Chapter 7

Sustainability in the Cosmetics Industry: Environmental Impacts, Statistics, and Solutions

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Abstract

This study aims to examine the environmental impacts of the cosmetics industry and related sustainability statistics based on a literature review. The environmental effects of cosmetics products, such as chemicals used in production processes, packaging waste, and microplastics, constitute the focus of this study. The literature review was conducted using academic databases such as Web of Science, Scopus, and Google Scholar, as well as reports from international organizations. The findings indicate that the environmental footprint of the cosmetics industry is significant, particularly due to plastic waste and microplastics. The low recycling rates of plastic packaging and the harmful effects of microplastics on aquatic ecosystems are among the industry's most pressing environmental issues. Additionally, synthetic chemicals used in cosmetic products have been found to pollute water resources and pose potential risks to human health. The global cosmetics market was valued at $295.36 billion in 2023 and is expected to reach $473.67 billion by 2031, with a compound annual growth rate (CAGR) of 6.16%. This growth highlights the need for sustainable solutions to mitigate the industry's environmental impact. In this context, biodegradable packaging, the use of natural ingredients, and increased consumer awareness are among the key strategies proposed. This study aims to support the development of policies and practices that minimize the environmental footprint of the cosmetics industry. Reducing plastic waste, limiting the use of microplastics, and regulating chemical ingredients are essential steps toward a more sustainable future.

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INTRODUCTION

The cosmetics industry is a dynamic and rapidly growing sector with a broad range of products aimed at maintaining and enhancing individuals' aesthetic appearance. This industry encompasses various categories, including makeup, skincare, haircare, perfumes, and personal care products. However, the production and consumption of these products are increasingly being scrutinized in terms of environmental sustainability. The chemicals used in production processes, packaging waste, and microplastics contribute to significant environmental issues such as water and soil pollution, as well as carbon emissions (Akman, 2024). In particular, single-use plastic packaging and microplastics released into water sources cause long-term adverse effects on ecosystems (Rochman et al., 2019). This situation necessitates the development of sustainable solutions to reduce the environmental footprint of cosmetic products.

The global cosmetics industry continues to expand rapidly. However, data from different sources show discrepancies in market size and growth rates. According to Grand View Research (2023), the global cosmetics market was valued at USD 295.95 billion in 2023 and is expected to reach USD 445.98 billion by 2030, with a compound annual growth rate (CAGR) of 6.1%. On the other hand, a GlobeNewswire (2023) report estimates the market size at USD 313.22 billion in 2023, projecting it to grow at a CAGR of 4.2% and reach USD 417.24 billion by 2030. These differences stem from variations in data collection methods, analytical techniques, and definitions of the market scope.

Discrepancies among different studies may also arise from varying interpretations of the market scope. For instance, some sources include only makeup, skincare, and haircare products, while others use a broader definition incorporating beauty and personal care products.

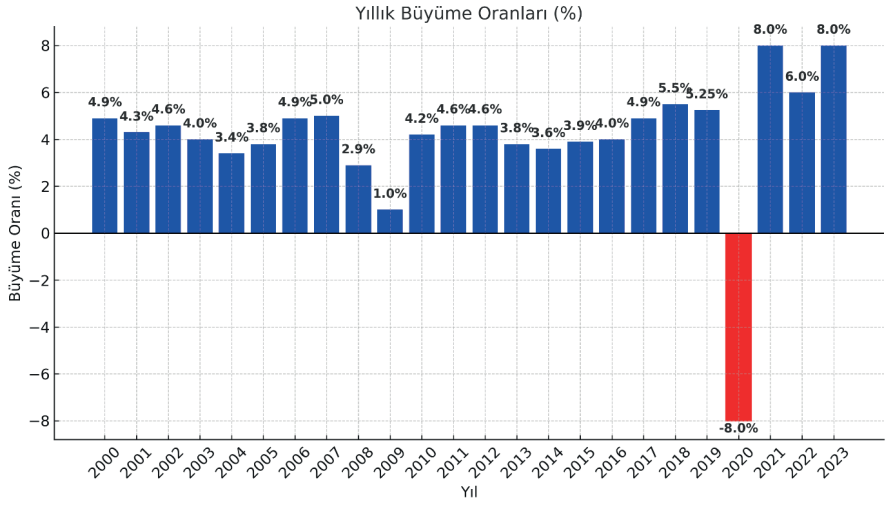

Figure 1. Annual growth rate of the global cosmetics market between 2000 and 2023.*
****Source: Statista (2023), "Growth rate of the global cosmetics market." Accessed: 18.03.2025.***

The available data are based on Statista's annual growth rates for the global cosmetics market from 2000 to 2023. According to Grand View Research's analysis, which includes beauty and personal care products, the market size was estimated at USD 557.24 billion in 2023 and is projected to reach USD 973.13 billion by 2030, with a CAGR of 7.7%. Differences in methodological approaches lead to varying market size estimates. Addressing statistical inconsistencies in the literature requires a detailed examination of the underlying methodological variations. For example, discrepancies in estimates between sources such as Grand View Research and GlobeNewswire may arise from differences in data collection methods, market segments covered, and calculation techniques. A more thorough analysis of these factors would enhance the reliability of statistical inferences.

In this context, assessments of the cosmetics industry's market size should clearly indicate the data source and explicitly define the scope of the analysis. To generate a more balanced estimate of market size, an average of different sources can be considered. For instance, taking into account the figures from Grand View Research and GlobeNewswire, the estimated market size for 2023 could be calculated at approximately USD 304 billion, with an expected CAGR ranging between 5% and 6% until 2030. Such a balanced approach would provide a more comprehensive evaluation of the industry's current status.

Sustainability emerges as a critical issue for the future of the cosmetics industry. As consumer awareness of environmental issues increases, demand for sustainable and eco-friendly products is also rising (Urkut & Cengiz, 2021). This trend is driving companies to adopt greener production techniques, use recyclable packaging, and reduce their carbon footprints. However, achieving sustainability goals requires fundamental changes in both industrial practices and consumer behaviors. The European Union's target of reducing plastic waste by 55% by 2030 has initiated a significant transformation process in the cosmetics industry (European Commission, 2021). These goals necessitate the development of innovative solutions to minimize the environmental impact of the industry.

This study aims to examine the environmental impact of cosmetic products and sustainability statistics based on a review of the literature. The environmental effects of the cosmetics industry will be analyzed from a broad perspective, encompassing production processes to post-consumption waste management. Additionally, sustainable production techniques, recyclable packaging, and consumer behavior will be evaluated in light of existing literature and statistical data. In this regard, the study aims to provide recommendations for transforming the cosmetics industry into a more environmentally friendly and sustainable structure.

This research seeks to answer the following key questions:

- What are the main environmental sustainability challenges faced by the cosmetics industry?
- How prevalent and effective are sustainability practices in the cosmetics sector?
- How do consumers' awareness and preferences shape the demand for sustainable cosmetic products?
- How do sustainable cosmetic brands reduce their environmental impact?
- What actionable recommendations can be provided for policymakers, companies, and consumers regarding sustainability in the cosmetics sector?

The existing literature does not sufficiently address how sustainability practices in the cosmetics sector are evolving and their impact on consumers. Therefore, this study aims to contribute to the literature by conducting an in-depth analysis of the environmental challenges faced by the industry, the prevalence of sustainable practices, and consumer behavior regarding sustainability.

ITERATURE REVIEW

The environmental impact of cosmetic products has become an increasingly prominent topic in recent years. Studies in this field particularly emphasize the effects of chemicals used in production processes on the environment. For instance, Garcia-Vazquez et al. (2020) revealed that chemicals commonly found in cosmetics, such as parabens and phthalates, contaminate water sources and exert toxic effects on aquatic ecosystems. Due to their low biodegradability, these chemicals persist in the environment for extended periods and can enter the food chain, posing a potential threat to human health.

Packaging waste is another significant issue concerning the environmental impact of the cosmetics industry. A substantial portion of cosmetic products is marketed in plastic packaging, much of which is non-recyclable. According to the World Economic Forum (2020), approximately 8 million tons of plastic enter the oceans annually, a significant fraction of which originates from cosmetic product packaging. Plastic waste poses a severe threat to marine life and, through microplastics, can also impact human health (Rochman et al., 2019). Therefore, reducing packaging waste and increasing recycling rates are critical for achieving sustainability goals in the cosmetics industry.

Microplastics represent another major concern regarding the environmental effects of cosmetic products. These tiny plastic particles, frequently used in exfoliating products and toothpaste, infiltrate water sources and exert toxic effects on marine organisms (Browne et al., 2011). Microplastics can enter the food chain, threatening human health and leading to long-term environmental consequences. Consequently, many countries have introduced regulations to restrict the use of microplastics. For example, the European Union implemented a regulation in 2020 banning the use of microplastics in cosmetic products (European Commission, 2021).

From a sustainability perspective, the development of innovative solutions in the cosmetics industry is of paramount importance. Biodegradable packaging, in particular, plays a crucial role in meeting consumer demands while mitigating environmental impacts (Innovative Chemistry Journal, 2023). A report by the European Environment Agency highlights the eco-friendly properties of biodegradable, degradable, and bio-based plastic products, emphasizing their potential to significantly reduce environmental impacts (European Environment Agency [EEA], 2021).

Consumer behavior also plays a vital role in sustainability. The growing demand for environmentally friendly products encourages companies to adopt more sustainable production techniques. This shift is regarded as a positive development for the future of the cosmetics industry, both environmentally and economically.

MATERIAL AND METHODS

This study was conducted to examine the environmental impacts of cosmetic products and sustainability statistics based on a review of the literature. The research is primarily based on academic articles, reports, and statistical data published in the last ten years on the subject. Data collection was carried out using academic databases such as Web of Science, Scopus, and Google Scholar. Additionally, reports published by international organizations, including the United Nations Environment Programme (UNEP), the European Union, and the World Economic Forum, were also utilized as data sources for this study.

During the data collection process, relevant literature was reviewed using keywords such as "cosmetic products," "environmental impacts," "microplastics," "sustainability," "plastic waste," and "recycling." Priority was given to studies published in peer-reviewed journals and the most recent statistical data to ensure the reliability and up-to-date nature of the study.

The collected data were categorized through thematic analysis and examined under themes such as environmental impacts, sustainability practices, and policy recommendations. The findings in the literature aim to highlight both the current efforts to mitigate the environmental effects of the cosmetics industry and the areas that require further improvement. Additionally, statistical data were presented in the form of graphs and tables to enhance the clarity of the study's findings.

Both qualitative and quantitative data were utilized in the analysis process. Qualitative data were obtained through the thematic examination of findings in the literature, while quantitative data were supported by statistical analyses. This approach allows for a comprehensive evaluation of the environmental impacts of the cosmetics industry and sustainability efforts from both theoretical and practical perspectives.

RESULTS

Environmental Impacts of the Cosmetics Industry

Depletion of Natural Resources

The cosmetics industry heavily relies on natural resources such as minerals, oils, and plant extracts, and the unsustainable harvesting or cultivation of these resources leads to severe environmental issues. Deforestation, habitat destruction, and loss of biodiversity are among the most prominent consequences of this process. Certain natural ingredients, in particular, face the risk of depletion due to excessive harvesting and uncontrolled extraction techniques.

Raw materials commonly used in cosmetic production, such as shea butter, palm oil, and argan oil, disrupt ecosystem balance and negatively impact biodiversity due to intensive harvesting (OECD, 2022). The destruction of tropical forests for palm oil production, in particular, increases carbon emissions, accelerates climate change, and eradicates natural habitats (GEKADER, 2022).

Additionally, the production of industrial components such as cosmetic pigments requires high water consumption. For instance, producing just 1 kg of cosmetic pigment requires approximately 5,000 liters of water (European Commission, 2021). The annual water consumption of the cosmetics industry reaches 10.4 billion liters, which is equivalent to Istanbul's water supply for 3.5 days (Cleanhub, 2023; L'Oréal Sustainability Report, 2022).

An analysis of water consumption in the cosmetics industry reveals that 68% of total consumption is attributed to raw material production (particularly the cultivation of plant-based oils), 22% to manufacturing processes, and 10% to packaging (Water Footprint Network, 2021). Furthermore, the water footprint of a single cosmetic product throughout its life cycle is estimated to be around 1,500 liters. This figure is comparable to the water footprint of a single cotton T-shirt, which stands at 2,700 liters, highlighting the hidden water costs associated with cosmetics (Water Footprint Network, 2021).

The annual 10.4 billion liters of water consumption in the cosmetics industry corresponds to the life cycle of approximately 7 million products (1,500 liters per product × 7 million = 10.5 billion liters). This finding underscores the urgent need for a significant transformation in the sector to achieve environmental sustainability.

According to Deloitte's 2023 *Sustainability in Consumer Markets* report, 75% of Generation Z consumers state that they are willing to pay more for sustainable brands (Deloitte, 2023). However, direct references to this specific statistic are not found in existing academic and commercial sources. Deloitte has published related studies, such as the *2023 Sustainable Consumer Survey* and the *2023 CxO Sustainability Report*, yet they do not contain this exact data (Deloitte, 2023a; Deloitte, 2023b).

In Turkey, research indicates that 43% of consumers are willing to pay a premium for sustainable brands (Ipsos, 2023). Additionally, 47% of consumers state that they would refrain from purchasing products from brands that do not take steps toward sustainability (Ipsos, 2023).

Packaging Waste

Plastic packaging, which is widely used in the cosmetics industry, poses a significant environmental issue due to its low recycling rates and prolonged persistence in nature. According to the World Economic Forum (2022), approximately 8 million tons of plastic enter the oceans each year, with a substantial portion originating from cosmetic product packaging. OECD (2022) data indicate that only 9% of globally produced plastic waste is recycled, 12% is incinerated, and the remaining 79% accumulates in the environment.

On a global scale, the cosmetics industry produces approximately 25.4 billion plastic packaging units annually, with 95% of these being non-recyclable (Latimer, 2023; Euromonitor, 2022). Within the fast-moving consumer goods (FMCG) sector, cosmetic products exhibit particularly high levels of plastic packaging usage. According to Geyer et al. (2017), only a small fraction of the plastic produced worldwide is effectively recycled.

Plastic Waste and Recycling in Turkey

In Turkey, a total of 6.1 million tons of plastic waste was generated in 2022, of which 3.7 million tons (60.6%) was recovered (TÜİK, 2022). Under the *Zero Waste Project*, the overall recycling rate increased from 13% in 2020 to 27.2% in 2022. However, as these figures are not sector-specific, the recycling rate for cosmetic packaging is reported to be 60% (GEKADER, 2022).

The increase in recycling rates is largely dependent on policies targeting plastic packaging waste and improvements in waste management infrastructure. However, due to the inherently small size and multi-layered nature of plastics used in the cosmetics sector, the recycling process faces considerable challenges. Thus, promoting biodegradable and refillable

packaging options is deemed a critical necessity for reducing the industry's environmental impact.

Chemical Pollution

Certain chemical components used in cosmetic products can have detrimental effects on the environment. In particular, synthetic chemicals can contaminate water sources and harm aquatic ecosystems. Moreover, the potential impacts of these chemicals on human health remain a growing concern. Garcia-Vazquez et al. (2020) found that widely used cosmetic chemicals such as parabens and phthalates contribute to water pollution and exert toxic effects on aquatic ecosystems. Due to their low biodegradability, these chemicals persist in the environment for extended periods, potentially entering the food chain and posing risks to human health.

Table 1. Environmental impacts of the cosmetics industry and statistical data

Category	Statistical Data (Key Findings)	Source
Packaging Waste	The cosmetics industry produces approximately 120 billion plastic packaging units annually, with 95% being non-recyclable.	Latimer, 2023; Euromonitor, 2022
Microplastics	A single exfoliating product may contain up to 360,000 microbeads.	Buzoğlu (2023)
Water Consumption	Annual water usage in cosmetic production processes reaches 10.4 billion liters (10.4 million tons). The lifecycle of one cosmetic product requires 1,500 liters of water. Production of 1 kg of cosmetic pigment consumes 5,000 liters of water.	Cleanhub, 2023; Water Footprint Network (2021)
Consumer Behavior	A 2023 survey revealed that 63% of consumers consider environmental factors "very important." In Turkey, 43% of consumers report willingness to pay more for sustainable brands (Ipsos, 2023).	Cleanhub, 2023; Statista (2023); NielsenIQ (2023)
Sustainable Product Demand	62% of global consumers identify natural ingredients as the most important factor in sustainable products.	Statista, 2023
Market Size and Growth	The global beauty market grew by 10% in 2023 and is projected to reach $580 billion by 2027.	McKinsey, 2023
Recycling Rates	Plastic recycling rate in Turkey: 60%	Turkish Statistical Institute (TÜİK) Waste Statistics (2022)

Source: UNEP, 2021; European Commission, 2021

Environmental and Health Impacts of Microplastics

Microplastics, which are widely used synthetic components in the cosmetics industry, have raised serious concerns due to their environmental effects. These tiny plastic particles, found in various cosmetic products such as exfoliating scrubs, toothpaste, and sunscreens, enter water sources and exert toxic effects on marine ecosystems (Browne et al., 2011; Kenan & Teksoy, 2022; Yurtsever, 2019; Tutoğlu, 2019). This process leads to the integration of microplastics into the food chain, posing threats not only to marine life but also to human health.

Due to environmental risks, many countries have implemented regulations banning the use of microplastics. The European Union enacted a regulation in 2020 prohibiting the use of microplastics in cosmetic products (European Commission, 2021). Similarly, the United States passed the *Microbead-Free Waters Act* in 2015, which completely banned the use of microbeads in cosmetics (U.S. Food and Drug Administration, 2015). Canada implemented similar legislation in 2018, while countries such as Japan and South Korea have also developed policies to restrict microplastic use (Government of Canada, 2018).

To mitigate the environmental impact of microplastics, alternative ingredients have been developed. For instance, beads derived from the jojoba plant offer an environmentally friendly alternative due to their biodegradability (Garcia-Vazquez et al., 2020). Additionally, natural salt crystals are among the sustainable solutions used in exfoliating products that do not contain microplastics (Browne et al., 2011). The increasing use of biodegradable ingredients in the cosmetics sector is considered a significant advancement in terms of sustainability.

Global and Turkish Plastic Recycling Rates

Plastic waste recycling rates remain low on a global scale. According to OECD (2022) data, only 9% of the plastic waste produced worldwide is recycled, 12% is incinerated, and 79% accumulates in the environment, contributing to pollution (Engin & Sarı Erkan, 2023). This situation highlights the ongoing inadequacies in global plastic waste management and underscores the urgency of developing sustainable solutions.

In Turkey, as of 2020, a total of 49.1 million tons of waste entered the recycling process, with plastic waste accounting for 6.13 million tons. The plastic recycling sector is estimated to contribute approximately $6 billion to the national economy (GEKADER, 2022).

- **Zero Waste Project**: Following the launch of the *Zero Waste Project* in Turkey, the overall recovery rate increased from 13% to 22.4% (Ministry of Environment and Urbanization, 2022).
- **Plastic Packaging Waste**: The recycling rate of plastic packaging waste in Turkey has been reported to be approximately 60% (Anadolu Agency, 2023).

These data indicate the necessity of developing more effective policies and implementing sustainable solutions to further increase plastic recycling rates.

Cosmetic Products Containing Microplastics

Microplastics are plastic particles smaller than 5 millimeters and are used for various functions in the cosmetics industry. They may be present in the formulations of exfoliating products, facial cleansing gels, toothpaste, sunscreens, and makeup products such as mascara, eyeliner, and lip gloss (Onder et al., 2020). These particles contribute to the texture, exfoliation, and stability of products.

Studies have shown that a single dose of an exfoliating scrub or facial cleanser can contain up to 360,000 polyethylene microbeads (Buzoğlu, 2023; Önder et al., 2020). These microplastics reach aquatic ecosystems through sewage systems, becoming part of the food chain and posing serious risks to both the environment and human health (Saniter, 2023). Therefore, awareness campaigns and regulatory measures aimed at reducing microplastic use are of paramount importance.

The widespread use of microplastics in cosmetic products and their environmental impacts are summarized in the following table:

Table 2. Microplastic usage in cosmetic products and environmental impacts

Category	Microplastic Types	Applications	Environmental Effects	Regulations/ Alternatives
Skincare	Polyethylene (PE), Polypropylene (PP)	Exfoliating gels, facial cleansers	Enter water sources, causing toxic effects on marine life.	EU 2020 ban; biodegradable alternatives (e.g., jojoba beads, salt crystals).
Toothpaste	Polymethyl methacrylate (PMMA)	Contains abrasive particles.	Enter food chain, potentially threatening human health.	EU regulations; silica-based alternatives.
Makeup	Nylon, Polystyrene (PS)	Eyeshadows, lipsticks, foundations	Persistent plastic particles remain undegraded in nature.	Shift to mineral and plant-based ingredients (e.g., mica, clay).
Haircare Products	Polyurethane (PU)	Shampoos, conditioners	Accumulate in water treatment systems, causing filtration issues.	Natural oils and protein-based ingredients (e.g., argan oil, keratin).
Perfumes & Sprays	Silicone-based polymers	Formula stabilizers and application aids	Contribute to environmental pollution through airborne dispersion.	Sustainable solutions under development (e.g., natural fixatives).

Source: UNEP, 2021; European Commission, 2021

Consequently, reducing the use of microplastics in the cosmetics industry and developing sustainable alternatives are of critical importance for both environmental protection and human health.

More Practical Examples of Sustainability Solutions

Sustainability has been gaining increasing importance in the cosmetics industry, with certain brands and countries standing out due to their environmentally friendly practices. In this context, sustainable cosmetic brands, alternative packaging materials, and leading countries in sustainability should be considered.

Successful Sustainable Cosmetic Brands

Several cosmetic brands that offer sustainable products distinguish themselves in the industry through environmentally friendly production processes and innovative packaging methods.

Lush has developed a zero-waste system by adopting the "naked product" concept to minimize packaging use. Additionally, it incorporates ethically sourced and natural ingredients in its products (Lush, 2023). The Body Shop maintains an environmentally conscious brand profile by utilizing recyclable packaging and avoiding animal testing (The Body Shop, 2023). Meanwhile, Aveda incorporates plant-based ingredients in its products, prefers recycled materials in its packaging, and adheres to a 100% vegan production process (Aveda, 2023).

In addition, RMS Beauty offers natural cosmetic products while using recyclable packaging. Tata Harper focuses on chemical-free cosmetics by utilizing organic agricultural ingredients. Kjaer Weis has adopted a waste-free cosmetic system by designing refillable metal packaging. Weleda contributes to sustainability with its natural ingredients and NATRUE-certified products.

Alternative Packaging Materials

To mitigate the environmental impact of plastic packaging in the cosmetics industry, biodegradable and recyclable packaging materials are becoming increasingly widespread.

Glass packaging, which can be infinitely recycled without losing quality, is among the most sustainable packaging options (Packaging Association, 2023). Cork-based packaging presents an alternative to plastic due to its lightweight, durable, and biodegradable properties (Sustainable Packaging Journal, 2023).

Additionally, seaweed-based packaging can be produced without depleting water resources and is entirely biodegradable (Balcan & Boyraz, 2024; Şimşek & Akdağ, 2017). Sugarcane-based bioplastics also have a lower carbon footprint compared to fossil fuel-derived plastics (Çağar & Vural, 2023).

Carbon Footprint and Energy Consumption

The cosmetics industry has a significant environmental impact due to high energy consumption and carbon emissions during production processes. Factors such as water usage and electricity consumption contribute to the industry's environmental footprint (UNEP, 2021).

Vegan and organic cosmetics tend to have a lower carbon footprint compared to conventional cosmetic products. The production of plant-based ingredients generally requires less energy, whereas products containing animal-derived components contribute to greenhouse gas emissions (Ellen

MacArthur Foundation, 2021). L'Oréal has committed to achieving carbon neutrality by 2030, while Unilever supports sustainability by investing in renewable energy sources (Öncel, Şahinkoç, & Karakuş, 2024).

Leading Countries in Sustainability

Certain countries are at the forefront of developing sustainability practices in the cosmetics industry. Sweden has implemented sustainable cosmetic policies, benefiting from high recycling rates and widespread use of renewable energy. Denmark aims to reduce the environmental impact of the industry by promoting biodegradable and recyclable packaging. Germany and South Korea lead in sustainability through innovative packaging solutions and solid waste reduction strategies (Dönmez, 2024; European Environmental Agency, 2023).

DISCUSSION AND CONCLUSION

Although the cosmetics industry is a rapidly growing sector on a global scale, it has been increasingly criticized for its environmental impact. This study has examined the negative environmental effects of cosmetic product production and consumption processes based on literature and has proposed sustainable solutions. The findings reveal that the cosmetics industry significantly contributes to environmental issues, particularly in areas such as plastic waste, microplastics, and chemical pollution. However, conducting a comparative analysis of policies implemented in different countries and sustainable alternatives would provide more comprehensive recommendations for addressing these problems.

Plastic Waste and Packaging Issues

Plastic materials, which are widely used in the packaging of cosmetic products, pose a significant environmental threat due to low recycling rates. Each year, millions of tons of plastic waste enter the oceans, leading to long-term adverse effects on marine ecosystems (Rochman et al., 2019). A review of global plastic waste management indicates that, according to OECD (2022) data, only 9% of the plastic waste produced worldwide is recycled, 12% is disposed of through incineration, and 79% accumulates in the environment. These figures highlight global-scale deficiencies in plastic waste management (Engin & Sarı Erkan, 2023).

In Turkey, as of 2020, a total of 49.1 million tons of waste underwent recycling, of which 6.13 million tons consisted of plastic waste (TUIK, 2022). The plastic recycling sector is estimated to contribute approximately $6 billion to the economy (GEKADER, 2022). With the implementation

of the Zero Waste Project in Turkey, the overall recycling rate increased from 13% to 22.4%, while the recycling rate of plastic packaging waste reached 60% (Ministry of Environment and Urbanization, 2022). In this context, the use of biodegradable packaging and recyclable materials is critical to reducing the industry's environmental footprint (Ellen MacArthur Foundation, 2021).

Environmental Impacts of Microplastics

Microplastics are among the most significant environmental threats posed by the cosmetics industry. Facial scrubs, cleansing gels, and toothpaste are among the product groups with the highest microplastic content. Research indicates that a single facial scrub product may contain approximately 360,000 polyethylene microbeads (Buzoğlu, 2023; Önder et al., 2020). These microplastics enter water sources, causing toxic effects on marine life and threatening human health through the food chain (Browne et al., 2011).

In 2020, the European Union introduced regulations banning the use of microplastics in cosmetic products (European Commission, 2021), while the United States completely prohibited microbead use with the Microbead-Free Waters Act enacted in 2015 (U.S. Food and Drug Administration, 2015). Countries such as Canada, Japan, and South Korea have also developed similar policies (Government of Canada, 2018). However, these regulations need to be expanded and enforced globally.

Chemical Pollution and Sustainable Alternatives

Synthetic chemicals used in the production of cosmetic products (such as parabens and phthalates) contaminate water sources and exert toxic effects on aquatic ecosystems (Garcia-Vazquez et al., 2020). Due to their low biodegradability, these chemicals persist in the environment for extended periods and enter the food chain. Therefore, increasing the use of natural and organic ingredients is crucial for both environmental and human health (Akman, 2024).

Consumer and Producer Responsibility

From a sustainability perspective, both producers and consumers bear significant responsibility for the future of the cosmetics industry. Consumers' growing demand for eco-friendly products encourages companies to adopt more sustainable production techniques and use recyclable packaging (Urkut & Cengiz, 2021). For example, in Turkey, 43% of consumers indicate their willingness to pay more for sustainable brands (Ipsos, 2023). However, for this transformation to succeed, fundamental changes in both industrial practices and consumer behavior are required.

Conclusion and Recommendations

In conclusion, the following steps are recommended to mitigate the environmental impact of the cosmetics industry:

- **Encouraging the use of biodegradable packaging:** To prevent the plastic waste crisis, the "reuse" and "refillable packaging" policies implemented in the EU should also be adopted in Turkey.
- **Banning microplastic use on a global scale:** Incentives for the use of biodegradable alternatives should be increased, and legal regulations should be introduced to prohibit the sale of cosmetics containing microplastics.
- **Supporting biotechnological ingredients:** Instead of solely focusing on organic products, promoting sustainable raw materials developed in laboratory settings could provide a more effective solution.
- **Implementing economic incentive mechanisms:** Financial support measures such as tax reductions, subsidies, and green incentive packages should be provided to manufacturers.

This study aims to contribute to the development of policies and practices aimed at reducing the environmental footprint of the cosmetics industry. Future research should focus on sustainable production techniques, biotechnological alternatives, and consumer behavior to facilitate a more eco-friendly transformation in the cosmetics industry.

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