Hazardous effects of Cosmetics, Perfumes and Detergents

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Cosmetic products, which are used in cleansing, improving or altering the skin, hair, lips, nails or teeth have been used by humans for a long time. These include a wide range of products like skin cream, hair dyes, perfume and lipstick. Cosmetics are in different forms, have different uses and different levels of exposure. Some cosmetics such as shampoo and toothpastes are rinsed off immediately after application while some others are left on for several hours eg: perfumes, body lotions, lipsticks. Some are applied on larger surface areas (eg: body lotion) and some are applied on small areas like lips. According to a survey on the use of personal care products done in 2004, an average adult in Europe uses nine personal care products daily with 126 unique chemical ingredients to clean or beautify themselves, change appearance and enhance the odour. It is highly important that these cosmetic products do not cause any adverse health effects on consumers. However, dermatologists consider cosmetics are more harmful than good.

Are we aware of the danger?

In the past it was believed that cosmetics would always remain on the surface of the skin, and therefore there was not much concern on the safety of cosmetics. Later it was found that some of the compounds in cosmetics could penetrate through human skin giving various localized effects (these include skin creams, shampoos, powders). Some people are sensitive to different types of skin care products and produce immediate allergic reactions such as itching. Body sprays and perfumes are volatile in nature and therefore the users are exposed to them at a higher level through inhalation while lipsticks give the risk of direct oral ingestion.

Even if any kind of reaction is not encountered by applying cosmetic products, there can be long term effects after their absorption through skin, ingestion or inhalation. The nature and the severity of these effects depend on the cosmetic ingredients present and the time/level of exposure. Therefore, the safety of user has become an important concern and regulatory criteria which should be fulfilled in respect of ingredients used in cosmetics has been introduced. In addition to toxicity of ingredients, likely routes of exposure and potential health effects to humans are considered as main factors when deciding regulatory criteria for cosmetics. The regulatory standards on cosmetics vary from country to country. Some countries and Unions (eg EU) have imposed very strict regulations while some countries have no such strict regulations and hence there are vast range of cosmetics in the market that do not comply with the accepted standards. Therefore, it is the sole responsibility of the user to choose good quality products from reputed brands that comply with accepted norms and regulations in the production of cosmetics and perfumes.

Cosmetic ingredients

Reports say that the global market for skincare and colour cosmetics exceeded 53 billion dollars in

2002. Global cosmetic producers introduce new products to the market at a rapid rate and they use vast array of ingredients (chemicals or compounds) in making new products or in the improvements of existing products. Over the years the ingredients that are used in cosmetics have changed dramatically. The dictionary of this Cosmetics Toiletries and Fragrance Association (CTFA - New Zealand) lists more than 10,000 raw materials that are being used in the production, and every year hundreds of new ingredients are added to this list. In addition, these chemicals can be carried into the product as contaminants, by products of the manufacturing process, residuals of starting materials or as processing aids. Although the ingredients used in cosmetics have to be safe to use, cosmetic companies produce and market products with ingredients that are poorly studied, not studied at all, or worse, known to pose potentially serious health risks such as cancer, birth defects, reproductive and developmental problems, allergies and respiratory ailments, as well as other health problems. Many of these harmful chemicals have been detected in human bodies and even in human breast milk.

According to the European Union standards, more than 1000 substances including formaldehyde and its releasers (common in shampoos), lead and its compounds (an ingredient in men's hair coloring product), acrylamide polymers (found in foundation and skin lotions), some phthalates (commonly found in a large variety of products), and heavy metals have been prohibited in cosmetics due to toxicity. However, US Food and Drug Administration (FDA) has banned only 9 chemicals including only 1 toxic metal, Hg. Consumers should be aware that a variety of hazardous ingredients are used in cosmetics in the form of colourants, preservatives and antimicrobials, UV filtering agents, emulsifiers, solvents, and plasticizers.

Colourants

Colourants are added to cosmetic products to colour the product itself or to colour hair, skin or nails for decorative purposes. Even though natural substances have been used to colour cosmetics in the past, synthetic dyes are widely used in cosmetics at present. Synthetic dyes can be further categorized into azo, triaryl methane, xanthene, indigo and quinolone classes. For colorants the main route of human exposure is dermal contact, although for oral products like lipsticks, ingestion also is a route of exposure. Some of the adverse health effects of commonly used colorants are shown in the table 1.

Even though azo group dyes have the potential to cause cancer and genetic mutations, they are widely used in cosmetics due to their low price. Paraphenylenediamine (PPD), is a known irritant and allergen found in many permanent and some semi-permanent hair dyes. Therefore, use of such dangerous colorants have to be controlled.

Preservatives and anti-microbial agents

Preservatives and anti-microbial agents are added to increase the life time of cosmetic products by destroying or inhibiting the growth of microorganisms. The most widely used family of preservatives is 'parabens' (methyl-, ethyl-, propyl-, butyl-, isobutyl- and other parabens) and listed in Table 2. Other preservatives and anti-microbial agents used in cosmetics include Isothiazolinones, Formaldehyde releasing agents and Triclosan.

Parabens are found in many cosmetics: foaming cleanser, body mist, body lotion, lipstick, body cream, facial cream, body and shower gel, skin cream, hand lotion, moisturizers, and lip gloss that are in widespread use by girls and women. Isothiazolinones and Formaldehyde releasing agents

Table 1. Health hazards of Colourants

Colouring agent	Potential Health Effects
Pigments (Organic or mineral)	Cause cancer, respiratory diseases
Triarylmethane-dyes	Enter blood stream
Azo dyes	Cause cancer and genetic mutations
Paraphenylenediamine	Cause allergic reactions and irritation

Table 2. Health hazards of preservatives and anti-microbials

Preservative	Potential health effects
Parabens	
Butyl Parabens	Have the possibility to produce car cinogenic nitrosoamines, Endocrine disruption
Isothiazolinones	
Methylisothiazolinone	Can cause skin allergic responses when contacted with skin, Prolonged exposure can cause neurotoxicity (can harm nervous system)
Chloromethylisothiazolinone	Can cause skin allergic responses when contacted with skin
Other preservatives	
Formaldehyde releasing agents	Can cause cancer
Triclosan	Skin and eye irritation, Can disrupt thyroid function
Iodopropynyl Butylcarbamate (IPBC)	Can cause acute inhalation toxicity

are mainly used in hair products and moisturizers, while triclosan is widely used in deodourants and sanitizers.

UV filtering agents

UV filters are used to protect the skin against UV radiation by absorbing, reflecting or scattering UV radiation. These are mainly used in sunscreen products, although their use in daily skin creams and lip balms is also increasing.

UV filters can be categorized as physical filters and chemical filters. Physical filters mainly consist of metal oxides. Chemical filters are organic compounds which contain aromatic structures, Carbon-Carbon double bonds and/or carbonyl groups. These chemical filters have the ability to penetrate the skin and therefore they can cause various dermatological side effects. Some of the hazardous UV filtering agents used in cosmetics are shown in Table 3.

Emulsifiers

Emulsifiers are used to hold insoluble particles in suspension. Most of the emulsifiers contain surfactants which change the surface tension of water. Some of the compounds included in emulsifiers can be harmful to humans as shown in Table 4. However, the most dangerous compound in emulsifiers is 1,4-dioxane, which may be present as an impurity in most emulsifiers and is a known carcinogenic.

Solvents

Some of the solvents used in cosmetics are hazardous to humans. Since most of the solvents are volatile they also increase the risk of exposure by inhalation. Some of the widely used solvents and their hazardous effects are shown in the Table 5. Out of these solvents, 1,4-dioxane has been banned from being used as an intentional ingredient in cosmetics, but it still can be found as an impurity in most cosmetic products.

Table 3. Health hazards of UV filtering agents

Compound	Potential Health Effects
Octyl methoxycinnamate	Endocrine disruption, reproductive problems
Benzophenone	Can cause cancer, endocrine disruption
Homosalate	Endocrine disruption, birth defects

Table 4. Health hazards of emulsifiers

Compound	Potential Health Effects
Polyethylene glycol (PEG)	Kidney damages, skin irritation, suspected carcinogen
Triethanolamine (TEA)	Can cause allergic reactions, suspected carcinogen
Diethanolamine (DEA)	Suspected carcinogen

Plasticizers

A variety of Phthalates including dibutyl phthalate and diethylhexyl phthalate are used as plasticizers in cosmetics. They are used mostly in nail polish in order to impart flexibility to nail polish after it dries. Although use of phthalates in cosmetics have been banned or limited in some countries, investigations have shown that most cosmetics contain more than the safe level of phthalates. Health hazards of phthalates include

- Reproductive disorders
- Disruption of endocrine system
- Birth defects
- Cancer

Moisturizers and anti-moisturizers

Moisturizers and anti-moisturizers are used to increase and decrease the moisture of cosmetics respectively. Some moisturizers and anti-moisturizers and their effects are shown in Table 6.

Heavy Metals

Toxic heavy metals present in cosmetics include Antimony (Sb), Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Mercury (Hg), Nickel (Ni) and Lead (Pb). It is reported that even if these heavy metals are not used intentionally in cosmetics production, they can be present as impurities. Some countries have introduced 'Technically avoidable limits' for those heavy metals. It is considered that if the amount of metal present as an impurity is lower than the technically avoidable limit, it is generally safe for the consumers.

However, these technically avoidable limits also may not be safe because heavy metals can accumulate inside the body and cause long term health effects like cancer, reproductive problems, kidney diseases etc. In addition researches have revealed that some of the cosmetic products in market contain heavy metals in much higher concentrations than the technically avoidable limit.

Table 5. Health hazards of solvents used in cosmetics

Solvent	Potential Health Effects
Chloroform	Skin irritation, damages to the nervous system
1,4 – dioxane	Carcinogenic, damages to nervous system, liver and kidney damage
Polyethylene Glycol (PEG)	Kidney damages, skin irritation, suspected carcinogen
Dibutyl phthalate	Liver and kidney damage, reproductive disorders, birth defects

Details of some of the heavy metals present in cosmetics and their potential health effects are given in table 7.

Among these heavy metals Hg and Pb are the most dangerous. Hg is a very toxic metal and extremely high concentrations of Hg has been found in skin creams, which can cause severe health hazards to consumers. Pb is also dangerous because it can affect small children

Table 6. Health hazards of moisturizers and anti-moisturizers

Compound	Application	Health Effects
Siloxanes	Softening and moistening	Endocrine disruption, reproduction disorders
Talc	Reducing moisture	Lung cancer, ovarian cancer

Table 7. Heavy metals present in cosmetics

Heavy Metal	Applications in cosmetics	Potential Health Effects	Maximum allowable limit	Presence in cosmetic products
Arsenic (As)	Arsenic is a highly toxic carcinogenic and is not added as an intentional ingredient in cosmetics	•Inhalation – lung cancer, nervous disorders •Ingestion – urinary tract cancers •Skin contact – skin cancers, skin eruption	3-5 µg/g	lipsticks, lipgloss and skin creams contain more than permissible level of As.
Antimony (Sb)	Black paint for eyebrows Vermillion, yellow or blue pigments	•Inhalation – respiratory diseases •Ingestion – vomiting, diarrhea, ulcers •Skin contact – skin lesions	5-10 µg/g	Lipsticks
Cadmium (Cd)		•Inhalation – lung cancer •Ingestion – kidney diseases	3-5 µg/g	unbranded lipsticks (as high as 400-3390 µg/g)
Chromium (Cr)		cancer and allergic reactions	1 µg/g	eye shadows (as high as 5470 µg/g)
Cobalt (Co)		Cobalt can cause severe skin allergies and has been identified as possibly carcinogenic	1 µg/g	eye shadows
Lead (Pb)	White pigments	Can harm fetuses and small children, have the possibility of causing cancer	10-20 µg/g	eye shadows, some hair dyes, lipsticks and lip gloss
Mercury (Hg)	skin creams and soaps preservatives in eye make-up cleansers and mascara	Hg is carcinogenic and can also cause kidney failures and neurological diseases	1-3 µg/g 5 µg/g	skin lightening creams (as high as 35824 µg/g) very high concentrations of Hg-ammonium chloride, a very toxic substance has been found in skin creams
Nickel (Ni)	Used as a pigment	Can cause severe allergic reactions when contacted with skin have the possibility of causing cancer		eye make up

and fetuses severely. The presence of Pb in the lipsticks used by pregnant women can be highly hazardous to fetuses. In addition, high concentrations of Cr, Co and Ni in cosmetics is also a concern because they can cause severe allergic reactions

Other hazardous chemicals present in cosmetics

In addition to the above mentioned substances and heavy metals, there are some other hazardous compounds which are used in cosmetic industry. Such compounds and their applications are shown in Table 8.

Adverse Health effects of perfumes and deodourants

Perfumes contains exclusive fragrances and different alcohols that can stimulate receptors in the nose. Chemicals used in fragrances are synthetic compounds derived from petroleum. They include benzene derivatives, aldehydes and many other known toxins and sensitizers - capable of causing asthma or migraine headaches, cancer, birth defects, central nervous system disorders and allergic reactions. Alcohol content in perfumes is about 80 per cent and alcohols are reported to cause breast cells to produce excessive amounts of estrogen which can lead to development of breast cancers.

Skin rashes, swelling, redness and itching are the commonest forms of perfume allergies reported. Jasmin synthetic, cinnamic alcohol and hydroxycitronellal are the most commonly found allergens in perfume. In some countries, use of perfumes and fragranced products are banned in public places. Like passive smoking of cigarette smoke, perfumes and fragranced products can cause major health problems to the non-users mainly due to their volatile nature. Deodorants are used to disguise and reduce body odour created by the activity of microbes and these contain perfume and antimicrobials. Deodourants are widely used, as sprays, creams, sticks or rollons. Deodourants can reduce the amount of sweat produce in the body due the presence of antiperspirants which are typically metal (aluminium) salts. These metal salts can obstruct the sweat glands in the arm pit preventing the production of sweat that removes toxins from the body.

Adverse Health and Environmental Effects of Detergents

Detergents are another group of widely used substances which can be hazardous to humans. According to recent investigations exposures to detergents have been most frequent among children, and ingestion has been the likely route of

Table 8. Other hazardous compounds used in cosmetics

Compound	Applications	Potential Health Effects
Mineral oil	As a moisture retaining agent in skin creams and lotions	Skin cancer, liver damage, diarrhea
Sodium Lauryl	Bubbling agent in shampoos, cleansers	Liver damage, respi ratory Sulphate difficulty, eye and skin irritation
Hydroquinone	Skin lightening creams	Can cause cancer, skin irritation
Salicylic acid	Skin creams	Skin irritation, vomiting, respiratory diseases
Acrylates	As an adhesive in nail polish	Can cause cancer, irritation

Table 9. Health hazards of detergents

Component	Potential Health Effects
Alkyl benzene sulfonate (ABS)	Vomiting, gastrointestinal irritation
Ammonium germicides	Vomiting, collapse, gastrointestinal irritation, convulsions, muscle weakness
Sodium tripolyphosphate	Vomiting, diarrhea
Polymeric Polyphosphates	Hypocalcemia
Pine oil	Eye irritation, gastrointestinal irritation, respiratory difficulties
Sodium hypochlorite	Respiratory difficulties, cough, eye in flammation

exposure. However, in some cases contact with skin or eyes also have caused adverse health effects. While the components in detergents are not generally considered as toxic, they have the ability to cause various health effects at high concentrations. Detergents in powder form are generally more toxic compared to liquid detergents.
Some of the potentially hazardous compounds in detergents are shown in Table 9.

However, most of these compounds are likely to be hazardous only if they are ingested. Therefore, it is recommended to keep small children away from detergents to avoid accidental ingestion.

In addition to health concerns, detergents are also a source of environmental pollution. Alkyl benzene sulfonate (ABS) is the compound responsible for the most of the environmental issues caused by detergents. ABS is used as a surfactant, and therefore it has the ability to cause excessive foaming in water. Even an ABS concentration as low as 1 ppm can cause very high amount of foaming. This is a very serious issue because foaming

in water bodies can damage aquatic species, and foaming during water treatment process can cause difficulties in water treatment.

Two statements made by renowned toxicologist Philip W. Harvey: "Absence of evidence is not evidence of absence of a harmful effect" and "These chemicals are being directly applied daily, by very large numbers of people, and the long-term health effects of exposure are essentially unknown", depict the seriousness of this issue. As intelligent consumers, it is our responsibility to be conscious about the health effects of cosmetic products and always select products which comply with the regulatory standards.

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