

## Cosmetics' Safety: Gray Areas with Darker Inside

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### ABSTRACT

Cosmetic items contain a wide scope of chemicals to which we are exposed every day. All cosmetics were separated into 3 classifications: rinse-off items (shower gel, shampoo, toothpaste, liquid soap, private soap, shaving foam) leave-on items (body cream, face cream, hand cream, antiperspirant, sunscreen, post-shaving astringent) and make-up ones (lipstick, lip-balm, foundation, nail polish). The utilization of a significant number of these substances is permitted inside specific limits, because of their toxicity at higher concentrations. Other significant viewpoints ought to be considered as, for example, the likelihood of long-term effects. In the light of the continuous and close nature of the contact on skin and mucosa with these items, it is significant that they don't contain conceivably perilous substances. Additionally, the everyday use and continuous exposition of people to a wide scope of personal consideration items

and to various types of chemicals, got from a few sources, may cause the alleged "cocktail effect" because of the synergistic interaction of various substances and, likewise, the "added substance effect" in light of the nearness of a similar ingredient in numerous items. Actually, every one of the ingredients utilized in cosmetic items meet certain regulatory prerequisites. Notwithstanding, the utilization of numerous substances is permitted inside specific limits, because of their toxicity at higher concentrations.

**Key words:** Safety issues of cosmetics; Personal care products; Sensitizations; Skin irritation; Contact dermatitis; Formaldehyde releasers; Phthalates family; parabens

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### Abbreviations

VOCs: volatile organic compounds; ACD: allergic contact dermatitis; NDELA: N-nitrosodiethanolamine; PPD: p-Phenylenediamine



**Figure 1** Can Makeup Harm My Vision<sup>1,2</sup>? Eye cosmetics are frequently applied among female populations of all age groups around the world. However, the migration of cosmetic products across the eyelid margin has been reported, and this is thought to exacerbate tear film instability and symptoms of dry eye. Makeup application and allergic reactions can cause significant eye injuries, and it's important to recognize what to avoid.

### REVIEW

Cosmetics and personal care products are ubiquitous. Currently, an increasing number of compounds are being assimilated in the

formulation of cosmetic products as preservatives, fragrances, surfactants, etc. to intensify the performance, quality, value, and lifespan of cosmetics. Nevertheless, many of these chemical additives pose toxic effects to the human body, exhibiting health risks from a mild hypersensitivity to life-threatening anaphylaxis or lethal intoxication<sup>[3]</sup>. Most cosmetic products are directly applied on the skin and their ingredients can cross the cutaneous barrier to reach the systemic circulation<sup>[4]</sup>. With continued consumer concern and several recent cosmetic-related public health controversies, the FDA should be given more resources and broader authority to protect consumer safety<sup>[5]</sup>. Toklu *et al*, 2019 reported that more than 95% of cutaneous complaints are burning and itching. Interestingly, 60% of the cosmetic-related injuries did not consider any type of consultation<sup>[6]</sup>. The condition is found in more than 50% of women and 40% of men, creating a sizable demand for products designed to minimize skin sensitivity<sup>[7,8]</sup>. Moreover, such effects are underestimated because of the absence of formal and reliable monitoring systems ('cosmetovigilance')<sup>[9]</sup>. Fragranced ingredients are widespread diffused in cosmetic products but many of these may cause sensitizations, allergies and skin irritations<sup>[10]</sup>. A Senegalese cohort study of 147 women showed a statistically significant increase in the risk of hypertension and diabetes linked to the use of skin-lightening agents<sup>[11]</sup>. Both kojic acid and hydroquinone used as skin lighteners cause dryness of skin, peeling, and contact dermatitis<sup>[12]</sup>. Fransway *et al*, 2019 reported endocrine activity, carcinogenesis, infertility, spermatogenesis, adipogenesis, perinatal exposure impact, and non-alegologic cutaneous, psychologic, and ecologic effects with parabens<sup>[13]</sup>. For this reason, many countries have banned the use of some parabens in personal care products intended for newborns and children<sup>[14,15]</sup>. FDA dissuades pregnant/nursing women and small children from using personal care products containing chlorphenesin (anti-fungal and anti-bacterial preservative)<sup>[16]</sup>. The sensitizing reactions with Amidopropyl Dimethylamines (anti-static agent) was due to the impurities like 3,3-dimethylaminopropylamine<sup>[17]</sup>. Two of the 16 main ingredients used in OTC sunblock products are safe, the FDA said. Moreover, the FDA is requesting more information on 12 ingredients among the 16<sup>[18]</sup>. Dry skin often occurs in the elderly and tends to worsen in association with the use of standard alkaline bar soaps. Lipid solvents such as acetone, alcohols and even nonionic surfactants can cause dryness of the skin<sup>[19]</sup>. The major concern regarding the biocide triclosan (commonly used in household and personal care items to prevent the microbial growth) is antibiotic resistance<sup>[20-22]</sup>. Lee *et al*, 2019 reported that Triclosan in toothpaste, soap, and cosmetics may accumulate in the body, which could have an adverse effect on thyroid hormones and genitalia, and increase the risk of developing breast cancer<sup>[23]</sup>. Pregnant women are particularly vulnerable to the potential risks of the endocrine disruptors contained in cosmetics<sup>[1]</sup>. Li *et al*, 2019 reported that maternal prenatal exposure to phenols (2,4-dichlorophenol and 2,5-dichlorophenol) is inversely correlated with male birth weight and exposure to phthalates is associated with preterm birth or pregnancy loss<sup>[24]</sup>. According to Crobeddu *et al*, 2019 phthalates family (used for industrial plasticizers to impart flexibility and durability to polyvinyl chloride) is generally considered as an endocrine disruptor could potentially increase the risks to develop breast cancer<sup>[25]</sup>. A Missouri jury ordered Johnson & Johnson to pay \$72 million to the family of Jacqueline Fox, whose death by ovarian cancer was linked to her daily use of talcum-based Johnson's Baby Powder and Shower to Shower products<sup>[26]</sup>. Park *et al*, 2019 reported that volatile organic compounds (VOCs) and phthalates concentrations of sanitary pads and diapers were significantly higher than those found in common commercial

plastic products, potentially posing risks to women (them likely causing menstrual irregularities) and children who use<sup>[27]</sup>. Diazolidinyl urea and imidazolidinyl urea are known formaldehyde releasers. The data from FDA showed that 20% cosmetic products are formaldehyde-releasers and among them, imidazolidinyl urea is the most widely used<sup>[28]</sup>. Chronic exposure to benzalkonium chloride has deleterious effects via oxidative stress, leading to cholinergic neurotoxicity<sup>[29]</sup>. Sensitization to newer and lesser known isothiazolinones has been reported<sup>[30]</sup>. Sukakul *et al*, 2019 reported that despite the ministerial regulations restricting their use, methylchloroisothiazolinone and/or methylisothiazolinone are still found in cosmetics sold on the Thai market<sup>[31]</sup>. Studies from Europe and Israel have indicated that products with undeclared formaldehyde and formaldehyde releasers on product labels may have detectable levels of formaldehyde. For consumers allergic to formaldehyde and suffering from any kind of dermatitis, it is very important to know the potential for formaldehyde exposure in order to avoid allergic contact dermatitis (ACD)<sup>[32,33]</sup>. However, Bilal *et al*, 2019 discussed cytotoxicity, genotoxicity, mutagenicity, neurotoxicity, estrogenicity of many of these mentioned ingredients<sup>[34]</sup>. Beauty products used for cosmetic purposes can have adverse effects to human health due to the fact that they contain Pb, Cd and other highly toxic heavy metals<sup>[35]</sup>. Cosmetics contaminated with heavy metals can lead them to accumulate in the skin, while the further migration of these toxic elements to blood vessels can cause subsequent difficulties. Saadatzaheh *et al*, 2019 reported that arsenic contents of lipsticks, eye shadows, and eyebrow pencils was significantly higher than the BVL (Federal Office of Consumer Protection and Food Safety of Germany) standard<sup>[36]</sup>. Among the heavy metal impurities, mercury, arsenic, lead, cobalt, antimony, cadmium, nickel and chromium are highly toxic and are banned in cosmetics to be added intentionally as ingredients in EU and US<sup>[37]</sup>. The sales of skin lightening products increased 100% every year (2007-2012) in Malaysia<sup>[11]</sup>. A recent survey showed that 80% of Indian men use fairness creams and number of users growing at a rate of 20% annually. There were no differences between women and men currently using products in their desire to look as fair as media celebrities<sup>[38]</sup>. People use steroid containing pimple creams indiscriminately without knowing that steroids take off the protective outer layer of the skin so it is more exposed to UV rays and environmental pollutants such as smog and cigarette smoke<sup>[39]</sup>. In the field of dermatology, Botox A is generally injected into the muscles of facial expression for reducing the appearance of facial wrinkles<sup>[40]</sup>. Serious adverse events included dysphagia, respiratory compromise, generalized muscle weakness, marked bilateral ptosis, pseudoaneurysm of the frontal branch of the temporal artery, necrotizing fasciitis, sarcoidal granuloma, Fournier gangrene, and cervical kyphosis. Death was attributed to botulism or anaphylactic shock<sup>[41]</sup>. Applying kajal (also known as Kohl or Surma) to babies' eyes is an old tradition in many cultures of the world specially in South Asia. Most of kajal brands contains lead as one its important ingredient<sup>[42]</sup>. In people with tattoos containing red pigment of the origin of mercuric sulfur (cinnabar-vermilion, Chinese red), they may experience inflammation that is limited to this region within 6 months of tattooing<sup>[43]</sup>. Sindoer, a cosmetic powder used in Hindu religious and cultural ceremonies has unsafe levels of lead<sup>[44]</sup>. Beauty salon workers and consumers suffered such injuries as eye and nervous system disorders, respiratory tract problems, chest pain, vomiting and rash as a result of using the straightener<sup>[45]</sup>. The percutaneous absorption of N-nitrosodiethanolamine (NDELA), an impurity in many cosmetic products, has been evaluated in diffusion cells using excised human skin<sup>[46]</sup>. p-Phenylenediamine (PPD), which

was used in more than 80% of permanent dyes, is frequently reported to cause vascular neuroedema, acute renal failure or bladder cancer<sup>[47]</sup>. Qin *et al*, 2019 reported that hair dye use increases the risk of non-Hodgkin's lymphoma, especially for females<sup>[48]</sup>. OTC use of cosmetic lenses is rapidly increasing. Several studies have reported an increased risk of infectious keratitis with the use of soft contact lenses. Prompt treatment of microbial keratitis is important to prevent vision loss<sup>[49]</sup>. Łodyga-Chruścińska *et al*, 2018 reported presence of lead and nickel in lipsticks and powders at level prohibited by European regulation in Polish market<sup>[50]</sup>. However, several studies revealed that human exposure to heavy metals and many other potential toxins were not only from food, water, mining activity, toys, plastics, jewelry, but also from personal care products. Cosmetics are one of the most important sources of releasing heavy metals and other toxins. Different varieties of chemicals are used in cosmetic products as ingredients and some are used as preservatives. There are concerns regarding the presence of harmful chemicals in these products. Although the target hazard quotients and the hazard indices suggest a measure of safety, cosmetics may add to the body burden of potential toxic chemicals after chronic exposure.

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