on microplastics in PCCPs would be an effective and precautionary approach by federal regulations. When it specifically comes to labeling, there is no law in place to protect consumers from certain cosmetic components. For example, "FDA guidelines only say that manufacturers *should* actually test cosmetics to determine whether they will cause allergies in…people…but they are not required to do so,". [65] This is one of many reasons that there shouldn't be most of the responsibility placed on firms to assure cosmetics products are not tampered with or misbranded, as they are expected to comply with "good manufacturing practice (GMP). There should be guidelines set in place for

[65] Rossol, Monona. 2011. Pick Your Poison. Hoboken, New Jersey: John Wiley & Sons.

adhering to good manufacturing practice, as there are currently no regulations set forth to regulate specific GMP requirements for cosmetics. Thus, personal care and cosmetic products should subsequently fall under the regulation by the Toxic Substances Control Act and be required to have FDA approval under the Federal Food, Drug, and Cosmetic Act, as cosmetics manufacturers are only required to test chemicals for human safety, not environmental protection. Taking ecosystem services into consideration should be a primary focus in PCCP policy and decision making. Oftentimes policymakers fail to consider the links between our surroundings and thus the true value of ecosystems when it comes to wellbeing. Successful means of taking these natural services into account may be accomplished through caps on the manufacturing of plastic packaging or providing incentive mechanisms for larger companies to mitigate their ecological footprint.

Furthermore, it would be immensely important for federal bodies globally to be more stringent on single-use plastics in the personal care and cosmetics industry. Though not PCCP-related, political offices, such as that of New York State Assembly Member Linda Rosenthal, have been working on reducing single-use plastics through a couple of "upon-request" bills for plastic straws and plastic utensils. This type of legislative improvement could certainly be expanded upon into stores, shops, or boutiques, with reducing single-use plastics like q-tips or plastic packaging boxes in personal care and cosmetics businesses. This type of issue also compliments another large issue faced by the PCCP industry, whereby these types of single use plastics offered at your average beauty counter or shipped to your home lack a government certification of industry standard definition of "clean" beauty. The issue here rests with the fact that many large corporate PCCP giants, such as Sephora, label many of their products sold as "clean beauty", when in reality any given product purchased by a consumer lacks transparency about its manufacturing footprint, regulatory standards, ingredient make up, and essentially anything else that should actually qualify

it as being “clean” in comparison to other products. Advocate organizations such as the Environmental Working Group (EWG) have attempted to transgress the lack of formal and definitive classification of many personal care and cosmetic products, with the creation of a worldwide database called “Skin Deep”. This database is operated by the EWG and essentially acts a way to track and rate chemical safety in cosmetics – classified through what it deems hazardous or those that have untested ingredients. Similar to a prior policy recommendation on a database denoting any given chemicals being produced within a given residential area, I think this recommendation should also be pushed in the direction of government regulation. It remains essential for public to understand that the preprocessing of plastic waste decreases the levels of plastic waste ending up in landfills but is also determined by its chemical properties. Government regulation over the “clean beauty” sector of the personal care and cosmetic industry

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21 U.S. Code § 321

42 U.S.C. §4321 et seq.

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