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ECO-FRIENDLY PACKAGING AND GREEN MARKETING: SHAPING THE FUTURE OF THE COSMETICS INDUSTRY

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ABSTRACT

The cosmetics industry is witnessing rapid growth and innovation, but it also faces serious challenges regarding environmental sustainability, health risks, and consumer trust. This review explores the complexities surrounding sustainable packaging, green marketing, edible packaging innovations, regulatory frameworks, and consumer behaviour models. This review emphasizes the role of biodegradable materials like PLA, PHAs, and polysaccharides in reducing environmental impact. Despite technological advances, the field struggles with inconsistent standards, public scepticism, and economic barriers. Addressing these challenges requires a multidisciplinary approach integrating science, technology, and consumer education to foster a truly sustainable cosmetic industry.

Keywords: Sustainable cosmetics, green packaging, Edible packaging, Biodegradable plastics, green marketing Environmental sustainability, Cosmetic regulations

1. INTRODUCTION

Key product categories in the fast-growing cosmetics market include skincare, haircare, makeup, perfumes, toiletries, deodorants, and oral cosmetics.

Skincare is the leading segment, capturing significant consumer spending. Companies are sourcing raw materials from sustainable sources like organic farms and fair-trade cooperatives to reduce deforestation and protect biodiversity. Green cosmetics use natural and biodegradable ingredients, eco-friendly packaging, and organic waste antioxidants to mitigate cellular aging and extend shelf life **[1]**. The cosmetics industry, driven by the desire for improved living standards, experienced rapid growth in the 20th century. The beauty and personal care industry is expected to grow at the third-fastest rate in the world, reaching $565 billion in 2022 and $758 billion by 2025 and the industry is expected to reach USD 736.80 billion by 2028 **[2]**.

Rapid growth demands excessive environmental resources, leading to increased earth overshoot day and biodiversity loss. The US National Environmental Policy Act of 1970 and the United Nations' link between poverty eradication and growth have exacerbated this issue. Plastics, with over 906 chemicals, pose a threat to humans and the environment, entering aquatic systems and contaminating food chains **[3]**. Around 79% of plastics produced until 2015 have been discarded or landfilled, with 150 million tonnes ending up in the oceans **[4]**.

The cosmetics industry faces significant sustainability challenges. Since the 1970s, less than 20% of the 12,000 chemicals used in cosmetics products are deemed safe, with substances like triclosan, parabens, and UV filters entering aquatic habitats as emerging pollutants. Microplastics and microbeads remain serious concerns, with regulations only beginning to take effect. In 80% of the world, animal testing is still permitted **[5]**.

Popular cosmetics brands frequently fail to use environmentally friendly packaging for colour cosmetics, leaving consumers powerless and expecting government regulations and the mainly manufacturers to drive change. Despite a 897% increase in searches for plastic-free cosmetics in 2020 compared to 2019, suggesting market demand, the poor success rate of green products may discourage companies from adopting sustainable packaging. Economic factors also make more expensive green alternatives less accessible to consumers **[6]**.

Industry experts indicate that bioplastics innovation is poorly covered in the cosmetics sector. Implementation faces barriers including: difficulty sourcing biodegradable materials for smaller manufacturers, bioplastics not being feasible for all applications, and challenges in finding materials that meet product requirements while maintaining optimal performance. Significant knowledge gaps exist that must be addressed to advance sustainable packaging solutions in the industry **[7]**.

1.1. Sustainability And Circular Economy:

Sustainability and circular economy principles emphasize reducing waste, reusing materials, and designing recyclable cosmetic packaging. However, inconsistent definitions and goals across industries can hinder true progress toward sustainable packaging solutions **[8]**.

1.2. Sustainable Packaging Materials:

Biodegradable, compostable, and recyclable materials such as paper-based, glass, and bio-plastics are increasingly used in green cosmetics. Yet, unclear disposal instructions and lack of recycling infrastructure can limit their environmental benefits **[9]**.

2. REGULATION AND STANDARDS

2.1. Eco-labels and Certification Systems:

Various certifications (e.g., Ecocert, COSMOS, Nature, BDIH) assess natural or organic ingredients and packaging sustainability. However, overlapping criteria and unclear standards create confusion, reducing consumer confidence in certified green cosmetics **[10]**.

2.2. ISO-16128 and Standardization Efforts:

The ISO-16128 standard was introduced to harmonize definitions of natural and organic ingredients in cosmetics. However, inclusion of GMOs and vague criteria sometimes increase confusion in eco-labelling and packaging claims **[11]**.

3.THE COSMETIC INDUSTRY

Body care, fragrance, and cosmetics markets comprise the cosmetics sector, with care and decorative cosmetics sub-segments. Over the last 20 years, the worldwide cosmetics market has grown by 4%; but, in 2020, the COVID-19 pandemic caused a 9% decline in sales volume **[12]**.The global market for cosmetics and personal care did, however, rebound in 2021, with sales of almost 425 billion euros. Sales of cosmetics and personal hygiene products have been rising in Germany since 2013, with over 14.3 billion euros made in the fiscal year 2022. About 25% of sales were made up of scent and decorative cosmetics **[13]**. Natural cosmetics increased their market share in Germany, as sales climbed 1.8% to 1.48 billion euros in 2021.This raised market share to more than 10%, demonstrating how crucial sustainability is to German consumers when it comes to cosmetics **[14]**.

The sale of cosmetics in Europe is regulated by EU Cosmetic Products Regulation No. 1223/2009, which defines cosmetics as chemical components and mixtures applied to skin, hair, nails, and other body parts for purposes of cleaning, fragrance, appearance modification, Odor correction, and upkeep **[15]**.

Table 1: Classification of Cosmetics Based on Type of Origin

Natural Cosmetics	• **Derived from natural sources (plants, minerals, animals).** • **Include organic & non-organic ingredients.** • **Minimize synthetic chemicals.**
Organic Cosmetics	• **Made without synthetic fertilizers, pesticides, or GMOs** • **Certified for organic standards** • **Labels: "Made with Organic," "Organic," "100% Organic"**
Vegan Cosmetics	• **Free from animal-derived ingredients** • **Cruelty-free, not tested on animals** • **May use natural or organic components**
Ecological Cosmetics	• **Emphasize sustainability & eco-friendly packaging** • **Use renewable energy, reduce waste**
Green Cosmetics	• **Use renewable, non-toxic materials** • **Eco-conscious manufacturing & packaging** • **Certified by Natrue, COSMOS, Ecocert, etc.** • **Free from parabens, sulphates, phthalates**

4. ECO-FRIENDLY PACKAGING

4.1. Packaging

The cosmetics packaging market is growing due to changing customer tastes, material innovation, and environmentally friendly packaging options. However, overuse of petrochemical plastics contributes to environmental pollution and threatens life forms. Research is being done on edible packaging materials as a replacement for conventional cosmetic packaging because they are recyclable, biodegradable, and renewable **[16]**.

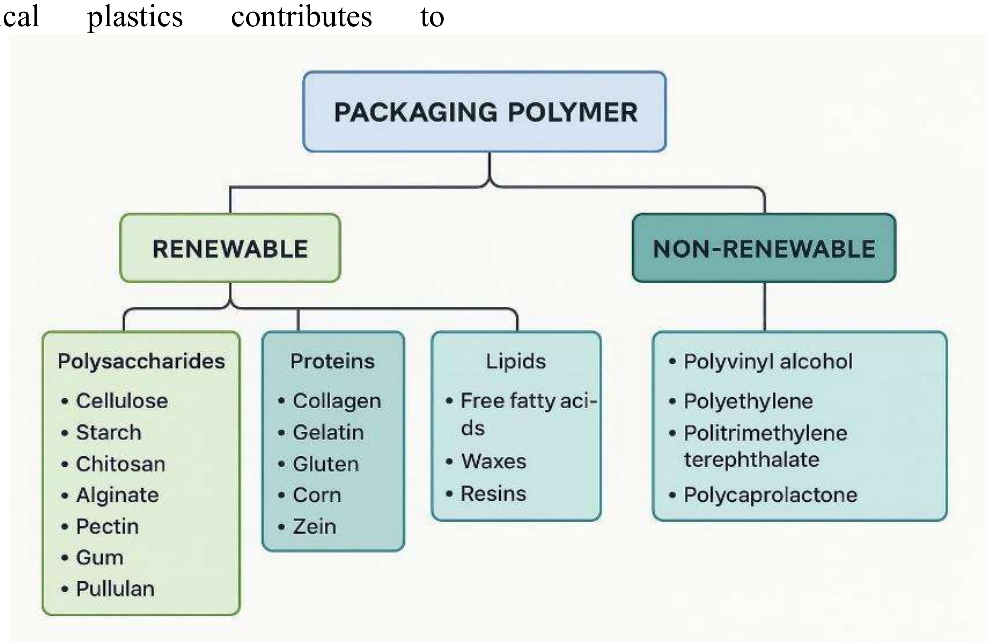

Figure 1: Classification Packaging Material

4.2. Eco-Friendly Packaging Design Elements in the Cosmetics Industry:

The cosmetics industry is focusing on eco-friendly packaging elements to address sustainability aspects and communicate the ecological properties of their products. Packaging design serves as an effective communication tool for consumers and allows companies to differentiate themselves from competitors. The three main categories of packaging design elements are verbal, visual, and tactile, allowing cosmetic companies to effectively communicate their products' ecological properties **[17]**.

4.3. Models Of Eco-Friendly Packaging Behaviour:

Research on green packaging behaviour emphasizes behavioural factors, leading to the development of various theoretical models—most notably the Theory of Planned Behaviour (TPB). Due to the complexity of consumer perceptions and attitudes toward packaging, no single model fully explains pro-environmental packaging behaviour.

Consumer theories related to green marketing and packaging are based on values, knowledge, beliefs, attitudes, intentions, motives, and social factors. Among the twenty theories, the ABC model (internal and external drivers of eco-friendly packaging choices) and the Alphabet model (integrating multiple behavioural theories) are significant. The TPB is the dominant model but has limitations such as challenges in validating behavioural measures, inconsistent relationships between constructs, and dependence on additional factors like moral values and past behaviour. One TPB-based intervention successfully reduced electricity consumption, suggesting potential application in sustainable packaging adoption. Other models like the VBN-ABC-D-K-IS-H include demographic influences on packaging preferences **[18]**.

Common frameworks for analysing green packaging behaviour use directed graph models, surveys, and Structural Equation Modelling (SEM). In comparisons, the Value-Belief-Norm (VBN) model was less effective than TPB in explaining eco-conscious packaging behaviour. Subjective norms were insignificant, while attitudes played a stronger role in shaping environmentally responsible packaging choices **[19]**.

Neuromarketing offers insights into consumer responses to packaging design and sustainability cues but faces challenges such as brain decoding complexity, high costs, and uncertain predictive value. Its findings remain debated compared to traditional research methods. Focus groups and remote ethnography are effective for understanding consumer disposal behaviour and perceptions of sustainable packaging.

With the rise of digital marketing, Virtual Reality (VR) enables realistic simulation of packaging experiences, helping assess consumer evaluation of eco-friendly packaging and its impact on green brand perception **[20]**.

The traditional cosmetics sector faces challenges in adapting to sustainability demands. Packages are usually outsourced, making it difficult to modify materials based on consumer or financial needs. To promote green marketing, companies must adopt circular business models, ensuring that new formulations, additives, and packaging are environmentally safe and recyclable. Cooperation among suppliers, consumers, and other stakeholders is essential for developing sustainable packaging and effective green marketing strategies **[21]**.

Figure 2: Areas Related to Sustainable Cosmetics Packaging

Table 2: Comparative Aspects of Eco-Friendly and Traditional Packaging Systems [22]

Aspect	Eco-Friendly Packaging	Traditional Packaging
Sustainability	**Biodegradable, recyclable, and sourced from renewable resources**	**Non-biodegradable, non-recyclable, and sourced from virgin materials**
Materials Used	**Paper, mushroom packaging, biodegradable plastics**	**Plastic, Styrofoam, and non-recyclable materials**
Environmental Impact	**Reduces waste, conserves resources, and decreases pollution**	**Contributes to landfill waste, resource depletion**
Regulatory Compliance	**Aligns with environmental regulations**	**Often does not comply with environmental regulations**
Cost	**Generally, more expensive due to sustainable materials**	**Typically, less expensive due to mass production**

4.4. Safety Considerations in Packaging and Edible Cosmetics:

Bio-based packaging from organic waste can reduce production costs and enhance the commercial potential of edible films. However, FDA regulations require these materials to be generally recognized as safe (GRAS) and to list all additives such as colours, antioxidants, and antimicrobials. Safety concerns include potential allergens from protein residues in polysaccharide extracts and protein-based films made from milk, wheat, soy, or peanuts. Additionally, toxic compounds may form from cross-linking agents, and the use of nanomaterials may pose health risks depending on their dose and interaction within the body **[23]**.

4.5. Edible packaging:

An environmentally responsible and sustainable way to package cosmetics is through edible packaging. It is predicated on bio-molecular matrixes, such as polysaccharides, proteins, and lipids, that are obtained from microbes, plants, or animals. These biopolymers combine functional components, active chemicals, and sensory enhancers to create a coherent structure. Capsules, pods, film, strips, powder, tablets, lip balms, lipsticks, sachets, and pouches are just a few of the different forms of edible packaging. This creative method encourages environmental responsibility in the beauty industry by lowering plastic waste and the negative environmental effects of conventional cosmetic packaging. By providing a unique and unique experience, edible packaging can attract consumers and increase brand engagement and loyalty **[24]**.

Table 3: Current Trends in Cosmetics Packaging

Trends	Examples
Recycled materials	Recycled paper, Recycled plastics
Bio-based and bio-degradable materials	Mushroom-based materials Cork and wood
Reusability of packages	Refill options
Minimalism and packaging design priorities.	Avoid unnecessary packaging layers. Avoidance of unnecessary printing and labels Mono-material packaging
Eco-friendly ink and labels	Water-based and soy-based inks Avoidance of labels, print on package.
Circular packaging and collaboration	Implement circular production system Recyclability of products Collaboration with recycling facilities
Smart packaging and consumer education	QR codes to reduce printing on package RFID chips Information on product use and disposal
Artificial Intelligence	Smarter recycling Smarter package design
Producer responsibility law-making	Hold producers responsible for the full product lifecycle
Transparency and traceability of materials	Establish sustainable packaging along the full value chain Avoid hidden

4.6. Biodegradable Plastic for Cosmetic Packaging:

With biodegradable and bio-based polymer matrices providing added value over non-bio-recyclable petrochemical-based polymers, the market for bioplastic-based packaging is growing. To evaluate the degradability of polymers, however, stringent control over their molecular weight, structural conformation, and crystallinity is required **[25]**.

4.6.1. Polylactic acid

Poly(lactic acid) (PLA) is a widely used bio-based and compostable packaging material due to its excellent processability and biocompatibility. It is mainly composed of lactic acid (2-hydroxy propionic acid), a three-carbon organic acid with an alpha carbon bearing a pendent methyl group, an alcohol carbon group, and a terminal carboxyl group. PLA exists in two optically active isomers: L-lactic acid (physiologically significant) and D-lactic acid (its mirror image). It is a thermoplastic suitable for extrusion, thermoforming, blow molding, and injection molding. Semi-crystalline PLA is preferred for its superior mechanical properties. Compared to low-density poly(ethylene) (LDPE), PLA offers better UV light barrier properties and is industrially biodegradable **[26]**.

PLA, a thermoplastic with four optical enantiomers, has excellent tensile strength but limited high-temperature performance due to its slow crystallization rate. Adding nucleating agents enhances crystallization by increasing nucleation sites and reducing induction time. Incorporating inorganic particles improves mechanical properties and lowers cost. PLA’s stiffness suits rigid packaging, though brittleness limits its use. Blending with other polyesters like poly(butylene adipate-co-terephthalate) (PBAT) improves toughness, while PLA/PC composites show incomplete biodegradability. PLA–cellulose acetate blends offer fully biodegradable rigid packaging options depending on acetylation degree and content. Plasticizers such as acetyl tributyl citrate, triacetin, oligoethers, oligo lactic esters, and oligo adipic esters enhance PLA ductility and toughness in flexible packaging **[27]**.

Jorda-Beneyto *et al*. used hydrophobically modified montmorillonite to reinforce PLA bottles with two organo-modified clays, improving mechanical and barrier properties. Cytotoxicity tests on two cell lines showed variable toxicity depending on clay type **[56, 57]**. Although nano-clays are unsuitable for food packaging, the European FP7 Bio-Beauty project explored their cosmetic packaging potential, assessing skin toxicity and biocompatibility using human HaCaT keratinocytes and Epi-Derm-TM models **[28]**. Zhang *et al*. studied the effects of poly(ethylene glycol) (PEG) and nanocrystalline cellulose (NCC) on PLA degradation. Hydrophilic NCC and PEG accelerated PLA hydrolysis, as PEG's rapid dissolution allowed water penetration and faster chain scission **[29]**.

Table 4: Various Additives Used in Poly (Lactic Acid) (Pla) For Both Rigid and Flexible Packaging Applications

Sr no	Additives	Properties	Applications	Processing Technologies	References
1	Plasticizers	Decreased Modulus and increased strain at break	Flexible packaging	Flat die,extrusion, blow extrusion	[30],[31], [32]
2	Nuclear agents	Increased crystallinity and elastic Modulus	Rigid packaging	Injection moulding	[30],[31]
3	Polymers	Increased impact properties, increased strain at break	Rigid packaging	Flat die extrusion (followed by thermoforming), injection moulding	[32]
4	Fillers	Increased impact properties, increased strain at break	Rigid packaging	Flat die extrusion (followed by thermoforming), injection moulding	[33]

4.6.2. Polyhydroxyalkanoates

Because of their excellent biodegradability and versatility, polyhydroxyalkanoates (PHAs) are increasingly used as biodegradable polymers in packaging, molded goods, coatings, textiles, adhesives, and films. They are naturally produced by bacteria from biomass and can be processed into various useful products, particularly for single-use packaging. Poly(3-hydroxybutyrate) (PHB) is the most common and well-studied PHA **[34]**. PHAs exhibit desirable packaging properties, including low water vapor permeability comparable to LDPE. PHB is used in flexible containers and food packaging, while copolymers like poly(β-hydroxybutyrate-co-β-hydroxyvalerate) (PHBV) show mechanical and thermoplastic properties similar to polypropylene. The presence of 3HV or 4HB co-monomers enhances toughness but reduces stiffness and tensile strength. PHAs' biocompatibility, biodegradability, and low environmental impact make them strong candidates to replace conventional plastics, particularly for skin-contact and eco-friendly applications. However, further research is needed on their durability and shelf life for packaging uses, including cosmetics **[35]**.

4.6.3. Polysaccharides

Cellulose and starch derivatives are widely used in packaging, while chitosan and chitin are preferred for active packaging due to their antimicrobial properties. Cellulose, the most abundant natural polymer, forms strong hydrogen bonds but is highly hydrophilic, limiting its use for perishable goods. Modified derivatives like hydroxypropyl cellulose, methylcellulose, and carboxymethylcellulose improve performance and are suitable for composite or multilayer materials **[36]**.

Starch, composed of amylose and amylopectin, is derived mainly from corn, wheat, rice, potatoes, and tapioca. After plasticization or modification, starch-based thermoplastics can be processed by extrusion or molding but are best suited for dry, non-hygroscopic products due to poor water resistance **[37]**. Chitosan, obtained by deacetylating chitin from plants or animals, is also used in composite or multilayer packaging but has limited moisture barrier properties **[38]**.

5.GREEN MARKETING.

5.1. Green Marketing Concepts:

Green marketing covers ecological, sustainable, and ethical marketing strategies promoting environmentally safe cosmetic products. It aims to align branding, formulation, and packaging with eco-friendly values but faces challenges from inconsistent standards and consumer scepticism.

5.2. Consumer Perception and Trust:

Consumers value sustainability but often prioritize price and performance. Trust in green cosmetic packaging depends on transparency, credible certifications, and brand reputation. Misleading or unclear labels weaken this trust.

5.3. Chemical Safety and Green Formulation:

Green cosmetic marketing promotes natural or non-toxic ingredients. However, "natural" does not always mean safe; both synthetic and natural chemicals can be harmful, highlighting the need for scientific evaluation.

5.4. Life Cycle and Environmental Impact:

True green marketing considers the entire product life cycle from sourcing raw materials to post-use packaging disposal ensuring minimal carbon footprint and waste generation **[39]**.

5.5. Challenges and Limitations of Green Marketing in the Cosmetics Industry:

The cosmetics industry's rapid global growth and heavy natural resource use present major sustainability challenges. Although green marketing is expanding, research remains limited. Companies like Weleda have achieved profitability while minimizing environmental impact.

Sustainable, circular, and resource-efficient products open new markets, but consumer attitudes toward sustainability vary widely, making segmentation difficult. Green marketing demands high investment in innovation and technology, as sustainable product development depends on collaboration and knowledge sharing **[40]**.

While ecological, green, and sustainable marketing emerged to meet eco-conscious demand, many early initiatives failed, and the "green consumer" remains elusive. Only a few companies succeed with green products despite widespread adoption attempts.

Misleading practices such as greenwashing, false recycling claims, and excessive PR have led to consumer mistrust and regulatory action. About 67.75% of manufacturers give false recycling information, and only 5% of claims are accurate; 98% of labels are misleading. Misconceptions persist, such as assuming "bioplastics" are biodegradable. Brands like L'Oréal, Lush, and The Body Shop promote sustainability, whereas Colgate-Palmolive and P&G have faced criticism for using microbeads. Even Lush, known for packaging reduction, has been accused of greenwashing due to harmful ingredients **[41]**.

Green marketing integrates environmental concerns into segmentation, targeting, positioning, and differentiation to enhance brand trust and green perceived value **[42]**.

Brand identity plays a key role, as consumers associate reliability and empathy with trusted brands. However, global firms face challenges when marketing sustainable and high-impact products under the same brand. Emotional attachment, perception issues, and acquisitions of sustainable start-ups can complicate brand integrity. Green products also face high costs, uncertainty, and risk of cannibalizing existing products **[43]**.

Low adoption of green cosmetics stems from consumer scepticism, premium pricing, resistance to new technology, status-driven motives, and short-term thinking over long-term environmental benefits **[44]**.

6. Broad Approaches to Eco-Friendly Packaging and Green Marketing.

Individualism and collectivism influence green behaviour, influencing economic philosophies and environmental protection. Two approaches, market and regulatory, have been used to promote development and poverty alleviation. Market-based approaches involve deregulation and voluntary CSR implementation, focusing on the financial benefits of green practices and consumer behaviour research. Regulatory approaches, on the other hand, focus on impact assessments for future developments and require changes in existing economic activities. These approaches are often irreconcilable due to differing assumptions about happiness and rights **[45]**.

6.1. Public Perception of Green Packaging and Marketing in the Cosmetics Industry.

The global cosmetics market, valued at $460 billion in 2014 and projected to reach $675 billion by 2020 with a 6.4% annual growth rate, shows rising consumer interest in sustainability. This demand drives the use of sustainably sourced raw materials and eco-friendly packaging. Marketing strategies now highlight green, compostable, and biodegradable packaging to align with consumers' environmental values. Events like the Sustainable Cosmetics Summit further reinforce the positive public perception and adoption of sustainable practices in the cosmetics sector **[46]**. Challenges in Developing and Marketing Edible Packaging Materials:

6.2. Challenges in Developing and Marketing Edible Packaging Materials:

Edible packaging provides a sustainable approach to reducing waste, yet its development and commercialization face several challenges. These include safety and labelling concerns, such as potential allergens and high iodine levels in seaweed-based films; stability issues under varying temperature, humidity, and pressure; and susceptibility of protein- and polysaccharide-based coatings to enzymatic or microbial degradation. Additionally, edible films must balance functionality and sensory quality without raising production costs. Compatibility problems also arise, as wax or resin coatings are unsuitable for current packaging systems, while chitosan or gelatin films are expensive and require complex, energy-intensive processing **[47]**.

6.3. Fundamental Issues:

In green marketing and cosmetic packaging, environmental goals are linked with technological, social, and economic challenges. Creating sustainable, affordable, and attractive packaging requires collaboration across disciplines. Despite digital innovation, redesigning supply chains and adopting biodegradable materials remain major challenges for achieving truly sustainable cosmetics **[48]**.

6.4. Predicting Outcomes in Green Marketing and Packaging:

Predictive models are expected to guide future developments in sustainable cosmetics by forecasting consumer preferences, market trends, and the environmental impact of green packaging. Data-driven approaches can optimize packaging design, reverse logistics, and supply chains, reducing cost and waste. Integrating technical, environmental, and behavioural models will help companies select biodegradable materials and design effective green marketing strategies. However, challenges like limited data on biodegradability and inconsistent consumer responses may affect accuracy. Overall, predictive modelling will play a key role in promoting efficient, eco-friendly packaging and marketing decisions **[49, 50, 51]**.

7.SUMMARY

7.1. Traditional Practices and Environmental Burden

The cosmetics industry largely depends on petrochemical-based plastics (e.g., PET, PVC, PE, PP), which contribute heavily to environmental degradation and plastic waste accumulation, especially in aquatic ecosystems.

7.2. Adaption of Sustainable Alternatives

Research into biodegradable materials such as PLA (Poly Lactic Acid), PHA (Polskázalonte), and polysaccharides (bike starch, cellulose, chitosan) is progressing. These alternatives show promising properties like composability, good barrier properties, and high biocompatibility, bar challenges like brittleness, poor moisture resistance, and higher production costs remain.

7.3. Green Marketing and Consumer Behaviour

The demand for eco-friendly cosmetics is increasing, but consumer scepticism, toward green claims is prevalent due to widespread greenwashing, Surveys show that most "green" labels either exaggerate or falsely claim eco-friendliness, which erodes consumer trust.

7.4. Edible Packaging Innovations

Edible packaging from organic waste or biopolymers (polysaccharides, proteins, lipids) is emerging as a potential solution. However, safety issues (e.g., allergen, toxicity from nanomaterials) and technical limitations (e.g., durability, compatibility) are significant hurdles for commercialization.

7.5. Regulatory and Industry Response

Although the EU and UN have initiated frameworks like the Basel Convention and EU Cosmetic Regulation No. 1223/2009, global enforcement is inconsistent. The cosmetics industry is slowly adapting but faces economic, technical, and social barriers to full sustainability.

7.6. Integration of New Technologies:

Smart packaging, Al-based recycling solutions, QR codes for consumer education, and virtual reality marketing are emerging trends, but their adoption is still in early phases, mostly due to high costs and limited consumer awareness.

7.7. Challenges with Bioplastics:

Although bio-based plastics present a better environmental profile, the production scale, shelf-life stability, performance under varying conditions, and economic viability are still under scrutiny. Furthermore, the safety of nanoparticles used to enhance bioplastics is being actively debated.

8. CONCLUSION

The transition to a sustainable cosmetics industry is complex but necessary. Innovations in biodegradable materials, stricter regulations, and increased consumer awareness are driving forces towards greener practices. However, significant challenges persist, including technological limitations, economic hurdles, and public scepticism. Collaboration among industry stakeholders, policymakers, and consumers is crucial for the successful adoption of sustainable packaging and marketing practices. Ultimately, building a trustworthy and truly eco-friendly cosmetic industry will require an integrated approach combining scientific innovation, transparent communication, and consumer empowerment.

9. FUTURE PERSPECTIVES

The future of the cosmetics industry is centred around developing novel biodegradable materials and promoting consumer-driven sustainability through education and awareness. Stricter global regulations will push companies to adopt transparent, eco-friendly practices. Technology integration, including smart packaging and AI-based recycling systems, will enhance traceability and efficiency. Brand accountability will become critical to maintain consumer trust and combat greenwashing.

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