International Journal of Environmental and Ecology Research
www.environmentaljournal.in
Online ISSN: 2664-7117, Print ISSN: 2664-7109
Received: 10-10-2023, Accepted: 25-10-2023, Published: 11-11-2023
Volume 5, Issue 1, 2023, Page No. 27-35

Toxic chemicals in cosmetic products and need of behavioural change to shift to sustainable cosmetics

Bishakh Choudhury
University School of Environment Management, Guru Gobind Singh Indraprastha University, Dwarka, Delhi, India

Abstract
The urge for beauty is part of human life since the dawn of civilization. In ancient era, cosmetics contained ingredients- honey, milk, clay along with plant-based ingredients- turmeric, brahmi, amla, etc. But modern cosmetics have replaced those ingredients with chemicals like parabens, UV filters, sulfates, heavy metals, microplastics and phthalates which are known to be the cause of cancer, skin allergies, infertility, low brain development, hormone disruptions, etc. The microplastics of cosmetic are negatively impacting the marine life and the UV filters from sunscreen are causing coral bleaching. Despite numerous disadvantages, cosmetics are still being used, thus a behavioural change is required to shift towards a green alternative. There are various reasons for not using eco-friendly products; lack of reliability, disorganized local markets, past negative experiences and so on. To spread pro-environmental behaviour, it requires to enrich us the behavioural principles like Value Based Norm Theory, and Theory of Reasoned Action. Strengthening knowledge to use green cosmetics to a large population could be possible using social media, which has the credibility to urge consumers to buy eco-friendly cosmetics. This provides a new gateway for green cosmetics to produce on a large scale and end the pollution caused by toxic conventional cosmetics.

Keywords: Toxic chemical, cosmetics, green consumer behaviour, sustainable cosmetics, behavioural change

Introduction

The life of the current generation cannot exist without cosmetics as they have an inclination to look charming (Kale *et al*., 2022) [25]. The Federal Food, Drug and Cosmetic Act defined cosmetics as 'articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance (U.S. FDA, 2023). The earliest evidence of cosmetics and its usage antedates to Circa 2500 and 1500 B.C., to Indus Valley Civilization (Gupta *et al*., 2023) [19]**.** At present cosmetics are an important asset in the world's gross domestic production (Muda *et al*., 2017) [33]. The total global sales by cosmetic industries from America, Australia, Asia, Europe and Africa is above 230 billion U.S Dollars (Dauda *et al*., 2023) [13]. The market size for cosmetic products in India has increased from 868 billion Indian Rupees in 2016 to 1,120 billion Indian Rupees in 2020 (Srivastava *et al*., 2022) [48]**.** According to US Food and Drug Administration Cosmetic Products are divided into 13 Categories:

1. Baby Products
2. Bath Preparations
3. Eye Makeup Preparations
4. Fragrance Preparations
5. Hair Preparations (non-coloring)
6. Hair Coloring Preparations
7. Makeup Preparations (not eye)
8. Manicuring Preparations
9. Oral Hygiene Products
10. Personal Cleanliness
11. Shaving Preparations
12. Skin Care Preparations (Creams, Lotions, Powders, and Sprays)
13. Suntan Preparations

Toxic Chemicals in Cosmetics and their ill effects

The quantity of chemical compounds in cosmetics has escalated as preservatives, stabilizers, dye, additives, fragrances, surfactants to bolster their shelf life, quality and property. The unsystematic usage of cosmetics may cause an imminent effect on public health because most of the chemicals in cosmetics have the ability to bio-accumulate and persist in the environment. From the list of 12,000 and more synthetic and industrial chemical ingredients used in the manufacture of cosmetics, less than 20% are safe to use. (Bilal *et al*., 2020) [7]. The toxic compounds incorporated into the cosmetics are above acceptable limits which may cause serious ill effects on the human population and are prominent carcinogenic elements (Gupta *et al*., 2023) [19].

The commonly used cosmetics around the globe comprises lipsticks, lip gloss, foundations, concealers, powders, rouges, eyeliners, eyeshadows, skin creams, shampoos, soap, cleansing lotion, shower gel, hair dyes, deodorant and perfumes, nail polishes and mouth washes (Matwiejczuk *et al*., 2020 [29]; Dauda *et al*., 2023) [13]. According to different research articles reviewed, a number of toxic chemicals are most commonly used in cosmetics which are listed in Table 1:

Vast amount of toxic chemicals is exposed to our body indirectly via these cosmetics (Table 1).

Table 1: Toxic chemicals present in most commonly used cosmetic products

S. No.	Cometic Product	Toxic Ingredient Present	References
1	Shampoo	Triclosan (TCS)	(7)
		1,4-Dioxane (C4H8O2,)	(7)
		Microplastic	(7, 20)
		Formaldehyde (FA) or formalin (37% v/v solution of formaldehyde) or oxymethylene	(7, 48, 45)
		Synthetic Musk Compounds	(7)
		Diethanolamine and Triethanolamine	(25)
		Diethanolamine	(48, 45)
		Octinoxate	(25)
		Parabens	(25, 29, 1, 43, 45)
		Alkanolamines and Alkylamines	(43)
		Heavy Metal (Cadmium, Arsenic)	(43, 45)
		Microplastic	(18)
		SLS (Sodium Lauryl Sulfate)	(46, 45)
		Phthalates	(48, 45)
		Nanoparticles: Titanium dioxide (TiO2) and zinc oxide (ZnO)	(9)
		Perfluoroalkyl substances (PFAs)	(17)
		Ethylene oxide	(45)
		Silica	(45)
2	Deodorant	Triclosan	(7)
		Synthetic Musk Compounds	(7)
		Parabens	(1, 42)
		Phthalates	(42)
		Formaldehyde	(48)
		Nanoparticles: Titanium dioxide (TiO2) and zinc oxide (ZnO)	(9)
		Cyclic methyl siloxanes (volatile silicones)	(9)
3	Perfumes	Synthetic Musk Compounds	(7)
		Acetaldehyde, benzophenone, BHA, BHT, benzyl salicylate, benzyl benzoate, butoxyethanol, butylphenyl methylpropional, methyl chloride, methylene chloride, diethyl phthalate, methyl eugenol, formaldehyde, ethanolamine, methanol, oxybenzone, propyl paraben, resorcinol, styrene, synthetic musks, titanium dioxide, 1,4- dioxane, ethylbenzene and vinyl acetate (called as Fragrance Compounds)	(25)
		Phthalates	(43,42, 9, 45)
		Parabens	(42)
4	Toothpaste	Triclosan (TCS)	(7, 45)
		1, 4-Dioxane	(7)
		Microplastic	(7, 18, 14, 20)
		Parabens	(29, 1, 40)
		Fluorine and its derivatives	(45)
		SLS (Sodium Lauryl Sulfate)	(45)
5	Sunscreen	Triclosan	(7)
		Organic (eg: Octocrylene) and Inorganic (eg: ZnO and TiO2) UV-Filters/Absorbers	(7, 9)
		Benzophenone	(45, 48, 45)
		Butylated hydroxy anisole and Butylated hydroxytoluene	(25)
		Homosalate	(25)
		Methylisothiazolinone and Methylchloroisothiazolinone	(25)
		Octinoxate	(25)
		Parabens	(29)
		Alkanolamines and Alkylamines	(43)
		Polyethylene glycol	(48)
		Aluminum chloride and its complexes	(9)
		Perfluoroalkyl substances (PFAs)	(17, 45)
		Silica	(45)
		Heavy metal (Mercury)	(35)
6	Moisturizers	Siloxanes and Silicones	(7, 45)
		Benzophenone	(25, 19)
		Hydroquinone	(25)
		Heavy metals (Arsenic, Lead, Aluminium, Mercury, Zinc, Chromium and Iron)	(25, 24)
		Parabens	(1, 45)
		BHA (butylated hydroxyl anisole) and BHT (butylated hydroxyl toluene)	(19)
7	Detergents	Triclosan (TCS)	(7)
		Methylisothiazolinone and Methylchloroisothiazolinone	(25)

		SLS (Sodium Lauryl Sulfate)	(8)
8	Lipsticks	Antimony	(7)
		Carbon black	(25, 45)
		Octinoxate	(25)
		Parabens	(29, 43)
		Heavy metals (Lead, Chromium and Nickel)	(13, 42, 19, 24, 39, 45)
		Phthalates	(43)
		Rhodamine B and Rhodamine 6G	(43)
		BHA (butylated hydroxyl anisole) and BHT (butylated hydroxyl toluene)	(19, 45)
		Nanoparticles: Titanium dioxide (TiO2) and zinc oxide (ZnO)	(9)
		Aluminum chloride and its complexes	(9)
		Silica	(45)
9	Facewash/ Facial Cleanser	Microplastic (Microbeads)	(14, 6, 15)
10	Nail Polish	Benzophenone	(25)
		Carbon black	(25)
		Formaldehyde	(25)
		Octinoxate	(25)
		Phthalates	(25, 43, 19, 9, 45)
		Parabens	(29)
		Heavy Metal (Cadmium)	(43)
		Toluene	(48, 45)
		Perfluoroalkyl substances (PFAs)	(9)
		Cyclic methyl siloxanes (volatile silicones)	(9)
11	Soap	Parabens	(29)
		Formaldehyde	(13, 45)
		Heavy Metal (Mercury, Cadmium and Chromium)	(13, 19, 42, 39, 45)
		Triclosan	(43)
		Diethanolamine	(45)
		Phthalates	(45)
		SLS (Sodium Lauryl Sulfate)	(45)
	Fairness Cream/ Skin Whitening Cream	Heavy Metal (Mercury, Arsenic and Lead)	(13, 22, 24, 2, 3, 42, 39, 45)
		Hydroquinone	(22)

The common ingredients shown in the above table- parabens, sulfates, heavy metals, phthalates, sodium lauryl sulfate, are hazardous and have tremendous health and environmental impact. To identify the toxic effect of the chemicals in these cosmetic products, the research articles were reviewed and tabulated in Table 2.

Table 2: Toxic effect of chemicals present in cosmetic products

S. No.	Chemicals present in the Cosmetic Products (of Table 1)	Toxic Effect	References
1	Triclosan	1.After entering the marine ecosystem, it causes alteration in the composition of bacterial communities, toxic effect on algal species, destruction of endocrine system of fish and teratogenic effect and mortality in embryos and larvae of zebrafish. 2.It affects the thyroid and reproductive hormones. 3. It causes skin irritation and an endocrine disruptor	(7, 45, 48)
2	1,4-Dioxane (C4H8O2,)	1. Dioxane causes breast, hepatocellular and skin cell carcinoma. 2. They are also disruptors of endocrine components	(7)
3	Microplastics	1. Microplastics have the ability to carry persistent organic pollutants like organochlorine pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, alkylphenols; integrated during their manufacture or uptake from the medium (like water, through which it is transported) which is then entered into the food chain and may damage organisms. 2. They are a potential contributor to aquatic biodiversity loss. 3. Small marine animals ingesting microplastics are at major risk from reduced food intake due to repleteness that they have had enough food for their metabolism but it is the microplastic they have engulfed, starvation or intestinal blockage leading to death. 4. The microplastic on contact leads to skin ageing and dark spots by allowing the bacteria to enter via tiny rips formed. They also injure cornea when stucked in the eyelid due to face washing. Microplastics present in toothpaste may cause bleeding and gingivitis if trapped between gum.	(7, 18, 15, 14)
4	Formaldehyde (FA) or formalin (37% v/v solution of formaldehyde) or oxymethylene	1.It is carcinogenic with serious health impacts like cutaneous carcinoma and sinus carcinoma, increased risk of myeloid leukaemia, irritation of eyes and respiratory system, asthma.	(7, 45, 25, 13, 48)

5	Synthetic Musk Compounds	1. They bioaccumulate in the aquatic ecosystem since they are lipophilic and are therefore easily detected in indoor air, dust, adipose tissue, blood and breast milk.	(7)
6	Diethanolamine and Triethanolamine	1.Diethanolamine is a hepatotoxin; it causes liver cancer and liver fibrosis. They also cause skin irritation. 2. Triethanolamine is carcinogenic	(45, 25)
7	Octinoxate	1.It causes rashes, itching and swelling. It is also an endocrine disruptor and also causes reproductive and developmental toxicity.	(25)
8	Parabens	1.They have the capability to mimic estrogen, hence are endocrine disruptors that also harm male reproductive system development (reduces male fertility) 2. They are also related to neurotoxicity 3. Associated to triggering of breast cancer. 4.It increases fat cells formation (adipocyte differentiation). 5.It causes allergic effect and skin irritation in damaged, cracked or delicate skin	(25,45, 1, 29, 48)
9	SLS (Sodium Lauryl Sulfate)	1. Causes skin irritation, severe eye damage, cataract and even blindness	(45, 8)
10	Silica	1. Human carcinogen	(45)
11	Ethylene oxide	1.It leads to disruption of central nervous system, respiratory system and reproductive system. 2. It causes breast cancer, hematopoietic cancer, lymphatic cancer and peritoneal cancer	(45)
12	Phthalates	1.Reported as kidney and liver failure in children. 2. Induces low sperm count in men. Prenatal exposure of the developing foetus disrupts genital development in males and females and responsible for causing Testicular Dysgenesis Syndrome. 3. They are considered as obesogens and alter thyroid hormone level. 4. It is linked to cause cancer.	(45, 48, 9, 25, 19)
13	Perfluoroalkyl substances (PFAs)	1.Irregular menstrual cycles and delayed puberty. 2. Function as obesogens in adult and increases cholesterol level 3.Linkage to abnormal birth weight and length. 4. Disrupts sex hormones (and low sperm quality) and thyroid hormone production.	(45, 9)
14	Acetaldehyde, benzophenone, BHA, BHT, benzyl salicylate, benzyl benzoate, butoxyethanol, butylphenyl methylpropional, methyl chloride, methylene chloride, diethyl phthalate, methyleugenol, formaldehyde, ethanolamines, methanol, oxybenzone, propyl paraben, resorcinol, styrene, synthetic musks, titanium dioxide, 1,4-dioxane, ethylbenzene and vinyl acetate (called as Fragrance Compounds)	1. Characterized as Neurotoxic, Carcinogenic, allergens 2. Health implications like migraine, asthma, cardiovascular and gastrointestinal complications, contact dermatitis.	(25)
15	Fluorine and its derivatives	1. It abates bone density and is also neurotoxic	(45)
16	Organic (eg: octocrylene) and Inorganic (eg: ZnO and TiO2) UV-Filters/Absorbers	1.Studies have reported Organic UV filters as toxic substance for protozoa, crustaceans and microalgae. 2. Inorganic filters have also been documented as toxic substances for many aquatic organisms like zebrafish, sea urchins, marine algae.	(7)
17	Benzophenone	1.Causes skin allergy and photoallergic dermatitis 2.Reported as endocrine disruptors, carcinogenic, reproductive toxin	(25, 48, 45, 19)
18	Butylated hydroxyanisole and Butylated hydroxytoluene	1.Butylated hydroxytoluene is a human respiratory irritant, reproductive toxin. 2. Butylated hydroxyanisole is carcinogenic and disrupts hormone function.	(25)
19	Homosalate	1.Accelerates breast cancer cells multiplication. 2. Endocrine disruptor.	(25)
20	Methylisothiazolinone and Methylchloroisothiazolinone	1. Methylisothiazolinone reported signs of neurotoxicity. 2. Both Methylisothiazolinone and Methylchloroisothiazolinone are skin allergens.	(25)
21	Polyethyleneglycol	1.It can cause cancer and respiratory disorders. 2. It attacks sebaceous glands to secrete more sebum that results in greasy skin.	(48)
22	Aluminum chloride and its complexes	1.Aluminium Chloride is suspected to be a risk factor for breast cancer 2. Aluminium chloride complexes cause delayed puberty.	(9)
23	Siloxanes and Silicones	1.CycloPentasiloxane and Cyclotetrasiloxane, are ecotoxic and undergoes bioaccumulation in aquatic organisms. 2. Cyclotetrasiloxane is an endocrine disruptor and interrupts hormone function. It may also impede human fertility.	(45, 7)
24	Hydroquinone	1.It reduces melanin pigments in skin, which elevates the exposure of skin to UVA and UVB radiation, resulting in increased risk of skin cancer. 2. It is the genesis of pigmentation and permanent corneal damage when exposed to eyes. 3. It brings about irritation to nose, throat and upper respiratory tract, if inhaled.	(25)

25	Antimony	1.Health implications of antimony includes pnuemoconiosis, gastrointestinal disorders, emphysema, bronchitis, abdominal pain, diarrhea, vomiting, ulcers.	(7)
26	Carbon black	1.Study has reported the cardiovascular risk by hyperhomocysteinemia, by exposure of carbon black. 2.Carcinogenic to humans.	(25, 45)
27	Toluene	1.Health implications are blood cancer, toxic to Central Nervous System and damages the developing foetus.	(45, 48)
28	Arsenic	1.Arsenic is reported as carcinogen 2.Long exposre can damage almost all systems of the body	(45, 24)
29	Mercury	1.Symptoms of mercury poisoning are migraine, rashes, shortness of breath, swelling of face, excess sweating, skin redness, hair growth reduction. The skin becomes prone to fungal and bacterial infections. Mercury also blocks the synthesis of melanin pigment of skin. 2. It is a nephrotoxin and neurotoxin. It causes nephritic syndrome, impaired vision and hearing, low IQ development 3. It is also associated with reproductive system damage leading to infertility 4.When ingested, mercury is absorbed by gastrointestinal track through epithelial cells causing indigestion. 5. Instances prove that children, pregnant women and breast-feeding women are the major population being affected by mercury toxicity. 6. Other health implications are renal cancer, acute tubular necrosis, leukemia	(35, 25, 45, 13, 2, 3, 19)
30	Lead	1.Lead toxicity has been reported to cause infertility in men and women, miscarriage, irregular menstrual cycles, delay in puberty onset in girls, and hormonal changes. It is also a neurotoxin 2.Lead is characterized as suspected carcinogen	(25, 19, 45, 39)
31	Cadmium	1.The most devastating cadmium toxicity is Itai- itai disease leading to kidney and bone damage. 2. Prolonged exposure causes clinical renal fanconi syndrome and leads to renal failure.	(39)
32	Chromium	1.Toxic behaviour of chromium is related to its oxidation state. Hexavalent chromium is a carcinogen. When inhaled it elevates the risk of lung cancer and also damages small capillaries in intestines and kidneys. Chromium is also closely related to immune toxicity. 2.Other health implications of hexavalent chromium are eye irritation, coughing, wheezing, shortness of breath, irritation of larynx and pharynx, nose ulcers, asthmatic bronchitis, nasal cancer, sinus cancer.	(13, 42, 25)
33	Nickel	1.Exposure of Nickel in high amounts disrupts kidneys, liver and stomach. 2. It is also evident as a carcinogen. 3. Common nickel allergy can cause severe contact dermatitis	(42)

Table 2 evidences that we are exposed to numerous effects, being unnoticed. The major diseases caused by these chemicals like cancer, skin allergies, infertility, neurological disorders, hormone disruptions, bioaccumulation in the ecosystem. This raises an alarm to shift from these polluting cosmetics to a more environment friendly approach. The aforesaid studies suggest the estimates of toxic chemicals present in these cosmetics using the analytical methods. But only few or none have suggested to identifying the remedy to change behavioural approach towards the use of these products. Although many outstanding studies have provided the estimated quantity of the chemicals possessed in these products. Still the usage of cosmetics is very evident in our daily lives. This shows a behavioural change is lacking among the population and such knowledge should be enlightened towards the usage of safe and effective cosmetic products. Since these cosmetics cannot instantly be removed from our daily lifestyle, the possible immediate approach is to minimize their usage.

Humans have an impulse to present themselves in the best way. The reason is insecurity about how we look. In current time, social media plays an utmost role to look best, to look attractive with fair skin and good body fragrance, for which we use a wide range of cosmetic products flooding the market. An adult uses an average of about 9 cosmetic products and more than 25% women uses about 15 cosmetic products or more per day (Matwiejczuk *et al*., 2020 [29]; Srivastava *et al*., 2022) [48]. The era of globalization has introduced synthetic and toxic chemicals to the cosmetic world (Naqvi *et al*., 2022). The present generation is least concerned about how these cosmetics are not only a silent killer, but degrading our environment.

Plastics are omnipresent. The large plastic's final spot is the ocean where they form Microplastic (MP). Now Personal Care and Cosmetic Products (PCCP) have also become a contributing member of the plastic pollution. As per the report of UNEP (United Nations Environment Programme), MPs are more commonly used as ingredients in about 90% of PCCP. (Bayo *et al*., 2017 [6]; Frantzeskos, 2022) [16]. These MP of PCCPs are washed into the domestic drains and transported to sewage treatment plants. However, due to their micro size, these substances will eventually pass through these plants and enter aquatic ecosystem. Researchers have depicted various ingestion cases of MP by numerous marine species and expressed their ability to bioaccumulate in the food web. The vital reason behind the marine species to ingest MP is the formation of biofilm on the MP surface. (Habib *et al*., 2019 [20]; Enyoh *et al*., 2020) [14]. Small marine animals ingesting MPs are at major risk from reduced food intake due to repleteness that they had enough food, but it's the MP they engulfed, starvation or intestinal blockage leading to death (see Table 2).

Another devastating consequence of using cosmetics are constituents of sunscreen affecting coral reefs. The

constituents of sunscreen products enter either directly via activities like swimming, wave riding etc., or indirectly through sewage treatment plants into the coastal areas. Annually, 4000-6000 metric tons of sunscreen from swimmers are released that are potential coral reef destroyers at local level (Moeller *et al*., 2021) [32]. Zooxanthellae are tiny organisms living within most of coral polyps (National Ocean and Atmospheric Administration, 2023). UV filters such as octocrylene, benzophenone, present in sunscreen (see Table 1), have negative impact on zooxanthellae causing coral bleaching. Benzophenone induces tissue necrosis in corals and disrupt the photosynthetic mechanism within zooxanthallae. The inorganic filters in sunscreen (TiO2 and ZnO) showed that their exposure to corals lead to zooxanthallae loss finally causing coral bleaching (Chatzigianni *et al*., 2022) [10].

There are various toxic effects of cosmetics as previously mentioned in Table 2. Despite multiple studies depicting the ill effects of cosmetics, the study on pro-environmental behaviour and their implementation is few or missing. The major reason may be the lack of awareness among the population. The low rate of such behaviour is due to the inappropriate framing of pro-environmental behaviour; as a burden or sacrifice that everyone bears for the earth and future generations. Rather, we must frame the behaviour as essentially advantageous. There are many evidences around the world that people who are following environmental friendly lifestyles are happier than those are not (Prinzing, 2020) [37].

Although eco-friendly cosmetics global sales is predicted to increase up to 54.5 billion U.S Dollars by 2027 from 34.5 billion U.S Dollars in 2018. Whereas the eco-friendly cosmetics contribute about 15% or less of the total cosmetic industry. This clearly states that the eco-friendly cosmetic industry is still in the budding stage and the reason might be a sort of resistance among buyers to purchase eco-friendly products. There can be various reasons for the resistance towards eco-friendly products. The disorganized retail market in India has a broad variety of greenwashed products; which makes it difficult to identify the original eco-friendly product. The buyers are confused whether they are buying 100% real eco-product or not. Though there are real eco-friendly products, consumers deny buying them due of lack of reliability on such product manufacturers and low insight about ecolabels. Other denial reasons are traditional restriction towards their usage which might be based upon past bad experiences. Also, an individual might not be acknowledged by their family members and friends for buying eco-friendly products, and moreover resulting in keeping them in suspicion about their environmental friendly effort (Sadiq *et al*., 2020) [41].

Role of Behavioural Change

There is a need to opt a green purchase behaviour that correlates to environmental sustainability (Quoquab *et al*., 2020) [38]**.** To understand and spread pro-environmental behaviour it requires to act according to certain behavioural principles. One such model is Value Belief Norm (VBN) theory, developed by Stern *et al*.,1999 [49] to elaborate the linkage between human values and their behaviour in an environmental context. VBN theory identified that green purchase behaviour is an idiosyncratic norm and linked to environmental belief. The idiosyncratic norm can be a moral duty to be involved in a behaviour that benefits the environment, like buying eco-friendly cosmetic products. VBN theory suggests that individuals with positive behaviour possess a feeling of responsibility for their activities towards the environment. Such an awareness about one's actions leads in forming pro-environmental beliefs that plays a pivotal role in developing idiosyncratic norms. Environmental belief relies on human-environmental relations which warns them about adverse consequences of their actions and guides them to correct those actions. (Stern *et al*., 1999 [49]; Stern, 2000 [50]; Harland *et al*., 2007) [21]

Ajzen and Fishbein, 1980 [5] proposed the Theory of Reasoned Action (TRA) which can be used to investigate the relation between consumer beliefs and purchase behaviour for eco-friendly cosmetics. The theory suggests the behaviour of an individual depends on personal and social factors. Personal factors mean individual's self-perception whether to perform the behaviour of interest or not. The social factor means social coercion experienced by the individual. The behaviour of interest to be performed depends on the validation of the people or society surrounding him/her (Ajzen and Fishbein, 1980) [5].

A study observed that self-enhancement and open to change are the two positive attitudes that can improve the personal values of consumers towards eco-friendly cosmetics (Mishra, 2018) [31]. The individuals were self-motivated to use green cosmetics. Before knowing the intent to buy eco-friendly cosmetics, one should be well versed about green products (Amberg and Fogarassy, 2019 [4]; Wang *et al*., 2019) [52]. Spreading knowledge about the green cosmetics to the mass population, is one of the present requirements, as supported by Cinelli *et al*., 2019 [12]. The study suggested knowledgeable consumption prefers use of natural and biodegrading packaging instead of conventional plastic packaging (Amberg and Fogarassy, 2019 [4]; Cinelli *et al*., 2019) [12]. Lawful regulations may serve as guarantee for environmental protection within the cosmetic industry, but that is not sufficient. Unlike the conventional cosmetic products, the eco-friendly cosmetics are hard to locate.

The green cosmetic manufacturers need to bridge this void and identify solutions to make them available in local markets and propagate about their products. The government may also support such manufacturers and provide them with opportunities of large-scale setup. The government can obtain certain measures to identify these green industries and felicitating them for their green behaviour approach. This may boost their social status and a greater number of people will be able to know about them. The best method to reach the mass is via social media that plays an influencing role in persuading behaviour, opinions and purchasing decisions. People perceive social media as reliable for their decision of purchasing cosmetics, as well, can motivate to buy eco-friendly cosmetics. It is also identified that Instagram celebrities affect the attitude towards purchasing eco-friendly cosmetics in a positive way (Pop *et al*., 2020). Companies have stopped using conventional endorsements of their products by celebrities and shifted to brand endorsement by Instagram famous celebs and influencers. People trust and idolize more with social media influencers than traditional celebrities (Schouten *et al*., 2019) [44]. This provides a new gateway for inducing pro-environment behaviour among masses for buying eco-friendly cosmetics and minimize the pollution caused by the toxic conventional cosmetics.

Conclusion

The study highlights the toxic chemicals contained cosmetics and their effect and a need for a behavioural change among mass to shift towards an eco-friendly usage of cosmetic products. This study attempts to contribute to the expansion of this field. Before buying the cosmetics, the minimal approach should be to look for the ingredients. We have to act smart because cosmetic brands are only concerned about their economic growth. Words like cruelty free, 100% natural, 100% ayurvedic, are some of the common words used by cosmetic brands to greenwash and to make their product look more eco-friendly. Some brands don't even mention their ingredients in their products, which clearly justifies that they are hiding their toxic ingredients from their consumers. It is our individual effort to protect our own health and upgrade our environment. An individual step leads to mass action. This study attempts to identify how can the pro-environmental behaviour be introduced with the help of some renowned and established theories like Value Belief Norm (VBN) Theory, as well, Theory of Reasoned Action (TRA). Both the theories convey one common approach that a positive and a flexible behaviour is a key to adapt pro-environmental behaviour. Environmental friendly behaviour can be spread to a large audience with the help of social media as consumers find social media as reliable to buy cosmetic products. It is observed that the consumers are inclined to buy only those products which are endorsed by their favorite social media influencer. This brings a new way for inducing pro-environmental behaviour among masses towards buying eco-friendly cosmetic products for the betterment of life and a sustainable environment.

Acknowledgement

I am thankful to Prof. Sujata Mohanty, Department of Biotechnology, Jaypee Institute of Information Technology, Noida for providing their valuable time and guiding me throughout my work for this paper. I would like to express my heartfelt gratitude to my parents, Dr. Ashok Kumar Choudhury and Mrs. Ranjulata Choudhury for their unwavering support and encouragement throughout this research endeavour.

Conflict of Interest Statement

The author declares that there are no conflicts of interest regarding the publication of this research paper. The research was conducted impartially and without any financial, professional or personal relationships that could potentially influence the results or interpretations presented in this paper.

References

1. Alaba PAA, Cañete ED, Pantalan BSS, Taguba JMC, Yu LDI, Faller EM. Toxic Effects of Paraben and its Relevance in Cosmetics: A Review. *International Journal of Research Publication and Reviews*,2022:3(5):3425-3466.
2. Agrawal SS, Mazhar Mohd. Adulteration of Mercury in Skin Whitening Creams – A Nephrotoxic Agent. *Current Medicine Research and Practice*,2015:5*:172-175*. doi:10.1016/j.cmrp.2015.07.007
3. Agrawal SS, Sharma Pallavi. Current Status of Mercury Level in Skin Whitening Creams. *Current Medicine Research and Practice*,2017:7*(2):47–50.* Doi:10.1016/j.cmrp.2017.02.001
4. Amberg N, Fogarassy C. Green consumer behavior in the cosmetics market. *Resources*,2019:8(3):137. https://doi.org/10.3390/resources8030137
5. Ajzen I, Fishbein M. Understanding Attitude and Predicting Social Behavior, Prentice-Hall, Englewood Cliffs, New Jersey, 1980.
6. Bayo J, Martínez A, Guillén M, Olmos S, Roca MJ, Alcolea A. Microbeads in commercial facial cleansers: threatening the environment. *CLEAN - Soil*, 2017. *Air, Water*. doi:10.1002/clen.201600683
7. Bilal M, Mehmood S, Iqbal HM. The beast of beauty: environmental and health concerns of toxic components in cosmetics. *Cosmetics*,2020:*7*(1):13. https://doi.org/10.3390/cosmetics7010013
8. Bondi CA, Marks JL, Wroblewski LB, Raatikainen HS, Lenox SR, Gebhardt KE. Human and environmental toxicity of sodium lauryl sulfate (sls): evidence for safe use in household cleaning products. *Environmental Health Insights*, 2015, *9*(1). https://doi.org/10.1177/EHI.S31765
9. Chantelouve M, Ripoll L. Endocrine disruptors in cosmetics: a review. *Molecules*. Retrieved, 2022-2023 from https://constellation.uqac.ca/id/eprint/8464/1/Review_Endocrine_disruptors_in_cosmetics_preprint.pdf
10. Chatzigianni M, Pavlou P, Siamidi A, Vlachou M, Varvaresou A, Papageorgiou S. Environmental impacts due to the use of sunscreen products: a mini-review. *Ecotoxicology*,2022:*31*(9):1331-1345. https://doi.org/10.1007/s10646-022-02592-w
11. Chen L, Matloob S, Sunlei Y, Qalati SA, Raza A, Limón MLS. A Moderated–Mediated Model for Eco-Conscious Consumer Behavior. *Sustainability*,2023:*15*(2):897. https://doi.org/10.3390/su15020897
12. Cinelli P, Coltelli MB, Signori F, Morganti P, Lazzeri A. Cosmetic Packaging to Save the Environment: Future Perspectives. *Cosmetics*,2019:6:26. https://doi.org/10.3390/cosmetics6020026
13. Dauda JS, Friday E, Benjamin B. Harmful effects of heavy metals in cosmetics. *World Journal of Advanced Engineering Technology and Sciences*,2023:08(01):374–381. https://doi.org/10.30574/wjaets.2023.8.1.0062
14. Enyoh CE, Shafea L, Verla AW, Verla EN, Qingyue W, Chowdhury T, Paredes M. Microplastics exposure routes and toxicity studies to ecosystems: an overview. *Environmental Analysis, Health and Toxicology*,2020:*35*(1):10.5620/eaht.e2020004
15. Fendall LS, Sewell MA. Contributing to marine pollution by washing your face: Microplastics in facial cleansers,2009:58(8):1225–1228. doi:10.1016/j.marpolbul.2009.04.025
16. Frantzeskos O. Beauty and the Beast: Plastic Pollution in the Personal Care and Cosmetics Industry. Retrieved, 2023. from https://research.library.fordham.edu/cgi/viewcontent.cgi?article=1134&context=environ_2015
17. Gaines LG. Historical and current usage of per-and polyfluoroalkyl substances (PFAS): A literature review, 2022. American Journal of Industrial Medicine. https://doi.org/10.1002/ajim.23362
18. Guerranti C, Martellini T, Perra G, Scopetani C, Cincinelli A. Microplastics in cosmetics:

Environmental issues and needs for global bans. *Environmental toxicology and pharmacology*,2019:*68*:75-79. https://doi.org/10.1016/j.etap.2019.03.007
19. Gupta S, Kalode MD, Doifode CA. A Review on Cosmetics and Their Associated Advers E Effects.*International Research Journal of Modernization in Engineering Technology and Science*,2023:*05(01):935-947.* https://www.doi.org/10.56726/IRJMETS33011
20. Habib RZ, Abdoon MMS, Al Meqbaali RM, Ghebremedhin F, Elkashlan M, Kittaneh WF, *et al*. Analysis of microbeads in cosmetic products in the United Arab Emirates. *Environmental Pollution*, 2019, *258*. doi:10.1016/j.envpol.2019.113831
21. Harland P, Staats H, Wilke HAM. Situational and personality factors as direct or personal norm mediated predictors of pro-environmental behavior: Questions derived from norm-activation theory. *Basic and Applied Social Psychology*,2007:*29*:323–334. https://doi.org/10.1080/01973530701665058
22. Irfan M, Shafeeq A, Siddiq U, Bashir F, Ahmad T, Athar M, *et al*. A mechanistic approach for toxicity and risk assessment of heavy metals, hydroquinone and microorganisms in cosmetic creams. *Journal of Hazardous Materials*, 2022, *433*. https://doi.org/10.1016/j.jhazmat.2022.128806
23. Jaiswal D, Kant R. Green purchasing behaviour: a conceptual framework and empirical investigation of Indian consumers. J. Retailing Consum. Serv,2018:41:60–69.
24. Jose A, Ray JG. Toxic content of certain commercially available fairness creams in Indian market. *Cogent Medicine*, 2018, *5(1).* doi:10.1080/2331205X.2018.1433104
25. Kale N, Bajpai N, Wasule D. Toxic Chemicals in Cosmetics. *World Journal of Pharmaceutical Research*,2022:11(10):409-427.
26. Kautish P, Paul J, Sharma R. The moderating influence of environmental consciousness and recycling intentions on green purchase behavior. *Journal of Cleaner Production*,2019:228:1425–1436.
27. Khare A. Antecedents to green buying behaviour: A study on consumers in an emerging economy. *Marketing Intelligence & Planning*,2015:*33*:309–329. https://doi.org/10.1108/MIP-05-2014-0083
28. Kim H, Lee SH, Yang K. The heuristic-systemic model of sustainability stewardship: Facilitating sustainability values, beliefs and practices with corporate social responsibility drives and eco-labels/indices. *International Journal of Consumer Studies*,2015:*39*:249–260. https://doi.org/10.1111/ijcs.12173
29. Matwiejczuk N, Galicka A, Brzóska MM. Review of the safety of application of cosmetic produ cts containing parabens. *Journal of Applied Toxicology*,2020:*40*(1):176-210. https://doi.org/10.1002/jat.3917
30. Meena BI, Tahir TF, Sdeeq SZ, Sediq KN. Toxic Metals in Some Decorative Cosmetics and Nail Products. *ARO- the scientific journal of koya university*,2022:*10*(2):56-61. Https://doi.org/10.14500/aro.11067
31. Mishra S. 'Understanding consumer behaviour towards toxic chemical-free cosmetics using Schwartz values – a study from India', *Int. J. Indian Culture and Business Management*,2018:17(2):185–201.
32. Moeller M, Pawlowski S, Petersen-Thiery M, Miller IB, Nietzer S, Heisel-Sure Y, Kellermann MY, *et al*. Challenges in current coral reef protection–possible impacts of UV filters used in sunscreens, a critical review. *Frontiers in Marine Science*, 2021, *8*. https://doi.org/10.3389/fmars.2021.665548
33. Muda Haiza, Aziz Azila, Taher Zarani, Aziz R. Cosmeceuticals and Natural Cosmetics. Retrieved, 2023. from https://www.researchgate.net/publication/313796813_Cosmeceuticals_and_Natural_Cosmetics
34. National Ocean and Atmospheric Administration. (n.d). Zooxanthellae... what's that? Retreived 15 March, 2023 from https://oceanservice.noaa.gov/education/tutorial_corals/coral02_zooxanthellae.html#:~:text=Tiny%20cells%20called%20zooxanthellae%20live,need%20to%20carry%20out%20photosynthesis.
35. Podgórska A, Puścion-Jakubik A, Grodzka A, Naliwajko SK, Markiewicz-Żukowska R, Socha K. Natural and conventional cosmetics—mercury exposure assessment. *Molecules*,2021:26(13):4088. https://doi.org/10.3390/molecules26134088
36. Pop RA, Săplăcan Z, Alt MA. Social media goes green—The impact of social media on green cosmetics purchase motivation and intention. *Information*, 2020, *11*(9). doi:10.3390/info11090447
37. Prinzing M. Going green is good for you: why we need to change the way we think about pro-environmental behavior. *Ethics, Policy & Environment*, 2020, 1-18. https://doi.org/10.1080/21550085.2020.1848192
38. Quoquab F, Jaini A, Mohammad J. Does it matter who exhibits more green purchase behavior of cosmetic products in Asian culture? A multi-group analysis approach. *International journal of environmental research and public health*, 2020, *17*(14). doi:10.3390/ijerph17145258
39. Raza-Naqvi SA, Idrees F, Sherazi TA, Anjum-Shahzad S, Ul-Hassan S, Ashraf N. Toxicology of Heavy Metals Used In Cosmetics. *Journal of the Chilean Chemical Society*,2022:67(3):5615-5622.
40. Razavi N, Es' haghi Z. Curcumin loaded magnetic graphene oxide solid-phase extraction for the determination of parabens in toothpaste and mouthwash coupled with high performance liquid chromatography. *Microchemical Journal*,2019:*148:*616-625.
41. Sadiq M, Adil M, Paul J. An innovation resistance theory perspective on purchase of eco-friendly cosmetics. *Journal of Retailing and Consumer Services*, 2020, 59. https://doi.org/10.1016/j.jretconser.2020.102369
42. Sahu R, Saxena P, Johnson S. Heavy Metals in Cosmetics. *Centre for Science and Environment*, 2014. https://www.researchgate.net/publication/259962042_Heavy_Metals_in_Cosmetics
43. Schettino L, Peris-Pastor G, Benedé JL, Chisvert A. A comprehensive review on the use of microextraction techniques in the analysis of cosmetic products, 2022.

Advances in Sample Preparation. https://doi.org/10.1016/j.sampre.2022.100024
44. Schouten AP, Janssen L, Verspaget M. Celebrity vs. Influencer endorsements in advertising: the role of identification, credibility, and Product Endorser fit, *International Journal of Advertising*,2019:39(2):258-281. DOI: 10.1080/02650487.2019.1634898
45. Sharma A, Kulshrestha S, Goel A, Singh SV. An Insight into Chemicals Toxicity in Cosmetics and Their Health-Related Perceptions. *Annals of the Romanian Society for Cell Biology*, 2021, 1773-1794.
46. Shekhar P, Tiwari S, Sagar S, Rajan N, Talreja S. Physio-Chemical Assessment of Various Marketed Shampoo Samples: A Comparative Study.*La Pensée*,2021:51:140-150.
47. Sohail M, Srivastava R, Gupta S. An Exploratory Study of Understanding Consumer Buying Behaviour Towards Green Cosmetics Products in the Indian Market. *Data Analytics and Business Intelligence: Computational Frameworks, Practices, and Applications*, 2023, 203
48. Srivastava P, Gupta M, Sharma RK. Chemicals In Cosmetics: Enhancing Awareness Among Students Through Science Teaching. *Journal Of Pharmaceutical Negative Results*,2022:13(05):1233-1236. Doi: 10.47750/pnr.2022.13. S05.195
49. Stern PC, Dietz T, Abel T, Guagnano GA, Kalof L. A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*,1999:*6*:81–97.
50. Stern PC. Toward a coherent theory of environmentally significant behavior. *Journal of Social*,2000:56:407–424. https://doi.org/10.1111/0022-4537.00175
51. U.S. Food & Drug Administration. (n.d). Cosmetic Products & Ingredients. Retrieved 18 March, 2023 from https://www.fda.gov/cosmetics/cosmetic-products-ingredients
52. Wang H, Ma B, Bai R. How Does Green Product Knowledge Effectively Promote Green Purchase Intention? *Sustainability*, 2019, *11*. https://doi.org/10.3390/su11041193