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Review Article

A review of air pollution and ethical consumption behavior due to fragrances

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ABSTRACT

This paper presents a comprehensive review of literature focusing on the detrimental effects of fragrances on air quality. While previous studies traditionally attributed air pollution to sources like automobile emissions or industrial discharge, this study delves into the impact of consumer products, particularly fragrances, on both indoor and outdoor air pollution. Through a systematic review of existing research utilizing databases such as Web of Science, Google Scholar, and Scopus, the study synthesizes findings regarding the composition of fragrances, regulatory practices related to ingredient labeling, and public awareness regarding the link between air pollution and fragrances. The findings indicate that the ingredients used in perfumes can contribute to air pollution and respiratory ailments, underscoring the need for stringent regulations. Despite this, there is a lack of comprehensive labeling requirements for perfume products worldwide, which may contribute to limited consumer awareness regarding the association between air quality and fragrances. Given the intimate relationship between air pollution and human well-being, this study underscores the importance of exercising caution in the use of household consumer products such as perfumes and air fresheners to mitigate their impact on air quality.

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INTRODUCTION

Contemporary society is replete with fragranced consumer goods spanning perfumes, air fresheners, soaps, hand sanitizers, laundry detergents, and personal care items [1]. The global fragrance market was valued at $50.85 billion in 2022 and is projected to reach $53.77 billion by 2023, driven primarily by heightened consumer expenditures on premium and exotic scents alongside improving socioeconomic conditions. Perfumery has become an essential commodity, emblematic of the expanding personal care sector, which is increasingly intertwined with individuals' self-assurance and poise. Sales growth in the market is further propelled by innovative responses to consumer preferences, such as L'Oréal's Jo Malone boutiques offering tailored fragrance consultations and bespoke blending services, alongside distinctive packaging designs featuring cityscape artwork by on-site artists, as witnessed in their Tokyo establishment [2]. Europe commands a substantial 34% share of global revenue within the fragrances sector, closely trailed by the Americas with a 32% market dominance. Remarkably, expenditures on fragrances are witnessing a notable surge in these developed, affluent regions. Consumers perceive fragrances as a source of emotional upliftment, facilitating the evocation of cherished memories and pleasant experiences. This sentiment resonates particularly strongly among younger demographics, who exhibit heightened engagement in fragrance consumption and a willingness to invest

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considerably in scents that resonate with their preferences. Insight from a survey utilizing Prime Target's social media analytics tool reveals a burgeoning interest among consumers in fragrances featuring natural, organic, and vegan ingredients, as evidenced by the heightened search activity surrounding these descriptors [3]. Building upon these insights, we undertake an examination of the ramifications of perfumes on both indoor and outdoor air quality as well as human health—a topic that has received limited attention in current scholarly discourse. This review seeks to elucidate the manner in which chemicals present in personal fragrance items, notably perfumes, influence environmental pollution dynamics and human well-being.

MATERIALS AND METHODS

This review updates the state of research focusing on the impact of ingredients in fragrance products, including perfumes, on indoor and outdoor air pollution in order to reduce air pollution associated with climate change. The literature review was conducted between March 2 and March 11, 2024. This review aims to introduce and elaborate on the contained air pollutants in fragrance products, including perfumes. In general, the study of air pollution as a whole and the study of individual components require different approaches and focuses in environmental science. Studies investigating air pollution differ in that they can provide a broad overview of general air quality and its potential impacts on human health and the environment by considering all substances and assessing the overall air quality comprehensively. In contrast, studies that focus on individual components of air pollution narrow the scope of the study to a specific pollutant or group of pollutants. An example of this is analyzing the major constituents and volatile organic compounds in perfumes and fragrances and examining their effects individually. This provides an in-depth understanding of the nature of specific pollutants and is useful for regulatory purposes or policy formulation. Also, it aims to draw attention to indoor and outdoor air pollution caused by chemicals in fragrance products as the consumption of scented consumer goods such as perfumes becomes more specialized and increasing. Below we describe in detail our search strategy, article selection methods, and data synthesis procedures.

Search Strategy

For this review, six databases in the natural sciences, social sciences, environmental engineering, management, and consumption were searched according to PRISMA flow guidelines: PubMed, Scopus, Medline, ResearchGate and Google Scholar using the search terms (a) 'perfume consumption' and 'premium fragrances' (b) 'volatile organic compounds' (c) 'air fresheners' and 'air pollution'. The literature search was conducted through a broad search strategy using the following keywords Environmental pollution; air pollution; air pollutants; nitrogen dioxide; carbon monoxide; sulfur dioxide; nitrogen oxides; ozone and volatile organic compounds; dioxins; organic pollutants; cadmium; lead; mercury; heavy metals; fragrance products; exhaust; fragrances; respiratory health; respiratory diseases; chronic diseases; reduced lung function; perfume ingredients; fragrance product ingredients; indoor air pollution; indoor air pollutants; fragrance substances; limonene. The literature search strategy and review process according to the PRISMA 2020 flow rules can be seen in Figure 1. In addition, the search for recent literature (published between 2019 and 2024) included specific keywords (air pollution and air pollutants): Volatile organic compounds, bioaerosols, formaldehyde, airborne constituents, atmospheric compounds, air quality index, sensitive receptor areas, air environmental pollution, emissions, air pollution monitoring, air pollution control, air pollution mitigation, climate change impacts of air pollution, urban air pollution, Air Pollution and Outdoor Air Quality, Air Pollution and Health Disparities, Air Purification Devices, Vehicle Emissions and Air Pollution, Air Pollution Modeling, Perfumes and Air Pollution, Perfumes and Indoor Air, Fragrances and Air Pollution, Fragrances and Air Pollutants, Fragrances and Indoor Air Quality, Indoor Air Quality.

Eligibility Criteria

Articles included in this review had to meet the eligibility criteria for this review, which included selecting studies related to the characteristics of fragrance consumption, fragrances and indoor air pollution, types of air pollutants, volatile organic compounds, and fragrance products and air pollution: Negative effects of increased fragrance consumption, indoor air pollution impacts of fragrances, air pollution impacts of fragrances, air pollution linkages between fragrance products and air pollution, air pollution caused by increased fragrance product consumption, long-term strategies for air pollution caused by fragrance products, environmental preferences of fragrance consumers, relationship between environmental values and fragrance consumption, strategies for reducing fragrance product consumption to prevent air pollution, and the role of ethical consumption in preventing air pollution.

Screening and Data Extraction

Articles were included in the corpus if they (1) examined the expansion of the fragrance market and increased sales, (2) addressed the link between fragrance products and air pollution, (3) addressed volatile organic compounds, (4) addressed the impact of fragrance products on indoor and outdoor air pollution, (5) were peer-reviewed, and (6) were journal articles or conference presentations.

We excluded articles that (1) did not examine the consumption of perfumes and fragrance products, (2) did not examine the link between fragrance products and air pollution or environmental pollution, or (3) did not examine volatile organic compounds.

We considered different types of articles, including original articles, full-text articles, internet articles, summary reports, and series, and did not impose restrictions on publication date or language. Exclusion criteria included inaccessible full text, full text without raw data, inappropriate topics, and doctoral dissertations, which were searched through the ProQuest Dissertations and Theses Global Database.

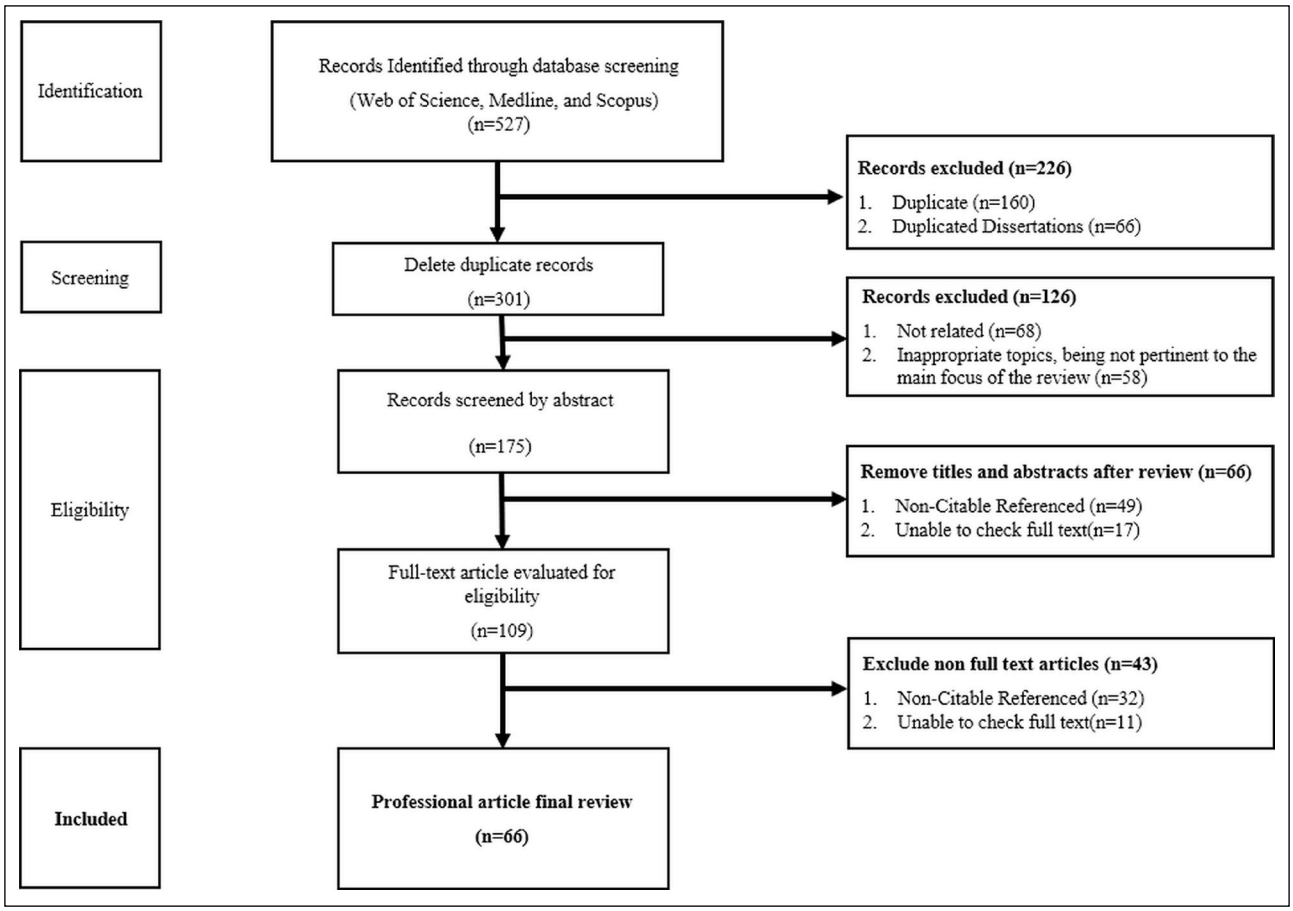

Figure 1. PRISMA flow chart for literature review search results.

Study Selection and Data Extraction

Of the citations from the articles reviewed in the primary search, additional references were identified through a manual search and assessed for eligibility by reviewing titles and abstracts. Articles that did not meet the inclusion/exclusion criteria were then excluded from this review. Finally, we reviewed the full text of the articles to determine inclusion of the remaining articles and excluded those that did not meet the criteria. The 65 articles included in this review were proposed under the following titles: "Air pollutants, the potential for increased perfume consumption", "Fragrance product ingredients contributing to air pollution", "Sustainable consumption to prevent air pollution from fragrances", "Ethical consumption strategies to prevent air pollution; reducing consumption of fragrances and personal fragrance products", "The impact of fragrances and fragrance products on overall air pollution", "Air pollutant induction and chronicity from fragrances", and "Limitations of the current review and future research". In the final stage, a total of 527 articles were selected, with publication dates ranging from 2004 to 2024. The model diagram of this study was organized as shown in Figure 2.

The main findings of the study are that the increased use of fragrances and fragrance products has a detrimental effect on air pollution levels, and the negative association between the consumption of these products and indoor and outdoor air pollution levels is significant. The main findings consistently emphasize the adverse effects of organic chemicals and ingredients in fragrances and fragrance products on air pollution, with particular emphasis on increased indoor air pollution levels.

FRAGRANCE CONSUMPTION AND AIR POLLUTION

Perfume-Making Substance

The primary purpose of perfume is typically to impart a pleasant scent, often employed for the purpose of obscuring or camouflaging malodorous odors [4]. Nevertheless, essential oils, prevalent in personal care items for their aromatic properties, contribute significantly to volatile organic compound (VOC) emissions derived from fossil fuels, constituting approximately half of such emissions [5]. Essential oils, encompassing well-known varieties like lavender, orange, eucalyptus, and tea tree, are extensively utilized across cosmetic, fragrance, and aromatherapy domains. However, these oils represent intricate blends containing diverse chemical constituents, notably terpenes, with each essential oil emitting at least one volatile organic compound (VOC) categorized as potentially hazardous [6]. Among 104 frequently utilized flavor products, limonene emerged as the predominant volatile organic compound (VOC), present in 77% of these items. These VOCs constitute a significant portion of pollutants implicated in detrimental impacts on both air quality and human well-being. Notably, 68 VOCs identified among the analyzed flavored products were

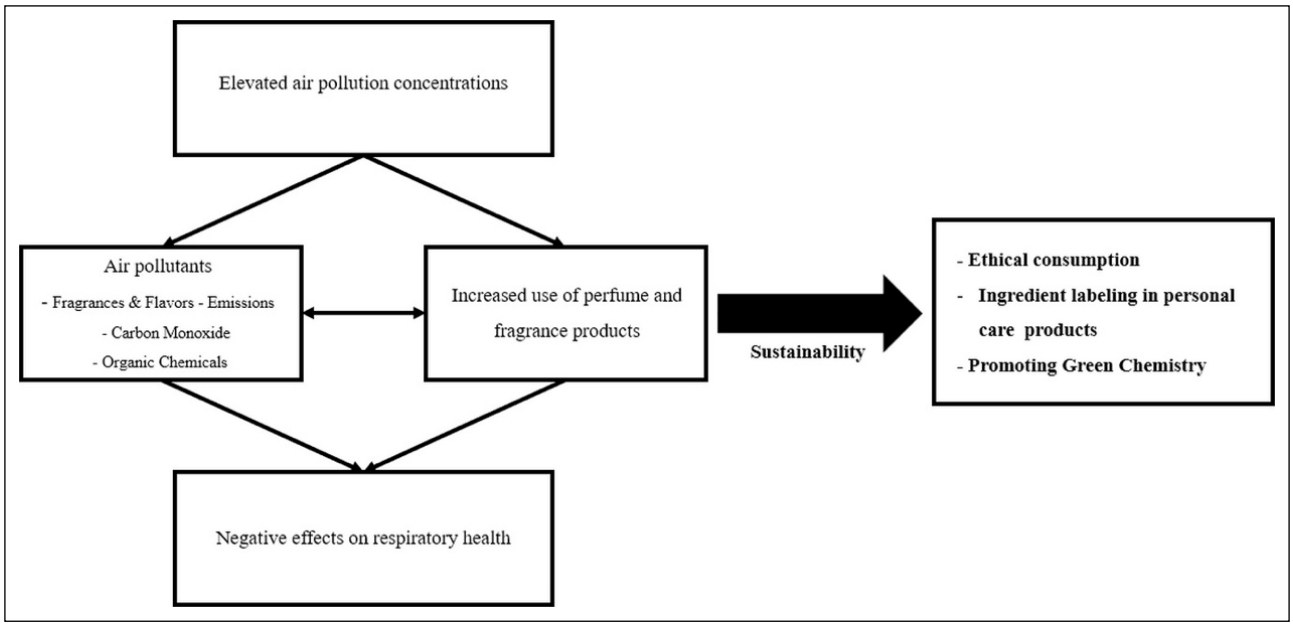

Figure 2. Model diagram of our study.

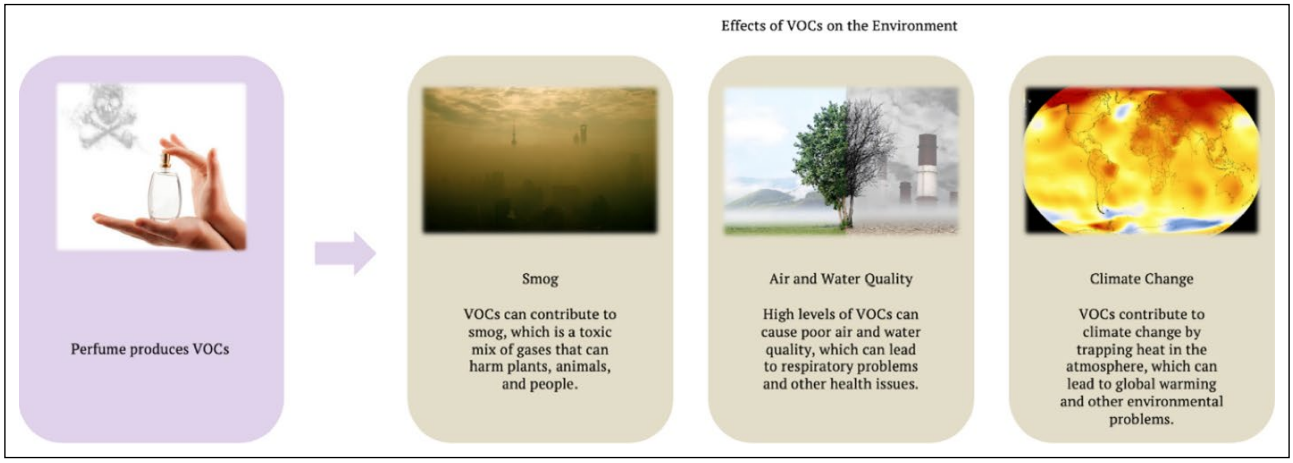

Figure 3. Environmental pollution caused by perfume consumption [20]. Perfumes are consumer goods made from potentially hazardous chemicals.

classified as potentially hazardous. Their interaction with ozone can lead to the formation of hazardous byproducts, including formaldehyde and acetaldehyde [7]. However, the majority of components constituting fragrant consumer goods remain undisclosed to consumers [4]. Furthermore, essential oils enjoy exemption from mandatory ingredient labeling requirements when marketed individually, thereby contributing to a dearth of information concerning the potential hazards associated with volatile organic compounds (VOCs) and essential oils found in perfumes [8]. Consequently, individuals may find it challenging to perceive certain compounds within perfumes as hazardous and to recognize the connection between perfume usage and environmental contamination (Fig. 3).

To investigate this, we assessed societal consumption patterns and perceptions regarding the potential health impacts of fragranced household and personal care products. The findings revealed that most participants utilize both fragranced and unscented household and personal care items, with one-third of these individuals and their families experiencing respiratory or dermatological allergies. Although the majority are cognizant that fragranced household and personal care products can provoke respiratory and skin allergies, there is a lack of awareness regarding which specific fragrance substances act as potential allergens for the skin and respiratory system [9]. Indeed, for numerous consumers, the presence of fragrances can significantly influence their engagement in public activities. Approximately half of individuals sensitive to scents have avoided certain locations to prevent exposure to fragrances. Conversely, some scent-sensitive individuals exhibit a preference for fragranced products and environments. Half of the scent-sensitive population report using perfume to enhance their attractiveness, while about half of the general population indicated they would refrain from using scented products if they were aware these products emit harmful air pollutants. These responses highlight the various

factors influencing risk perception and safety behaviors. Survey data indicated that in Germany, an average of 7.4 working days per person were lost due to illnesses attributed to exposure to fragranced products in the workplace, with an estimated economic cost of $14.5*10^9$ euros annually. This underscores the importance of effectively communicating the risks associated with fragranced products [10]. In conclusion, it's noteworthy that volatile organic compounds (VOCs) typically exist in significantly elevated concentrations within enclosed spaces where perfumes are applied. Undoubtedly, consumer products mimicking perfume scents serve as the primary source of indoor VOCs, thereby being categorized as contributors to air pollution [11–13].

A Health Problem Caused by Fragrances

Findings indicate that exposure to air pollution ranks as the fifth most significant risk factor for human health on a global scale, trailing behind malnutrition, dietary risks, high blood pressure, and tobacco usage [14]. Although fossil fuels remain an important factor in air pollution in cities, exposure to PM2.5 is increasing from chemicals [15]. On average, 32.2% of adults across four nations report experiencing scent sensitivity, characterized by adverse health reactions upon exposure to fragranced consumer products like perfume. Within sub-groups exhibiting below-average health conditions, the prevalence of scent sensitivity is notably elevated. For instance, among individuals diagnosed with asthma, 57.8% report experiencing adverse effects from fragranced products, while among those with autism, the figure rises to 75.8% [16]. Beyond perfumes, inhalation of fragrant emissions stemming from laundry products, such as fabric softeners boasting diverse scents, is correlated with detrimental health outcomes including asthma exacerbations and migraines [17]. Specifically, exposure to D-limonene, one of the predominant limonene compounds found in fragrant products, is associated with adverse effects on the skin and eyes, as well as respiratory symptoms such as wheezing and coughing [18, 19]. Asthma stands as a prevalent chronic ailment, and given limonene's utilization in the production of personal care items like perfumes and household cleaners, exposure to this compound is widespread. Consequently, in-home exposure to limonene could potentially elevate the incidence of asthma within the broader populace. Depending on the extent of contact, limonene adversely impacts dermatitis, airway reactivity, and various respiratory health metrics [20]. Empirical studies conducted in real-world settings have demonstrated that using essential oil diffusers in enclosed spaces can significantly contribute to the levels of terpene VOCs indoors. The concentration of emissions from these diffusers can influence indoor air quality over durations ranging from 5 hours to 60 days, depending on whether transient or continuous devices are used. Specifically, in terms of consumer exposure to evaporating essential oils within indoor environments, transient diffusers can release emissions as high as 100 mg/h per gram of product over short periods, generally around 1 hour. In contrast, continuous diffusers release lower concentrations of terpenes, approximately 5 mg/h per gram of product, but extend over much longer periods, often spanning several days. Therefore, transient diffusers are linked to acute exposure episodes, whereas capillary diffusers can lead to prolonged, chronic exposure [21]. A study entitled "Fragranced Products Emit a Bouquet of VOCs," based on a different experimental investigation, identified over 100 VOCs in numerous "green," "natural," or "organic" PCHPs. More than 20 of these VOCs were categorized as "toxic" or "harmful," yet only one product listed any of these substances on its label. The predominant VOCs detected included terpenes (such as limonene, α- and β-pinene), ethanol, acetone, acetaldehyde, as well as carcinogenic compounds like 1,4-dioxane, formaldehyde, and methylene chloride. Measurements taken in a well-ventilated room of 50 m^3 demonstrated that the levels of d-limonene, dihydromyrcenol, linalool, linalyl acetate, and beta-citronellol emitted from cleaners and air fresheners containing terpenoids and glycol ethers were significantly higher (~35-180 mg/day over 3 days) compared to their concentrations in the air (average air concentration ~30–160 μg/m^3) [22, 23]. Glycol ethers are recognized as regulated toxic air pollutants, and terpenes can interact with ozone to produce secondary pollutants [24].

Poor air quality exerts a significant influence on an individual's emotional well-being, with severe levels of air pollution correlating with diminished human happiness [25–27]. Weather patterns and the scheduling of significant events during holidays or weekends are likewise associated with the collective happiness levels of urban residents [28]. During periods of elevated air pollution, individuals sensitive to environmental contaminants tend to gravitate towards indoor pursuits, such as increased engagement with social media platforms, as opposed to outdoor activities, which may involve tasks like grocery shopping. Consequently, research indicates a higher likelihood of opting for food delivery services over dining out on days characterized by poor air quality. This shift towards food delivery reduces exposure to outdoor environments, as individuals opt to have meals delivered to their workplaces or residences. Indeed, air pollution impedes individuals' mobility and diminishes their inclination to venture outdoors. Particularly in urban centers within developing nations, consistent poor air quality serves as a significant driver prompting consumers to rely on food delivery services as a preferred dining option [29–32]. This phenomenon establishes a detrimental cycle, as heightened reliance on food delivery services in response to high air pollution levels contributes to increased waste generation, thereby exacerbating environmental pollution. Collectively, elevated air pollution levels correlate with diminished citizen happiness and adverse impacts on emotional well-being, underscoring the societal costs associated with air pollution [33].

Two Faces of Perfume Calling for Sweet Danger

For millennia, fragrances have been employed to enhance the appeal of products, creating aesthetically pleasing environments and satisfying user preferences. However, despite rigorous safety evaluations conducted on products containing these scents, recent findings have revealed their association with adverse impacts on air quality [34]. First, fragrant

consumer products such as perfumes can be a major cause of indoor air pollution [35]. Across global indoor environmental studies, aromatic chemical compounds, such as limonene, consistently emerge as prevalent pollutants found at elevated concentrations [13, 36, 37]. These compounds are not only implicated in indoor air pollution but also contribute to outdoor air quality degradation. Fragrance products utilized indoors ultimately disperse outdoors, exerting an impact on the surrounding air quality through their emission capabilities [38]. In a confined space, it can influence air quality by altering the concentration of particular volatile organic compounds within the atmosphere. Indoor air quality serves as a crucial determinant of residents' comfort, health, and cognitive performance, with certain airborne constituents originating from external sources [39].

The primary objective of fragrances, particularly those employed within households or enclosed spaces, is to impart a pleasant aroma to the air, thereby intentionally introducing a mixture of chemicals indoors and potentially compromising indoor air quality. Household scents may also emit compounds such as ethanol, iso-propanol, dipropanol, dipropylene glycol, and numerous other solvents. Consequently, eliminating air fresheners, perfumes, and scented candles can enhance overall indoor air quality. To foster a clean and healthy indoor environment, it is more advantageous to implement frequent ventilation, utilize vacuum cleaners equipped with HEPA filters, and ensure regular maintenance and cleaning of air purifiers [40].

A 2018 study conducted in Los Angeles, USA, investigated atmospheric chemicals and identified volatile organic compounds (VOCs) emitted from consumer products such as perfume, paint, and ink as significant contributors to air pollution, comparable to emissions from automobiles. These VOCs are recognized as primary precursors in the formation of smog and ozone, as well as fine particulate matter in the atmosphere. However, the consumer market for fragrances and other scented products is growing (Fig. 4). In Los Angeles, approximately 42% of fine particulate matter, known to pose serious respiratory health risks, originates from consumer products. This finding underscores the impact of consumer goods, such as perfume and paint, which are formulated for pleasant fragrance or designed to evaporate upon production [41].

Moreover, the production of consumer goods like perfumes contributes significantly to the accumulation of packaging waste, particularly plastic, a commonly utilized material known for its detrimental environmental impact. As the fragrance consumer market expands, there arises a heightened imperative for embracing eco-friendly practices in product design and packaging. Companies operating within the fragrance industry ought to prioritize sustainable product design, encompassing the selection of packaging materials that not only exhibit aesthetic appeal but also adhere to principles of reuse, recycling, and remanufacturing. Such sustainable practices are integral to addressing societal objectives and fostering environmentally responsible consumption patterns [42, 43]. Table 1 provides a concise

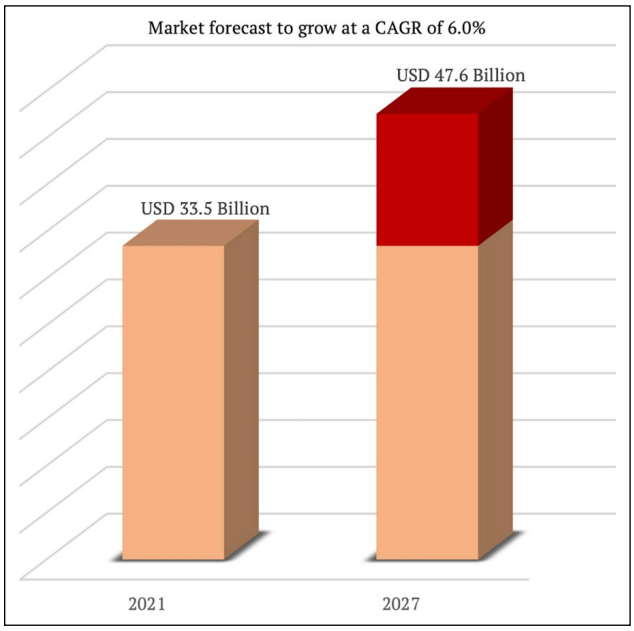

Figure 4. An increase in the perfume market [3]. Growing interest in personal care is driving fragrance consumption.

overview of the potential benefits and difficulties associated with the use of fragrances, particularly in relation to their environmental impact.

Sustainable chemistry is characterized as an approach to chemical development that prioritizes safer and more environmentally conscious practices, addressing the economic and social ramifications of chemicals throughout their life cycle. This concept spans various sectors, including water, energy, food, climate, and population, and significantly contributes to human health and biodiversity conservation. In contrast, green chemistry focuses on guiding chemists to synthesize chemicals through eco-friendly and highly efficient processes, aligning with fundamental science principles pertinent to the Sustainable Development Goals (SDGs). Key measures, such as promoting green chemistry in the manufacture of fragrances and their constituent chemicals, enhancing public awareness, and implementing stricter environmental regulations, will be crucial for future policymakers overseeing personal care products, including fragrances [44].

RESULTS AND DISCUSSION

Regulatory Status and Proposals for Personal Care Products (Fragrances, Air Fresheners, Etc.)

Phthalates, commonly employed as additives in cosmetics and everyday essentials, are incorporated into cosmetics and personal care items in substantial quantities. Regular usage of these products results in a rapid elevation of phthalate monoester levels in urine. These additives are prevalent in cosmetic formulations, including perfumes and nail care products [45]. Therefore, it can be said to be a substance that affects not only human health but also air pollution.

The attribution of responsibility for climate change is often correlated with economic advancement, particularly evident

Table 1. Potential benefits and challenges associated with fragrance use

Opportunities	Challenges
Increased Consumer Awareness: Growing awareness about the environmental impact of fragrances can lead to more informed consumer choices.	**Volatile Organic Compounds (VOCs):** Many fragrances emit VOCs, which contribute to air pollution and can cause health problems.
Development of Eco-Friendly Products: The demand for eco-friendly and natural fragrances can drive innovation in sustainable product development.	**Regulatory Compliance:** Ensuring that fragrances meet environmental regulations can be challenging and costly for manufacturers.
Market Growth for Natural Products: The market for natural and organic fragrances is expanding, offering economic opportunities for businesses.	**Lack of Standardization:** The absence of standardized guidelines for labeling and marketing eco-friendly fragrances can confuse consumers.
Health Benefits: Using natural fragrances can reduce exposure to harmful chemicals, promoting better health outcomes.	**Cost of Sustainable Ingredients:** Natural and eco-friendly ingredients can be more expensive, leading to higher product prices.
Reduction in Synthetic Chemical Use: Encouraging the use of natural ingredients can decrease reliance on synthetic chemicals that contribute to air pollution.	**Performance and Stability Issues:** Natural fragrances may have shorter shelf lives and less stability compared to synthetic alternatives.
Corporate Social Responsibility (CSR): Companies can enhance their CSR profiles by adopting sustainable practices in fragrance production.	**Consumer Skepticism:** Some consumers may be skeptical about the effectiveness and quality of eco-friendly fragrances.
Technological Advancements: Innovations in green chemistry can lead to the development of new, less polluting fragrance compounds.	**Supply Chain Constraints:** Sourcing sustainable raw materials can be challenging and may disrupt supply chains.

in affluent developed nations reliant on carbon-based economies. Consequently, these nations are typically assigned greater accountability for climate change due to the incidental consequences of their prosperity. This acknowledgment of responsibility fosters a sense of interdependence among individuals concerning social issues, prompting many to undertake measures aimed at curbing their own economic progression to mitigate potential adverse impacts on their community or collective [46]. Indeed, the consumption and market scale of perfumes are substantial in developed nations. John Broome, a philosopher and economist, posits that addressing climate change will necessitate the reduction of greenhouse gas emissions, predominantly from individuals within the more affluent segments of society, reflecting the global impact of their actions [47]. Undoubtedly, climate change presents inherent complexities, stemming from both internal dynamics and external influences. As we increasingly recognize the gravity of the climate crisis and endeavor to address it, the responsibility for mitigation rests collectively upon all of us. To this end, it is imperative to mandate the disclosure of general terms or ingredients used in fragrance formulations. While current regulations necessitate the listing of ingredients for personal care and cosmetic products on product labels, fragrance-related constituents are not required to be disclosed on Material Safety Data Sheets (MSDS) [48]. This is a factor that consumers are aware of perfume or fragrant substances, so it should be changed for a change in consumption behavior. Disclosing all ingredients in personal care products, such as fragrances and air fresheners, can enhance consumer protection and promote sustainable consumption. Regulatory authorities can guide the industry on providing safety information about product ingredients through various approaches: (1) listing all ingredients on the product label, (2) listing only key ingredients on the product label, (3) displaying all ingredients on the manufacturer's website, or (4) listing key ingredients on the product label and additional ingredients on the website. Each approach has its own merits and drawbacks in informing consumers about the constituents of fragrances and fragrance products. Moreover, risk communication forums that consistently address the environmental and health impacts of these products can effectively foster understanding of chemical information, toxicological science, regulatory guidelines, labeling practices, and consumer concerns [49].

Regulations for personal care products, including cosmetics, vary significantly across different regions, posing challenges for global compliance. Efforts have been made to harmonize regulatory frameworks to facilitate international trade. In the European Union (EU), all member states adhere to a unified regulatory framework under Regulation (EC) No. 1223/2009, overseen by the European Commission, which replaced the earlier Directive 76/768/EC. This regulation aims to standardize cosmetic regulations across the EU and incorporate technological advancements. However, such harmonization has not been universally achieved [50]. In contrast, the United States relies on the Federal Food, Drug, and Cosmetic Act (FD&C Act) of 1938 and the Fair Packaging and Labeling Act (FPLA) of 1966, regulated by the Food and Drug Administration (FDA) [51]. These laws have seen minimal amendments since their inception. Similarly, Canada's regulatory landscape is governed by the Cosmetic Regulation Act of 1977 and the Food and Drugs Act of 1985, which have also undergone only minor updates [52]. Brazil's regulatory structure for cosmetics involves three main bodies: the Ministry of Health, the Brazilian Health Regulatory Agency (ANVISA), and the General Directorate of Hygiene, Perfumery, Cosmetics, and Sanitary Products (GHCOS). These organizations operate through a series of

resolutions that have been periodically revised to address regulatory needs [53]. This disparity in regulatory evolution across regions underscores the challenges of achieving global regulatory harmonization in the cosmetics industry [54].

There is Ethics in Incense

The growing awareness of environmental impacts and the trend towards healthier consumption patterns have driven the popularity of eco-friendly products, including cosmetics made from natural ingredients without chemical additives [55–58]. Typically, eco-friendly or green cosmetics and personal care items encompass products such as skincare, body care, hair care, oral care, color cosmetics, and toiletries that utilize natural and organic ingredients. These products often come in environmentally friendly or reusable packaging and emphasize the exclusion of synthetic chemicals [59]. As consumers gain more awareness about the health and hygiene benefits of cosmetics and personal care products, they are increasingly opting for natural and organic options, which are considered safer alternatives due to the potential side effects of conventional products [60]. Additionally, the global demand for safe, healthy, and clean cosmetics and personal care products has surged, particularly in the wake of the COVID-19 pandemic [58]. This shift in consumption is known as sustainable and ethical consumption. Consequently, the rising demand has spurred international cosmetics companies to create more products featuring natural ingredients and to expand their natural product lines [58, 60]. As a result, the global market size for natural and organic cosmetics grew from $34.5 billion in 2018 to $36.3 billion in 2019, with projections estimating it will reach $54.5 billion by 2027 [61].

Also, opting for unscented products presents a viable approach. Unscented alternatives can effectively fulfill the same functions as conventional fragranced products, albeit without the associated potential issues linked to scented formulations. For instance, fragrance-free cleaning or disinfecting products offer comparable efficacy without the inclusion of added fragrances [16]. Unscented products can be a simple and effective approach to reducing air pollution and potential health risks [17]. It should be noted that fragrance-free and fragrance-free products are different. The fragrance-free product may be added with a fragrance to cover the odor of other components [62].

Furthermore, it cannot be assumed that customers or the general populace inherently favor scented environments. Moreover, individuals would likely refrain from using fragranced products if they were aware of the potential release of harmful air pollutants. Ethical consumption should not be hindered by unfamiliarity with certain practices or products [63]. Perfume, being a luxury item and a means of self-expression within consumer culture, often entails excessive packaging. Ethical consumption entails adhering to consumption practices that minimize the use of plastic and reduce waste, recognizing the detrimental effects of such practices on the common good. Human ingenuity is adept at devising sustainable solutions, and the realization that ethical consumption is not inherently burdensome enables the design of systems that harmonize with both human needs and environmental preservation [64].

Research has shown that scented products, such as perfumes and air fresheners, contribute significantly to indoor air pollution by emitting volatile organic compounds (VOCs). These emissions can react with ozone to form secondary pollutants such as formaldehyde and ultrafine particles, which can pose health risks and contribute to overall air quality degradation. For example, studies have shown that air fresheners and other scented products emit a variety of VOCs, including terpenes such as limonene, which can form harmful byproducts when they interact with indoor ozone, which highlights the need for stricter regulation and increased consumer awareness of the use of these products and their environmental impacts. A comparative analysis of regulatory frameworks also reveals significant differences in how regions address this issue. The European Union has made significant progress in harmonizing cosmetic regulations to enhance safety and market consistency through Regulation (EC) No. 1223/2009, while the United States and Canada still operate under outdated legislative frameworks with minimal amendments, posing challenges to harmonization and comprehensive risk communication [65]. Integrating these perspectives can provide a more robust analysis of the impact of increased fragrance use on air pollution and highlight the need for global regulatory consistency and public education on the environmental and health impacts of fragrance products. By effectively adopting these changes in ethical consumer behavior, the European Union (EU) is projected to achieve a reduction in its carbon footprint by approximately 25%. The most significant contributions would stem from altering consumption patterns (28% of the total), decreasing overall consumption (26%), transitioning to products with a lower carbon footprint during production (17%), and opting for goods that emit fewer carbon emissions during use (19%) [66].

CONCLUSION

The climate crisis impacts every industry, with air pollution intricately linked to both our emotional well-being and outdoor activities. Among the significant contributors to air pollution are perfumes and air fresheners, which serve multifaceted purposes such as self-expression and mood enhancement. Despite their increasing market demand, many perfume ingredients comprise potentially harmful chemicals, posing threats to both indoor and outdoor air quality and overall health. Furthermore, the production, transportation, use, and disposal of fragrance products generate environmental pollutants and contribute to resource waste through excessive packaging materials like glass, plastic, and paper. The lack of ingredient disclosure to consumers further exacerbates the risks associated with fragrance use. Thus, mitigating unnecessary fragrance consumption and ensuring the use of unscented, ethically sourced ingredients becomes imperative in promoting environmental sustainability and safeguarding public health.

DATA AVAILABILITY STATEMENT

The author confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

USE OF AI FOR WRITING ASSISTANCE

Not declared.

ETHICS

There are no ethical issues with the publication of this manuscript.

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