International Journal of Scientific Research in Chemistry
Available online at : www.ijsrch.com
Online ISSN: 2456-8457
doi : https://doi.org/10.32628/IJSRCH

# Evaluation of Cosmetic Ingredients Impacting Human Health

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ARTICLEINFO

**Article History:**

Accepted: 10 Oct 2023
Published: 30 Oct 2023

**Publication Issue**
Volume 8, Issue 5
September-October-2023

**Page Number**
17-36

ABSTRACT

Human skin is a serious problem universally, by and large in both developing as well as underdeveloped nations. Conversely, synthetic skin care or cosmetic products, fragrances and preservatives create an unexpected adverse effect towards human skins and it's not safeguarding too. This article reviews the current available scientific literature regarding the effect of human skins by using various ingredients to make the cosmetic and fragrances product. The present paper is an attempt to provide a detailed cosmetic product ingredients description, classification, synthetic study etc.

Keywords: Fragrance, Cosmetic, Preservative, Skin irritants, Carcinogens, BHT, Hair products, Endocrine UV filters.

## I. INTRODUCTION

Cosmetics have become an essential part of our everyday life, comprising a wide range of beauty and personal care goods. From skincare and cosmetics to hair care and perfumes, these goods are intended to improve or change one's look. Several reasons contribute to this developing tendency. Initially, technological improvements have resulted in the production of innovative and effective cosmetic compositions. These formulas provide enhanced advantages such as anti-aging effects, UV protection, and long-lasting wear. Second, the emergence of social media and digital platforms has had a tremendous impact on the popularity of cosmetics. People now have access to a variety of knowledge and inspiration thanks to the rise of beauty bloggers, videos, and product reviews, fueling demand for cosmetics.

Furthermore, the shift in cultural standards and attitudes towards beauty and self-care has led to the rise in popularity of cosmetics. People increasingly see cosmetics as tools for enhancing their natural characteristics, expressing their personality, and presenting themselves in the best light possible. While cosmetics are becoming increasingly fashionable, there are legitimate concerns about their possible influence on overall health. These issues stem from a variety of components of the cosmetics industry, such as the substances used, production techniques, and customer behavior. One important source of worry is the use of potentially hazardous substances in cosmetics. However, these can have a lot of side effects including cancer, allergies, developmental and reproductive toxicity etc. Furthermore, the production and disposal of cosmetics can have major environmental implications. Lastly, this exponentially

growing popularity has increased consumption and dependency by large numbers resulting in an overuse of certain cosmetic products which damage the skin's natural barrier function and lead to long-term negative effects. "Any substance or preparation intended to be placed in contact with the external parts of the human body... or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly for cleaning them, perfuming them, changing their appearance, and/or correcting body odors and/or protecting or keeping them in good condition." (Cosmetics)

## II. Evaluation of the Hypothesis

### 1) Allergens and Irritants

Cosmetic chemical components can cause a wide range of health issues, including skin, eye, and respiratory irritation, allergic responses, endocrine disruption, reproductive and developmental toxicity, organ(system) toxicity, and cancer. Some individuals may stop using such products that give rise to these problems and move to another chemically infused product, while others may grin and suffer their consequences such as the eye, skin, and respiratory irritation, as well as the other symptoms that chemicals can cause. Others may not realize that it is their usage of cosmetics that is causing such reactions. Furthermore, those who already have asthma, or a skin problem may be at a higher risk of facing heightened reactions.

An allergy refers to a situation in which "your immune system reacts to a foreign substance - such as pollen, bee venom or pet dander - or a food that doesn't cause a reaction in most people." (Mayo clinic) In an allergic reaction, after exposure to the antigen the body undergoes a sensitization period, during which in order to attack the antigens the immune system makes and activates antibodies, making the antigen an allergen. When you are exposed to the allergen again, these antibodies can cause a range of immune system chemicals, such as histamine, to be released, resulting in allergy symptoms (such as sneezing, itching, runny or stuffy nose, watery or red eyes etc.)

Irritants is a substance "which causes inflammation of the skin." ("Health and Safety: Skin Irritants - SAMANCTA") Primary skin irritants cause this inflammation at the point of contact, whereas secondary irritants have similar effects a while after exposure and the inflammation does not get confined to a certain area/part of the body. Irritation caused due to the application of chemically infused cosmetics is quite common and concerning.

A sensitizer is a "substance that can cause exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance." (Stanford) The initial reaction of a person to a sensitizing chemical may be minimal or non-existent. However, once sensitized, successive exposures can induce strong reactions even at very low concentrations. Most sensitization happens as part of an immunological system. Allergic responses can be life-threatening. Rhinitis, asthma, alveolitis, bronchitis, contact eczema, contact dermatitis, and blepharon conjunctivitis are the most common reactions. ("ISTAS: Sensitizers")

### Fragrances

"95 percent of the chemicals used as fragrance ingredients are petroleum based chemicals." (Safe Cosmetics Australia) Fragrance ingredients have come under scrutiny due to their potential to cause sensitization, a process where individuals develop allergies to specific chemicals after repeated exposure. This condition affects a significant portion of the population, ranging from 2 to 11 percent, with mild reactions initially and worsening allergies upon further contact. Fragrance chemicals can become potent sensitizers through various mechanisms, including air oxidation, photo-activation, skin enzyme catalysis, or cross- sensitizing to different

substances.Once sensitized, individuals must avoid further exposure to prevent the development ofsevere and irreversible allergies. Fragrance allergies impact millions of people worldwide, and the prevalence appears to be increasing. Fragrances are a leading cause of cosmetic contact dermatitis, according to the American Academy of Dermatology. Reactions to fragrance ingredients, both natural and synthetic, can range from skin irritation to respiratory symptoms and eye discomfort. The European Union's Scientific Committee on Consumer Safety has identified eighty-two fragrance substances as confirmed allergens in humans, with 26 requiring mandatory labeling.

To avoid allergic reactions, individuals with sensitivities are advised to use fragrance-free products. However, this is challenging because most cosmetic products on the market contain fragrance. Hair care products, in particular, are heavily scented. Furthermore, terms like "fragrance-free" and "unscented" lack standardized regulations, and many "unscented" products contain masking fragrances that are not disclosed on ingredient labels. Therefore, consumers may unknowingly be exposed to fragrance allergens even when choosing supposedly fragrance-free products. Disclosing fragrance ingredients could assist allergy sufferers in finding safer products while reducing the overall societal and economic burden of allergic reactions.

Fragrance ingredients pose respiratory and irritant risks because they easily vaporize into the air, exposing the eyes and respiratory tract. Asthmatics, in particular, may experience severe effects even at low concentrations of fragrance ingredients, similar to secondhand smoke exposure. Inhaling common sanitizing agents like quaternary ammonium compounds (QACs) has been associated with occupational asthma. Additionally, several fragrance ingredients, such as benzyl salicylate, benzyl benzoate, and butoxyethanol, are known irritants for the skin, eyes, nose, and throat, leading to symptoms like burning sensations, nausea, vomiting, and potential organ damage. Cinnamal and citral, both fragrance ingredients, have been identified as established allergens by the European Union's Scientific Committee on Consumer Safety.

## Chemicals of Concern in Fragrances

Below are a few chemicals of concerns in fragrances: -

1) **Acetaldehyde** - In humans, the predominant acute consequence of acetaldehyde inhalation is irritation of the eyes, skin, and respiratory tract. Erythema, coughing, pulmonary edoema, and respiratory tract in humans at higher exposure levels. Erythema, coughing, pulmonary edoema, and necrosis may occur at higher exposure levels. Acute acetaldehyde inhalation resulted in decreased respiratory rate and increased blood pressure in experimental animals.
2) **Benzophenone** - Benzophenone sensitivity can lead to classic allergic contact dermatitis and photocontact dermatitis, manifesting as redness, swelling, itching, and fluid-filled blisters upon exposure to products containing benzophenone or its derivatives. These symptoms may occur immediately or several days later, especially in cases of delayed contact and photocontact dermatitis, and in severe instances, anaphylaxis may even occur. Beyond allergic reactions, worries have emerged regarding the easy absorption of benzophenone into the skin, potentiallypromoting the generation of harmful free radicals. (Ngan)
3) **Cinnamal** - Fragrances like cinnamal, amyl cinnamal, cinnamic acid, and Myroxylon pereirae have been found to induce non-immunological contact urticaria, resulting in a range of skin problems. These issues include disruptions to the skin's protective barrier, exacerbation of dryness, onset or aggravation of

redness, depletion of essential substances on the skin's surface, and a general hindrance to achieving a healthy, smooth, and well-hydrated complexion. Surprisingly, the detrimental effects of fragrant ingredients on the skin may not always be visible or immediately felt, but they still occur beneath the surface. Research has revealed that skin can suffer from irritation even without obvious signs, much like the cumulative damage caused by sun exposure, where the negative impact and visible consequences of fragrance may not become apparent until later on. ("Amyl Cinnamal in Skin Care: What It Is & Is It Safe?")

4) **Formaldehyde** - Formaldehyde, designated as the 2015 American Contact Dermatitis Society Contact Allergen of the Year, can, at high concentrations, lead to chemical burns, primarily as an occupational hazard. However, in cosmetics, formaldehyde is widely recognized for its potential to induce allergic skin reactions and rashes in certain individuals. Even though personal care products generally contain low formaldehyde concentrations, they can still contain enough to trigger reactions in those with formaldehyde sensitivities. Research in 2015 found that when exposed to a 2.0% formaldehyde patch test, up to 11.9% of the population may exhibit allergies to formaldehyde, with sensitivity potentially developing over time from repeated low-level exposures.
5) **Phenoxyethanol** - Skin contact with phenoxyethanol has been associated with allergic reactions that encompass a spectrum from eczema and hives to severe anaphylactic responses. A study conducted in 2015 observed that Doppler ultrasound gel primarily resulted in skin inflammation, with occasional reports of life-threatening anaphylactic reactions. Notably, the combination of phenoxyethanol and parabens in Doppler ultrasound gel appeared to provoke more severe allergic responses compared to phenoxyethanol alone. Furthermore, products containing one percent or more phenoxyethanol can commonly trigger eczema as an allergic reaction, localized to the application area. However, discontinuing the use of the irritant product typically leads to the resolution of eczema symptoms.
6) **Resorcinol** - Resorcinol is known to cause acute irritation when it comes into contact with the eyes. Additionally, it has been shown to act as a skin irritant and sensitizer. While reactions are relatively rare at concentrations below two percent, higher concentrations are associated with an elevated incidence of reactions.

## Preservatives (Oakley)

Preservatives, also referred to as biocides and disinfectants, are chemical substances designed to hinder the proliferation of bacteria and fungi. These agents have been employed since the 1930s to prevent household items, textiles, personal care products, and medications from succumbing to mold or decomposition. The majority of cosmetic and industrial products incorporate preservatives for this purpose. Among the most significant categories of preservatives are parabens, formaldehyde-releasing compounds, and isothiazolinones, including methylisothiazolinone. It's important to note that these preservatives can potentially induce dermatitis in individuals who are sensitive to them.

Preservatives can occasionally trigger contact allergic dermatitis, with a higher prevalence among women compared to men. This allergy typically manifests as dermatitis in areas exposed to the specific chemical responsible for the reaction. For instance, a preservative in a hair shampoo might lead to a rash

on the neck, while one in textiles could result in dermatitis at points of contact with the skin, and a preservative in a cream may cause dermatitis wherever it's applied. The affected skin can exhibit symptoms such as redness, swelling, and blistering (acute dermatitis) or become dry, thickened, and intensely itchy (chronic dermatitis). Dermatitis episodes may occur intermittently or persistently, and distinguishing preservative-induced contact allergic dermatitis from irritant contact dermatitis (e.g., due towet work) or constitutional dermatitis (e.g., atopic dermatitis) can be challenging. Hand dermatitis, including occupational dermatitis in professions like hairdressing where various products containing preservatives are used, is a common presentation of preservative allergies.

### Health concerns that arise with some preservatives

**Parabens** - causes classic allergic contact dermatitis reactions (form of eczema resulting in high skin inflammation caused by an allergen)
Found in: - Foundations, powders, concealers, eye makeup, blush, bronzers, makeup remover, lipstick, quick-dry nail products.

**Formaldehyde** - may result in burning sensations in the eye, nose and throat, rashes, wheezing, fatigue, headaches. May also cause hypersensitivity leading to the development of allergic contact dermatitis.
Found in:- Face masks, makeup, bubble bath, bath oils, shampoos, creams, mouthwashes, deodorants

**Isothiazolinones** - Causes localized allergic contact dermatitis. The risk of developing sensitization to isothiazolinone is higher when the skin's barrier is compromised, such as when someone already has eczema. May also cause chemical burns.
Found in :- Foundations, concealers, bronzers, eye makeup, make-up remover, moisturizers, sunscreens, shampoos, conditioners, bubble baths, soaps, creams, lotions

**Benzyl Benzoate** - is a skin and eye irritant which may severely irritate, burn and sting the genitalia and scalp.
Found in:- baby products, bath products, soaps, eye makeup, blushes, cleansers, hair products, skin care products, nail products

**Benzyl Alcohol** - May cause contact urticaria (commonly known as hives or a skin rash with red itchy bumps)
Found in:- baby products, bath products, soaps, eye makeup, blushes, cleansers, hair products, skin care products, nail products

**Benzalkonium chloride** - May cause both irritant and allergic contact dermatitis resulting in red, itchy, dry or scaly skin. A subset of people may develop granular parakeratosis (a type of rash)
Found in:- Moisturizers, make-up removers, cleansers, hair products

**Phenoxyethanol** - May cause allergic reactions ranging from hives and eczema to anaphylaxis. Typical symptoms are redness, swelling, itching and fluid filled blisters.
Found in: - skin creams, sunscreens, cleansers, eye makeup, makeup, hair products, lotions

**Thiomersal** - may cause localized contact dermatitis. Symptoms include redness and swelling.
Found in: Make-up removers, eye moisturizers, eye make-up, cleansers.

### Hair Products

Sodium lauryl sulfate (SLS) is a commonly used surfactant found in a range of cleansing products, cosmetics, and personal care items, with concentrations varying from 0.01% to 50%. SLS, functioning as an anionic surfactant, has the capacity to disrupt cell membrane proteins and is recognized for its potential to induce skin irritation when

applied under an occlusive patch, with irritation starting at concentrations as low as 0.5%. Although it creates a satisfying foam or lather, sodium lauryl sulfate (SLS) creates a deceptive impression of cleanliness. It removes the natural protective barriers and disrupts the inherent oil and pH balance of both the skin and hair. SLS has a drying effect on both, resulting in a lackluster appearance and rendering them more susceptible to the penetration of harmful.toxins. Moreover, SLS can be readily absorbed into the body, accumulating in internal organs and heightening the risk of potential long-term health issues.

Sodium lauryl sulfate (SLS) poses a concerning issue due to its ability to permeate the skin, potentially entering the bloodstream. This chemical presents several risks:

1. SLS can lead to severe skin irritation and a heightened risk of contact allergies, especially for those with sensitive or acne-prone skin, as it can clog pores and contribute to acne development.
2. The World Health Organization (WHO) has issued warnings regarding SLS, indicating that it can be harmful if ingested and may cause irritation to the eyes, lungs, and respiratory system.
3. Since SLS can penetrate the skin's layers, it disrupts natural barriers, stripping away essential oils and moisture balance. This can result in dry, parched skin and increased vulnerability to

acne-causing bacteria.

4. SLS harms the fragile lipid layers responsible for maintaining skin suppleness and smoothness, ultimately leading to dry skin and lackluster hair, while also facilitating the entry of other toxins through the skin's surface.
5. SLS is readily absorbed by the body and can accumulate in internal organs, raising concerns about potential long-term health issues.

Furthermore, SLS is an environmental pollutant, and the WHO advises against allowing it to enter the environment in its raw form, as it can be toxic to fish and accumulate in their bodies. While the diluted form of SLS found in personal care products is generally considered non-toxic due to low concentrations, there are concerns about the possibility of chronic toxicity even at these lower levels.

## Endocrine Disruptors

An endocrine-disrupting compound (EDC) was defined by the U.S. Environmental Protection Agency (EPA) as “an exogenous agent that interferes with synthesis, secretion, transport, metabolism, binding action, or elimination of natural blood-borne hormones that are present in the body and are responsible for homeostasis, reproduction, and developmental process.” Exposure to low levels of EDCs during critical periods of human development can elevate the risk of various health issues, including infertility, alteration in puberty-related development, cancers, neurodevelopmental and neurodegenerative diseases, metabolic disorders, asthma, and immune disorders. They also have the capacity to interfere with hormone receptors, proteins that bind with specific hormones to facilitate cell-to-cell communication related to functions such as metabolism and sexual development.

## Ultraviolet Filters

UV filters are a group of chemicals capable of absorbing or reflecting ultraviolet (UV) light within the ultraviolet A (UVA) range (320 to 400 nm) and ultraviolet B (UVB) range (290 to 320 nm). These chemicals serve the purpose of safeguarding human skin from the harmful effects of direct UV radiation exposure. Ultraviolet (UV) filters are extensively

utilized in cosmetics, plastics, adhesives, and various industrial goods to shield human skin and products from harmful UV radiation.

**Chemicals that may lead to endocrine disruption.**

1) **Benzophenone-3**: Benzophenone-3 (BP-3) has shown in animal studies to potentially impact hormonal pathways related to sex and thyroid hormones. Additionally, it can be absorbed at varying rates, ranging from 1% to 9%, when applied topically incertain models. When the skin's protective barrier is compromised, the absorption of UV filters like BP-3 may occur more rapidly. Notably, UV filters have been detected in breast milk , placental tissues, and urine. There have been observations of increased instances of neonatal dysfunction, such as Hirschsprung's disease, associated with BP-3 exposure during pregnancy.
2) **PABA and derivatives**: Octyl Dimethyl PABA, also known as Padimate O, has been associated with estrogenic effects, the generation of free radicals, allergies, ecotoxicity, and environmental pollution. It is strongly recommended to avoid products containing it, as it is rated as a level 5 by the Environmental Working Group (EWG), indicating a high level of concern. Similarly, Ethylhexyl triazone, sometimes referred to as octyl triazone, is not authorized for use in the USA. It has the potential to enhance the effectiveness of other sunscreen filters but releases free radicals when exposed to sunlight.
3) **Cinnamates**: Octinoxate, also known as Octyl Methoxycinnamate (OMC) or Ethylhexyl Methoxycinnamate (EHMC), has been confirmed as an endocrine-disrupting chemical (EDC) with characteristics of persistence and bioaccumulation. It is capable of skin absorption and may enhance the absorption of other substances. Notably, it has been detected in breast milk, poses ecotoxic risks, and is considered one of the most problematic sunscreen filters presently
4) **Homosalate**: Homosalate has been shown to have a notable impact on the body's hormone systems, particularly the estrogen system, with exposure leading to a significant increase in cell growth and multiplication in human breast cancer cells responsive to estrogen. Additionally, studies have indicated that homosalate affects the androgen and progesterone systems. While these observations have been primarily made in cell cultures, caution is warranted due to the critical role these hormones play in regulating the development of reproductive organs. The concerning aspect of homosalate's endocrine-disrupting effects is compounded by its presence in human breast milk samples, as well as its observed estrogenic activity in human placental tissues. This is especially troubling because pregnancy and infancy are vulnerable developmental stages during which exposure to hormone-disrupting compounds can result in adverse health effects. Research has shown that breast milk contamination with UV filters, including Homosalate, may be relatively common, with a significant correlation between a mother's use of UV Filter-containing products during pregnancy and/or lactation and the presence of these compounds in breast milk, as seen in a study involving 54 mother-child pairs.
5) **Parabens**:- Parabens are considered potential endocrine disruptors because they have the ability to mimic estrogen. In laboratory studies, parabens have been found to weakly bind to estrogen receptors, and when present in sufficient concentrations, they can stimulate cell proliferation, particularly in human breast

cancer MCF-7 cells, which are often used to measure estrogenic activity. Among commonly used personal care product ingredients, the "long chain" parabens like butylparaben, isobutyl paraben, isopropyl paraben, and propylparaben exhibit the strongest estrogenic activity. Research involving prenatal exposure to isobutyl paraben in rats has shown increased uterine weight and heightened sensitivity to estrogen in the offspring. Ethyl paraben exhibits lower levels of estrogenic activity, while methylparaben demonstrates almost no estrogenic activity.

### Butylated Compounds

BHA is commonly employed as an antioxidant and preservative in a range of products, including food, cosmetics, food packaging, and animal feed. Additionally, it plays a preservative and antioxidant role in pharmaceutical preparations and cosmetic products containing oils and fats. Exposure to BHA typically occurs through skin contact with commercial items, with lipstick, hair products, fragrances, creams and eyeshadow being.

notable examples. On the other hand, BHT, a toluene-based ingredient, serves as a preservative in both food and personal care products.

Although BHA is commonly considered safe, it is classified as a suspected endocrine disrupting compound. One study carried on male and female rats in order to investigate the effects of BHA. “This study elucidates that high dose of BHA induce weak dysfunction and underdevelopment of the reproductive system of male and female rats with the change of T4 and testosterone levels, sex organ weights and sexual maturation and histological lesions of thyroid gland.” (Jeong et al.)

Another research, regarding their use in cosmetics, has indicated that BHT can penetrate the skinat very low doses, but the dermal absorption of BHA has not been thoroughly examined. Both BHA and BHT undergo metabolism in the body, producing various compounds, and the potential toxicity of these metabolites is a subject of concern. Interestingly, when both BHA and BHT are present in the same formulation, they have been observed to accumulate in adipose tissues, suggesting an interaction between them. These compounds have been shown to bind to nuclear receptors and act as estrogen receptor agonists. Alone, BHA and BHT exhibit low antiandrogenic activity, but when combined, they display higher antiandrogenic effects. Additionally, mixing them with propylparaben or butylparaben enhances their binding strength. Furthermore, exposure to BHA may lead to abnormal testicular development and hinder testosterone production in males, while BHT has been associated with reproductive and developmental impairments, primarily observed in animal studies. Behavioral effects due to BHA and BHT exposure have also been noted in fetuses and young children. Although the binding of BHA and BHT to nuclear receptors is established, their phenotypic effects in humans require further investigation, and the extent of BHT's skin penetration should be explored. It is crucial to emphasize that caution is warranted when dealing with mixtures containing these substances, as their synergistic effects raise concerns. (Chantelouve and Ripoll)

## 2) Phthalates

Phthalates, which share a similar chemical structure, are widely utilized in various consumer products. Two commonly used phthalates in personal care items are as follows: 1) dibutyl phthalate (DBP), frequently found in nail polish and considered a high-concern endocrine-

disrupting compound by the EU, has been phased out by some companies in nail products.

2) Diethyl phthalate (DEP) is widely employed in scented products to prolong fragrance retention, often hidden under the general term "fragrance" on labels. Another phthalate, Di- 2-ethylhexylphthalate (DEHP), is present in eyelash glue andvarious other consumer goods. An important regulatory gap allows phthalates to be included in fragrances without disclosing them to consumers. While field research by the Campaign for Safe Cosmetics found limited phthalate disclosure, earlier reports revealed their presence in the majority of tested products, though not listed on labels. Phthalates are frequently detected in human urine samples, with metabolites of DEP found in all samples and DBP metabolites in 99% of cases, largely attributed to their use in cosmetics and fragrance products. Disparities in exposure persist, with higher DEP levels among non-Hispanic blacks, potentially linked to their frequent use of products marketed to this demographic, according to data from the CDC's National Biomonitoring Program.The European Commission has established that there is substantial evidence indicating that DBP and DEHP can cause disruptions in the endocrine systems of living organisms. Furthermore, the Endocrine Disruption Exchange (TEDX) recognizes DEP, DEHP, and DBP as compounds that can disrupt endocrine functions.. Additionally, other studies in humans have revealed altered hormone levels in baby boys exposed to DEP and DEHP through breast milk.

### 3) Triclosan

Triclosan, a common ingredient in various personal care and household products such as soaps, hand sanitizers, cosmetics, oral care items, and even household items like cutting boards and footwear, is recognized as a potential endocrine disruptor. Its chemical structure bears resemblance to thyroid hormones, and while it exhibits lower acute toxicity, it has a tendency to accumulate in the body due to its lipophilic nature, notably in breast tissues. This accumulation poses developmental risks, especially for infants and during gestation. Approximately 96% of products containing triclosan ultimately find their way into wastewater treatment facilities, where they transform into methyl-triclosan. This derivative, being even more lipophilic, accumulates in the fatty tissues of aquatic organisms. Triclosan has been found to have toxic effects on organisms like earthworms and plants. It can undergo photolytic transformations into dioxin and furan, which are considerably more toxic. Triclosan has also been linked to altered swimming ability in fish and has been reported to generate chloroform as a by-product when reacting with residual chlorine, with potential carcinogenic effects in humans.

### Alkylphenols

The presence of alkylphenols like nonylphenol (NP) and BPA in aquatic environments is closely linked to human activities. Nonylphenol (NP) is a synthetic compound comprising a phenolic ring and a nine-carbon chain in the para position. It exists as a thick, pale-colored liquid that does not mix with water under typical conditions. In industrial settings, NP is produced through the alkylation of phenol with nonene using acid catalysis, resulting in a complex mixture containing over 22 isomers of 4-substituted alkylphenols. The estrogenic properties of alkylphenols were first demonstrated in 1938 by Dodds and Lawson. NP is commonly used as a surfactant, dissolving well in methanol and ethanol but remaining insoluble in water. It exhibits high resistance to degradation processes while displaying a propensity for bioaccumulation. In 2008, 4-NP was designated as a priority substance in water policy by the European Parliament and Council Directive (2008/105/EC)

and was identified as a priority hazardous substance.

### Aluminum Salts

The study investigated the impact of neonatal exposure to aluminum on the male ventral prostate and female prostate in adult and aging gerbils, focusing on its toxicity and potential to disrupt hormonal regulation. Young male and female pups received oral doses of aluminum chloride (10 mg/kg) from days 1 to 14 of life. Subsequently, the animals were allowed to age until reaching either 90 days or 1 year. The prostate glands were extracted and subjected to various analyses, including morphological, immunohistochemical, and ultrastructural assessments. In adult male gerbils, the ventral prostate displayed moderate hyperplasia and increased epithelial cell proliferation, unrelated to androgen receptor (AR) disruption. In contrast, senile male gerbils exhibited pronounced prostatic hyperplasia, heightened cell proliferation, and epithelial AR regulation. Furthermore, both age groups experienced a decrease in prostate secretory function. The observed morphological changes in the female prostate resembled those in males. However, in adult female gerbils, prostatic hyperplasia coincided with reduced AR and estrogen receptor alpha regulation, whereas senile females exhibited intense hyperplastic growth accompanied by increased estrogen receptor alpha and diminished stromal AR. These findings illustrate that neonatal exposure to aluminum chloride disrupts hormonal regulation in both male and female prostates, leading to tissue damage that manifests in adulthood and intensifies with aging.

### 4) Cancer (Carcinogens)

The skin, our body's largest organ, serves as a protective barrier against microorganisms, as well as physical and chemical agents. Paradoxically, it also has the capacity to absorb substances that can impact our physiological processes and potentially lead to harmful effects, including toxicity. Lipophilic molecules lacking an electric charge and weighing less than 500 Da can passively penetrate the skin, and various factors like temperature and skin occlusion can enhance the permeation of substances commonly found in cosmetics. Given that makeup cosmetics are often applied to the skin for extended periods, there's a risk of these substances being absorbed through the skin and accumulating within the body. This is particularly concerning in the context of cancer, a leading cause of death in developed nations, as certain factors are considered precursors to cancer. In response to the significant rise in cancer rates and mortality, extensive research and studies are being conducted on carcinogens. The World Health Organization (WHO) reports that nearly 30% of cancer cases could be prevented through proper prevention measures, including reducing exposure to potential cancer-causing agents. Interestingly, more developed countries tend to have 2-3 times higher cancer rates than less developed ones. The most common types of cancer include breast, lung, colon and rectal, prostate, and skin cancers. Facial makeup cosmetics, widely used products applied to the skin, are in regular contact with our skin for extended periods. Consequently, these products should exclusively contain ingredients recognized as safe and at concentrations that adhere to current standards.

The list of substances discouraged for cosmetic use is continuously updated and expanded based on new scientific findings. Despite significant progress in toxicology, it is impossible to completely rule out the presence of compounds with potential harmful effects in commercially available products. Ingredients with potential carcinogenic properties are of particular concern in this regard.

### 5) Carcinogens

Carcinogens are typically categorized into two main groups based on their mechanisms of action. The first group, known as genotoxic carcinogens, includes substances like formaldehyde, acetaldehyde, and ethylene oxide. These carcinogens directly affect the DNA in target cells, often leading to DNA damage and acting as genotoxic agents. It's worth noting that genotoxic carcinogens are considered risky even at low concentrations, as even a few DNA lesions can result in mutations that significantly increase the risk of tumors.

The second group comprises non-genotoxic carcinogens, which include substances such as parabens, heavy metals like arsenic and beryllium, 1,4-dichlorobenzene, 17β-estradiol, and cyclosporine. Non-genotoxic carcinogens exert their effects through mechanisms such as inflammation, immunosuppression, the generation of reactive oxygen species (ROS), and interaction with receptors.

Heavy metals can lead to tissue-specific toxicity and provoke inflammatory responses. Cyclosporine falls into the category of typical immunosuppressants, while 2,3,7,8- tetrachlorodibenzo-p-dioxin acts as a mediator for receptors.

However, it's important to note that a clear-cut classification for these groups is still lacking due to gaps in our understanding of the mechanisms of action of non-genotoxic carcinogens. Consequently, further research is needed to elucidate the subcellular mechanisms of carcinogenesis, which are crucial for establishing a classification system based on risk assessments from exposure to potential carcinogens.

In this study, a comprehensive examination of makeup products available in the European market was conducted to assess the presence of substances with potential carcinogenic properties, as reported in recent years. A sample of 50 cosmetics was randomly selected, and their International Nomenclature of Cosmetic Ingredients (INCI) compositions were analyzed for potential carcinogen content. Regulatory guidelines suggest that potentially carcinogenic substances should either be absent from cosmetics or should fall within specific concentration limits. However, existing data do not account for the potential long-term exposure that can occur with makeup cosmetics. This research focuses on reviewing the available literature on exposure to substances found in European cosmetics and scientific data related to heavy metals.

### 6) Parabens

Parabens, also known as nipagins, are esters derived from 4-hydroxybenzoic acid. They are colorless, odorless crystalline solids used as preservatives in cosmetics due to their broad- spectrum antimicrobial properties. Parabens are favored in cosmetics because they don't

impact sensory qualities like taste, smell, color, or texture.

Numerous studies have investigated parabens. Some have shown that parabens can penetrate the skin, with the extent of absorption dependent on the structure (alkyl substituent length) of the specific compound. The penetration order is typically methylparaben < ethylparaben < propylparaben < butylparaben, and absorption increases when an occlusive dressing is applied. Once they breach the skin barrier, parabens enter the bloodstream and can be transported to various organs. While many are

metabolized, they can also accumulate in adipose tissue.

Esters of p-hydroxybenzoic acid, like parabens, can bind to estrogen receptors, acting as xenoestrogens. When bound to these receptors, they mimic estrogen's actions, stimulating cell growth and influencing genes under estrogen receptor control. Studies, like Okubo et al.'s, have shown that parabens have weaker estrogenic activity than natural estrogen. This forms the basis for many opinions on the safety of parabens in cosmetics. However, parabens are also used in drugs and food additives, potentially exposing individuals to higher daily doses than expected, approaching or exceeding recommended estrogenic activity levels. Studies, such as one by Oishi involving male rats orally administered propylparaben, have indicated adverse effects on the male reproductive system, including reduced serum testosterone levels and sperm counts. A Korean study found harmful effects on the female reproductive system, with an increase in uterine weight in laboratory animals following paraben administration.

Because of their xenoestrogen properties, there are concerns about parabens' potential role in breast cancer. Darbre et al.'s 2004 study linked increased breast cancer risk to the use of antiperspirants containing 4-hydroxybenzoic acid esters. Parabens have also been detected in human mammary gland tumor tissue. Barr et al. found parabens in mammary gland tissue in female subjects, some of whom reported no antiperspirant use, suggesting alternative sources of exposure.

Researchers like Handa et al. have explored the impact of parabens on skin and their potential to promote skin cancer. They discovered that methylparaben, when exposed to ultraviolet B (UVB) radiation, can induce oxidative stress and lipid oxidation in keratinocytes. This damage may lead to skinissues, including genetic material damage, potentially contributing to cancer development.

The International Agency for Research on Cancer (IARC) hasn't classified p-hydroxybenzoic acid esters. A 2010 report from the Scientific Committee on Consumer Safety (SCCS) declared parabens used in cosmetic products to be safe, with no evidence of toxicity or carcinogenic effects. The only restriction is that their concentration should not exceed 0.1%.

While animal and in vitro studies have demonstrated the toxicity of parabens, data reliability is limited due to unlikely exposure scenarios. Concerns include their effects on endocrine activity, carcinogenesis, infertility, spermatogenesis, adipogenesis, perinatal exposure, non- allergic skin reactions, psychological factors, and ecological impacts. However, several studies have shown that methyl, ethyl, and propyl parabens are non-teratogenic, non- mutagenic, and non-carcinogenic, and there is currently noconcrete evidence of their toxicity in humans. As of now, it's generally believed that methyl, ethyl, and propyl parabens are safe for use in cosmetics and pharmaceutical products within recommended dose limits. Overall, there is substantial data supporting the absence of significant dermal toxicity when parabens are used as preservatives in cosmetic products.

### 7) Formaldehye

Formaldehyde, also known as methanal or HCHO, is the simplest compound containing an aldehyde group. It's a colorless gas with a distinctive odor and is typically found in a watery solution known as formalin. In cosmetics, formaldehyde serves as a preservative by interacting with bacterial proteins, disrupting their vital processes. There are substances known as formaldehyde donors, which are commonly used in cosmetics for their preservative properties. These compounds, listed in Table 4, can

release formaldehyde when exposed to water. The amount of formaldehyde released depends on several factors, including the type of compound, its concentration, water content, and the pH of the cosmetic product. This released formaldehyde can come into contact with the skin, particularly in areas with sweat, and its release is influenced by temperature and storage duration, potentially leading to prolonged exposure.

Research conducted between 2013 and 2019 has revealed the toxic effects of formaldehyde on various organs, including the lungs, upper respiratory tract, bone marrow, brain, and cells. Some reports in the literature suggest a potential link between formaldehyde exposure and nasal tumor formation, but this largely depends on factors like exposure duration, concentration, and route of administration.

Occupational exposure through inhalation has been a primary concern. While there are speculations about inhalation exposure from cosmetics, there is limited data specifying inhaled doses and concentrations, suggesting that short-term contact may result in marginal exposure. However, long-term exposure to formaldehyde through cosmetics, used for makeup over many years, raises concerns. Though the exact mechanism of formaldehyde absorption through the skin isn't fully understood, animal studies indicate significant absorption when using cosmetic products containing both free formaldehyde and its donors as preservatives. Formaldehyde donors, particularly when combined with nitrogen donors, can form potentially carcinogenic nitrosamines.

According to scientific reports, formaldehyde has been classified by the International Agency for Research on Cancer (IARC) as a Group 1 substance, indicating proven carcinogenic effects. Studies evaluating the dermal absorption of preservatives like bronopol, bronidox, and formaldehyde, as well as the absorption of formaldehyde released from bronopol and dimethyldimethyl hydantoin (DMDM hydantoin), have shown that the extent of absorption depends on the formulation of the cosmetic product.

### 8) Ethoxylated Compounds

Ethoxylation, a chemical process utilizing ethylene oxide (EtO), involves incorporating ethoxyl groups into alcohols or phenols. In the realm of cosmetics, ethoxylated compounds play a crucial role, including polyethylene glycols (PEGs). PEGs, derived primarily through anionic polymerization, can exist as either water-soluble solids or liquids depending on their chain length, determined by the quantity of EtO utilized. These compounds serve various functions in cosmetics, such as emulsifiers, solvents, viscosity enhancers, and even foaming agents. Ethoxylated fatty alcohols like laureth, steareth, ceteth, and ceteareth fulfill similar roles in cosmetic formulations, acting as emulsifiers, surfactants, and more.

The usage of ethoxylated compounds in cosmetic products generally lacks specific quantitative restrictions, except for certain representatives listed in Annex III of the Regulation of the European Parliament and of the Council of the European Union No.1223/2009/EC, which do have designated concentration restrictions. Ethoxylated ingredients have been deemed safe for cosmetic applications based on assessments conducted by the Cosmetic Ingredient Review (CIR) and studies from Germany and Korea. However, it's essential to consider the purity of ethoxylated compounds. Contaminants, particularly 1,4- dioxane, ethylene glycol (EG), and residual unreacted EtO, are potential toxicants, potent poisons, and confirmed carcinogens, respectively.

1,4-Dioxane has the ability to permeate the skin and provoke skin inflammation, potentially leading to tumorigenesis. Human exposure epidemiological studies published by the NTP in 2014 revealed occurrences of pulmonary edema, lung damage, kidney and liver tumors leading to fatalities following exposure to 1,4-dioxane vapors. Nevertheless, there's insufficient evidence to firmly establish its carcinogenicity in humans. Animal studies exposed to 1,4-dioxane via inhalation observed heightenedinstances of liver tumors. Notably, 1,4-dioxane is believed to impact DNA biosynthesis by binding to DNA within cell nuclei, potentially interfering with RNA transcription processes by affecting ribonucleic acid polymerase activity, as noted in studies on rat liver.

Ethylene oxide (EtO), also known as epoxide or oxirane, exhibits some pro-cancerous properties.

Evidence suggests an association between EtO exposure and the occurrence of cancer in humans. Epidemiological studies on workers in industrial plants where EtO was used as a gaseous sterilizing agent have indicated a slightly elevated incidence of lymphatic and hematopoietic cancers, particularly in men. Women with occupational exposure to EtO sterilizers have also shown an increased risk of breast cancer. Laboratory animal studies have demonstrated that inhalation exposure to EtO can lead to tumors in the hematopoietic system and uterus of mice, as per the NTP. The mechanism of carcinogenicity is primarily attributed to EtO's genotoxic and mutagenic properties. EtO is believed to initiate genetic events by reacting with DNA, forming DNA adducts that result in genetic mutations. Additionally, it induces chromosomal aberrations, particularly deletions, which can contribute to genetic changes and cancer development. Both the IARC and the United States Environmental Protection Agency (USEPA) classify EtO as a known human carcinogen, with both agencies noting that epidemiological evidence for lymphatic and breast cancers is "limited" but acknowledging "sufficient" and "extensive" evidence from animal studies that EtO is genotoxic. However, epidemiological studies haven't consistently shown an increased risk of breast cancer or lymphohematopoietic malignancies (LHMs) due to EtO exposure.

Similarly, toxicology and biomarker investigations in animals and humans haven't provided strong indications that EtO causes LHM or breast cancer. Consequently, there's insufficient data on animal responses at very low doses, making it challenging to determine the precise dose-response relationship for tumors.

The IARC classifies 1,4-dioxane as potentially carcinogenic and EtO as a compound with proven carcinogenicity. Regulation 1223/2009/EC of the European Parliament and the Council of the European Union prohibits the use of 1,4-dioxane and EtO as ingredients in cosmetics. However, these compounds can still be contaminants in cosmetic products due to manufacturing processes, and their presence may not be listed on cosmetic labels. The Scientific Committee on Consumer Safety conducted a safety assessment in 2015 regarding dioxane contaminants in cosmetic products, concluding that the concentrations of these contaminants do not exceed dangerous levels for human health. However, these assessments

may not account for the effects of prolonged low-dose exposure to these compounds.

### 9) Lead

Lead, a metal often found as a contaminant in cosmetic ingredients, possesses the ability to permeate the skin. Once it breaches the skin barrier and enters the bloodstream, it can accumulate in various tissues and organs, with the kidneys and

brain being particularly susceptible. Concerningly, it's currently believed that there may be no threshold level for lead's toxic effects, and even low concentrations can have detrimental impacts, especially on young children. Lead poisoning can manifest as nervous system disorders, including difficulties in concentration, delayed reactions, and headaches, alongside symptoms like anemia and abdominal pain.

A 2011 study conducted in Canada examined 49 makeup cosmetics and found generally low levels of lead in the tested products, except for lip-tinting products. In the case of lip tints, several products exceeded the safe lead standard (10 μg/g body weight per day) by a significant margin, with lip gloss containing 110 μg/g and lipstick containing 28 μg/g. Similarly, a study in New Zealand that assessed 557 lipsticks discovered that 35 products exceeded established metal standards. While lead contamination in other facial cosmetics was negligible, research by Silbergeld et al. raised concerns about the complete safety of these cosmetics. It's noteworthy that the concentrations of lead capable of causing carcinogenic effects are lower than those typically considered toxic to humans, according to Silbergeld's findings.

Epidemiological studies have also indicated the nephrotoxic effects of lead, potentially contributing to kidney tumors in humans. Laboratory animal studies align with these findings, observing an increased incidence of kidney tumors with exposure to high lead doses. Furthermore, among pigment plant workers exposed to lead and its compounds via inhalation, an elevated occurrence of lung and gastric cancers has been identified. This correlation extends to the level of cellular DNA damage and duration of lead exposure. Lead's role in promoting inflammatory responses has been recognized, including the induction of pro-inflammatory cytokines by endothelial and Langerhans cells. Chronic inflammation in the body can create a predisposition to carcinogenesis. Lead also amplifies the generation of free radicals, which harm cellular structures, including enzymes and nucleic acids. This diminishes glutathione activity, disrupting the equilibrium between free radical formation and antioxidant production. Consequently, DNA repair mechanisms may be impaired, potentially leading to the accumulation of genetic errors. However, the precise mechanisms behind lead's potential carcinogenicity remain unclear due to insufficient evidence, necessitating further research.

### 10) Butylated compounds

BHA (Butylated Hydroxyanisole) and BHT (Butylated Hydroxytoluene) have been subjects of extensive safety studies due to their widespread use in cosmetics and food products. Despite their longhistory of use, their effects on the human body remain somewhat uncertain and not fully confirmed.

Research has yielded both indications of anticancer and pro-cancer properties for these compounds.

Some studies suggest that BHA and BHT may have anticancer properties. According to analyses by Saito et al., tert-butyl compounds in these antioxidants could induce enzymes like cytochrome P450 and glutathione transferase, which play a role in detoxifying harmful substances that can cause cancer.

Additionally, their antioxidant properties can help neutralize free radicals, which can damage DNA and lead to mutations.

Conversely, there are reports of pro-oxidant activity. Studies by Sablin et al. have shown that high doses of BHA may inactivate the p53 protein or inhibit the transcription of TP53, the gene encoding the p53 protein. The precise mechanism behind this action is not yet fully understood and requires further investigation. Inactivation of the p53 protein is known to disrupt redox balance, cause DNA oxidation, and increase mutation rates, potentially

resulting in genetic disorders, excessive cell proliferation, and tumor formation. Tert-butyl hydroxy anisole has also been linked to cellular toxicity and apoptosis induction. Yu et al. found that BHA, when incubated with isolated cellular mitochondria, triggered the release of cytochrome c and the activation of caspases, ultimately leading to apoptosis. Moreover, some studies have suggested that tert-butylated compounds, particularly BHA, may have weak estrogenic effects and influence endocrine disruption. Pop et al. conducted in vitro tests indicating that these compounds, including tert-butylated hydroxy anisole, exhibit an affinity for estrogen receptors and can stimulate the growth of human breast cancer cells.

Researchers like Baran et al. have sought to understand the potential mechanisms of BHA-induced toxicity at the molecular level, using zebrafish embryos as a model. They exposed these embryos to BHA and observed effects on survival rate, hatching rate, developmental defects, apoptosis, and histopathological characteristics. The generation of reactive oxygen species (ROS) during BHA exposure was identified as a factor contributing to these changes and potentially triggering apoptosis.

Furthermore, studies by Mizobuchi et al. have differentiated the effects of BHA and BHT, indicating that BHA induces apoptosis, while BHT leads to non-apoptotic cell death in rat thymocytes. These findings suggest the safety of BHA and highlight the importance of assessing toxicity at both the tissue and cellular levels.To address concerns about BHA and BHT, the Cosmetic Ingredient Review (CIR) expert panel has established maximum concentration limits of 0.5% for these substances in cosmetics due to their uncertain toxicological profiles and potential irritant effects on the skin and mucous membranes.

Current regulations and the requirement for safety assessments in the use of cosmetic products are intended to ensure consumers are adequately protected from substances that are known to be harmful and even those that might have potential risks. However, there are concerns about the possible contamination of cosmetics with heavy metals, which is a well-documented issue in scientific literature. This contamination problem deserves careful evaluation and consideration, especially when introducing new products to the market. One ongoing challenge is the presence of cosmetics that lack the necessary permits and have not undergone proper authorization, particularly those from smaller manufacturers.

Given these concerns, it appears essential to conduct studies that investigate the long-term exposure to compounds found in cosmetics. Moreover, it may be necessary to establish stricter standards and regulations regarding the allowable levels of heavy metals in cosmetics. This study sheds light on the issue of prolonged exposure to potential carcinogenic substances by using makeup cosmetics. It raises the possibility of implementing legislation that requires confirmation of the absence of specific compounds recognized as potential carcinogens in cosmetic products. It's important to note that our study did not directly assess long-term exposure to these substances but should be seen as an initial step toward further evaluations of consumer exposure over time. Further research should focus on investigating the effects of long-term exposure in this context.

### Data Collection

The primary data collected through online questionnaires (using Google Forms) while secondary data used in this study were obtained from literature reviews such as journals, books, and references in accordance with the research.

### 11) Problems Identified

#### 1) Lack of data on side effects of certain ingredients

One significant issue in the cosmetic industry is the lack of comprehensive data on the potential side effects of certain ingredients commonly used in cosmetics. This gap in information poses a risk to consumer safety, as individuals may unknowingly expose themselves to harmful substances without clear warnings or knowledge of potential adverse effects. The absence of detailed information on side effects makes it difficult for consumers to make informed choices when purchasing and using cosmetic products. It can lead to health concerns, allergic reactions, or other adverse effects that could have been prevented with better data.

#### 2) Simplification of data - current data is not user friendly

Cosmetic product labels and ingredient lists often contain complex chemical names and terminology that can be challenging for the average consumer to understand. This simplification of data on product labels can lead to confusion and a lack of transparency regarding the substances individuals are applying to their skin. Consumers may find it difficult to identify potential allergens, irritants, or harmful ingredients in cosmetic products due to the simplified or unfamiliar terminology. This lack of transparency can hinder consumers from making informed choices and avoiding products that may not align with their specific skin types or sensitivities.

## CONCLUSION AND RECOMMENDATIONS

#### 1) Enhance Ingredient Testing and Reporting:

- **Research and Testing:** Invest in extensive research and testing of cosmetic ingredients, particularly those with potential side effects or allergenic properties. Collaborate with scientific institutions, dermatologists, and toxicologists to gather comprehensive data.
- **Database Creation:** Establish a centralized and publicly accessible database that compiles information on cosmetic ingredients, their potential side effects, and recommended safety guidelines. This database should be regularly updated with new findings.
- **Labeling Requirements:** Implement regulations requiring cosmetic manufacturers to provide detailed information about ingredient safety on product labels. This should include the potential side effects, allergens, and any known risks associated with ingredients.

#### 2) Improved Consumer Education and Transparency:

- **User-Friendly Labeling:** Develop a standardized, user-friendly labeling system that uses clear language and symbols to convey essential information about cosmetic products. This system should highlight potential allergens, irritants, and known side effects.
- **Accessible Information:** Make ingredient information easily accessible to consumers through various means, such as mobile apps, websites, or QR codes on product packaging. Provide explanations and definitions for complex chemical names.
- **Consumer Awareness Campaigns:** Launch consumer education campaigns to raise awareness about cosmetic ingredients and their potential effects on different skin types. These campaigns should encourage consumers to check ingredient lists and understand the products they use.

#### 3) Industry Collaboration:

- **Industry Best Practices:** Encourage the cosmetic industry to adopt best practices for ingredient safety assessment and labeling. Promote transparency and cooperation among companies to improve consumer trust.
- **Sharing Research:** Encourage cosmetic companies to share their research findings

related to ingredient safety and side effects with regulatory authorities and the public. Collaboration can lead to a more informed and safe cosmetic market.

**4) Mandatory education to be provided to students on skin care:**

a. Implementing mandatory skin care education for students is crucial for fostering a cultureof informed consumerism and personal well-being. Such programs should be integrated into school curricula, providing students with essential knowledge about skin types, common skin issues, and the importance of choosing safe and suitable cosmetic products. This education can empower young individuals to make informed choices, recognize potential hazards in cosmetics, and develop healthy skin care habits from an early age.

**5) A User-friendly mobile application**

a. Developing a user-friendly mobile application dedicated to cosmetic products and their ingredients can be a game-changer for consumers. This app should allow users to scan product barcodes, providing instant access to detailed information about ingredients, their safety profiles, and potential side effects. It can also offer personalized product recommendations based on individual skin types and concerns, promoting safer choices while shopping for cosmetics. App to be made and operated by an independent Company

/ Regulator which shall give all the information in respect of every skin care product and which highlights the areas of concerns and Caution the User

**6) Better administrative control of government regulator over false claims by companies in their advertisements**

a. To protect consumers from misleading advertisements and false claims by cosmetic companies, it is essential to strengthen the administrative control of government regulators. Regulatory bodies should enforce stricter guidelines and penalties for deceptive advertising practices. Regular monitoring and swift actions against companies that make unsubstantiated claims about their products will ensure higher accountability and consumer trust. Introduction of penalties and Civil / Criminal liabilities on companies selling on falsities

**7) Education on Safer Alternative + Better Advertisement of Safer Alternatives** Educating consumers about safer alternatives to harmful cosmetic ingredients is essential. Public awareness campaigns and educational initiatives should highlight the availability of products that prioritize safety and efficacy. Cosmetic companies can play a role in advertising these alternatives, emphasizing their commitment to consumer well-being. By promoting safer options, consumers can confidently choose products that align with their health and ethical values, ultimately driving positive change in the cosmetics industry.

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**Cite this article as :**

Tanvi Jain, C N Sivaramakrishnan, "Evaluation of Cosmetic Ingredients Impacting Human Health", International Journal of Scientific Research in Chemistry (IJSRCH), ISSN : 2456-8457, Volume 8 Issue 5, pp. 17-36, September-October 2023.
URL : https://ijsrch.com/IJSRCH23855