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Review Article

Chemistry behind Cosmetics: An Extensive Review

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Abstract

The word "cosmetics" actually stems from its use in Ancient Rome. They were typically produced by female slaves known as "*cosmetae*," which is where the word "cosmetics" stemmed from. Cosmetics are used to enhance appearance. Makeup has been around for many centuries. The first known people who used cosmetics to enhance their beauty were the Egyptians. Makeup those days was just simple eye coloring or some material for the body. Now-a-days makeup plays an important role for both men and women. In evolutionary psychology, social competition of appearance strengthens women's desires for ideal beauty. According to "The Origin of Species", humans have evolved to transfer genes to future generations through sexual selection that regards the body condition of ideal beauty as excellent fertility. Additionally, since women's beauty has recently been considered a competitive advantage to create social power, a body that meets the social standards of a culture could achieve limited social resources. That's right, even men have become more beauty conscious and are concerned about their looks. Cosmetics can be produced in the organic and hypoallergenic form to meet the demands of users. Makeup is used as a beauty aid to help build up the self-esteem and confidence of an individual. The importance of cosmetics has increased as many people want to stay young and attractive. Cosmetics are readily available today in the form of creams, lipstick, perfumes, eye shadows, nail polishes, hair sprays etc. Other cosmetics like face powder give glow to the skin after applying the base cream. Then we have lipsticks, which are applied by many women of all ages. They are made from wax and cocoa butter in the desired amount. Cosmetics like creams, gels, and colognes are used on a daily basis by both women and men. Creams act as a cleanser for the face in many circumstances. More recently anti-ageing creams have been manufactured which can retain younger looking skin for many years. The best cleansing agents are cleansing cream, soap and water. Cosmetic creams serve as a skin food for hard, dry and chapped skin. It mainly lubricates, softens and removes unwanted dirt from the skin. Some popular fat creams that are used include Vaseline and Lanolin. Dry creams are used in the manufacture of soap and gelatin which is used as a base for the skin. Hair care has become one of the fastest developing markets in the beauty industry. Many young men turn to oils and gels to maintain and style their hair. Products like hair gels, oils, and lotions have been introduced in the market to help protect hair fall and dandruff. Some professions, like the show business industry, focus on the importance of the outer appearance. Many personalities and artists have utilized makeup to beat the harsh lights and the glare of camera flashes. They very well know the importance of their looks and maintain them by using a variety of cosmetics. Their appearance is their most valuable asset and they take every endeavor to appear as the fans want them to appear. Recent research has shown that makeup helps in protection from harmful rays of the sun. Many beauty products manufacturers have utilized the needs of people to protect themselves and their skin from the rays of the sun. This is a great achievement because earlier make up and sun protection could not blend together. The Importance of Cosmetics Today Cosmetics help to enhance our appearance and make us feel more confident. With more cosmetics on the market today than ever before, it becomes obvious to us that they play a great role in our everyday life.

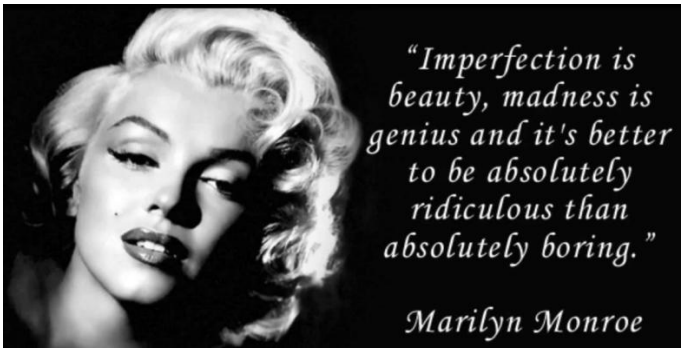

Fig-2: Famous Beauty Quote, Merlyn Monroe [66-68]. The "blonde bombshell" had a heavy peach fuzz "beard" but refused to wax it off. But her so called "imperfection" never left without cosmetics. Monroe used five different lipsticks and glosses to create her pouty look. Between shampoo jobs, she was said to have applied baby powder on the roots of her hair. To get skin glow, Monroe slathered on thick layers of Vaseline or Nivea Cream under her makeup before getting in front of the camera. She was also a huge fan of moisturizers, olive oil, and lanolin. She wasn't always a blonde bombshell—she was born a brunette. She dyed her hair golden blonde when a modeling agency told her it would make her more successful.

Keywords: *cosmetae*, cosmetics, The Origin of Species.

Background: *History of Skin Care*--Though cosmetics have likely existed for even longer, the first evidence of cosmetics stems from Ancient Egypt, approximately 6,000 years ago. They used cosmetics for a variety of reasons, the first being for mummification, burial traditions, and honoring their Gods and Goddesses. They also used cosmetics to protect them from the elements — mainly sun rays and insects. Egyptians - like using aloe, myrrh, and frankincense. These products, particularly frankincense, were believed to possess anti-inflammatory properties and were used as anti-wrinkle creams by Ancient Egyptians. Makeup was created using a variety of products including metal ore, copper, water, oil, animal fat, and precious stones. While Ancient Greeks and Romans used the ideas of the Ancient Egyptians, they took their skincare and beauty rituals one step further. Many Greeks and Romans would spend an entire day at the "spa" to focus on their skin. Women commonly used white lead, crocodile dung, and chalk in order to lighten the appearance of their skin. They also created face masks with starch and eggs, which were believed to tighten the skin, reduce wrinkles, and keep the face looking as youthful as possible. This was even more common in China, particularly under the Shang Dynasty (in 1760 BC). A powdered face with smooth skin was extremely popular and white powders were used to achieve the whitest complexion possible. Taking it another step further, many also used gels and lotions to permanently bleach their skin. As skincare moved to Europe and the Middle East, new ingredients and methods were invented and introduced. The first cold cream was developed using rose oil and water, and melting beeswax into it. They used the mineral alum to treat scabs and used olive lead to fight acne. They combined vinegar and lead to make a whitening foundation and used it to get rid of freckles and whiten their skin. During the Elizabethan Era, many Europeans used this whitening foundation. At the time, it wasn't popular to wash their faces and/or bodies, so typically, they piled on layer after layer of the whitening foundation to achieve a look as pale as possible. Despite the many social strides made in the late 1800's and early 1900's, dark skin was still seen as undesirable. Skin whitening was as popular as ever and products were made nearly exclusively for light skinned women. By the 1920's, a shift in beauty ideals caused slightly tanned skin to be seen as desirable. Cosmetics, in turn, followed this trend. Tinted face powders and lotions that emulated a tan were introduced.

Fig-1: The Beauty of Yesterday: Ancient Egypt [183]. Often referred to as the vainest civilization in history, Ancient Egyptians are known to have played a vital role in shaping modern ideals of beauty. For example, these populations used olive oil, honey and milk to keep their skin wrinkle free, as well as the pigment from clay to create lip and cheek tints to recreate a healthy glow. Another prime example is their use of a charcoal-like substance called Kohl to create thick black lines around their eyes to enhance their natural shape, believing that by following this technique, it would also protect their eyes from the glare of the sun.

INTRODUCTION

A cosmetic product is defined as 'a substance or preparation intended for placement in contact with any external part of the human body' (this includes the mouth and teeth). We use cosmetics to cleanse, perfume, protect and change the appearance of our bodies or to alter its odors. Products that claim to 'modify a bodily process or prevent, diagnose, cure or alleviate any disease, ailment or defect' are called therapeutics. Whatever the process one wishes to take, there is one goal in mind: covering up imperfections (Figure 2). Most cosmetic products are complex mixtures of chemical compounds that are directly applied to the skin. Unlike pharmaceutical products, cosmetics are not intended to cure diseases. However, modern cosmetics are often "functional." Products for whitening, wrinkle care, moisturizing, and treating pores, spots, etc. are produced to meet the needs of today's consumers. Thus, some cosmetic products contain quasi-drugs, although their effects on the body remain mild and gentle. Because cosmetics are freely used by consumers with no daily-exposure limits, the absorption of quasi-drugs (and other ingredients) through the skin needs to be carefully controlled, which makes monitoring transdermal drug absorption one of the important subjects in cosmetic science. Though use

and acceptance of the term "cosmeceutical" may largely be confined to the U.S., knowledgeable and increasingly demanding consumers have no national borders – and the onus to live up to these demands is on both brand owners and ingredient suppliers. According to research firm Kline & Company's "Specialty Actives in Personal Care 2011: U.S. Market Analysis and Opportunities," a growing consumer understanding of active ingredients in personal care products, driven by extensive consumer media coverage, is pressuring suppliers of active ingredients to produce innovative products ("innovative" and "active" are the hallmarks of cosmeceuticals). When seeking out personal care, consumers want the new and exciting, while their expectations for and of functional and efficacious ingredients and products grow. In addition, as a result of global economics, consumer frugality has become the new normal, and this, too, plays a role in what consumers expect from the performance of their products. Consumers will continue to spend on beauty products, but as their spending power decreases, they're ever quicker to move on from a product they deem as not living up to its promises. Consumers set the parameters and will continue to seek out the most effective beauty products for their needs – and value is determined first on efficacy. On the face of it, reaching today's consumers and winning their buy for the long term seems an ever more daunting proposition, but their quest and hunger for ever more efficacious and intriguing products actually translates to more opportunities to innovate for new unmet needs. Turning innovation into success, though, will truly depend on an open and honest conversation with consumers – listening to their needs and being as clear as possible about claims and the potential for any given product. Brand owners must convey the value of new ingredients, formulas and products through clear language, with explanations of benefits based on scientific studies or other trials. Backing good ingredients and products by developing smart marketing campaigns that are able to convey appropriate expectations from the use of products will foster a significant connection with consumers – and that translates to the growth of business.

Fig-3: How Do Plant Stem Cells Help Hair Growth? [69,70]. Plant stem cells possess similar genetic factors as human stem cells and can be used to influence the function of certain cells in our skin and hair follicles. Active plant stem cells work to increase the lifespan of hair follicles so that hair can remain in the anagen phase of the hair growth cycle for a longer period of time. Another hair-growth benefit of Asparagus Stem Cells is their ability to block the most common hair-killing hormone, DHT. High levels of DHT, as well as sensitivity to the hormone, are known for causing most male-pattern baldness and even female alopecia. Asparagus Stem Cells can aid the receptors in the skin to block the intrusion of DHT, and therefore minimizing the hair loss caused by it

General Use of Cosmetics

Cosmetic is a Greek word which means to 'adorn' (addition of something decorative to a person or a thing). It may be defined as a substance which comes in contact with various parts of the human body like skin, hair, nail, lips, teeth, and mucous membranes etc. Cosmetic substances help in improving or changing the outward show of the body and also masks the odor of the body. It protects the skin and keeps it in good condition. In general, cosmetics are external preparations which are applied on the external parts the body. Even in earlier days, men and women used to decorate their bodies for improvement of appearance. Men used leaves of vegetables and parts of animals whereas women use to wear colored stones and flowers round their neck and wrist. Gradually, they start using colored earth and ointments on their face and body. Even bangles and necklace made of baked earth materials became very common among the people. Eye shadow were made of copper (colored earth) ore and lamp black (colored earth) while red color was used for dyeing of hair. Now days, cosmetics are considered as essential components in life. They not only, attract the people towards it but also impart psychological effects. It has gained popularity in the last 3-4 decades and its use has been increased exponentially both-in males and females (Figure 5). The most popular cosmetics are hair dyes, powders and creams.

1. Foundation, used to smooth out the face and cover spots or uneven skin coloration. Usually a liquid, cream, or powder.
2. Powder, used to set the foundation, giving a matte finish, and also to conceal small flaws or blemishes.
3. Rouge, blush or blusher, cheek coloring used to bring out the color in the cheeks and make the cheekbones appear more defined. This comes in powder, cream, and liquid forms.
4. Bronzer, used to give skin a bit of color by adding a golden or bronze glow.
5. Mascara is used to darken, lengthen, and thicken the eyelashes. It is available in natural colors such as

brown and black, but also comes in bolder colors such as blue, pink, or purple. There are many different formulas, including waterproof for those of us prone to allergies or sudden tears.

6. Eye liner, eye shadow, eye shimmer, and glitter eye pencils as well as different color pencils used to color and emphasize the eyelids (larger eyes give a more youthful appearance).
7. Eyebrow pencils, creams, waxes, gels and powders are used to color and define the brows.
8. Nail polish, used to color the fingernails and toenails.
9. Concealer, Makeup used to cover any imperfections of the skin.
10. A hair growth tonic contains, as an active ingredient, a filtrate of lactic acid bacterial culture such as Streptococcus lactis, and Lactobacillus bulgaricus. The use of this type of hair growth tonic promotes hair regeneration, hair growth and hair nourishment. Modern technology is using plant stem cells to influence the function of certain cells in our skin and hair follicles (Figure 3).

Also included in the general category of cosmetics are skin care products. These include creams and lotions to moisturize the face and body, sunscreens to protect the skin from damaging UV radiation, and treatment products to repair or hide skin imperfections (acne, wrinkles, dark circles under eyes, etc.). Cosmetics can also be described by the form of the product, as well as the area for application. Cosmetics can be liquid or cream emulsions; powders, both pressed and loose; dispersions; and anhydrous creams or sticks [1-5].

Fig-4: Beauty is in the eye of the beholder, and there is nothing better than a pair of gorgeous eyes [184]. Made from an extract of nightshade berries, also called *Atropa belladonna*, the resulting eyedrops dilate the pupils, providing a soft and seductive effect, just like in a romance scene of a novel where someone's eyes 'darken with desire.' In Renaissance Italy, this dusky, lustrous appearance of a lady's eyes was considered to be the height of beauty. One drop per eye would block receptors in the muscles of the eye that constrict pupil size. As one might suspect, this comes at an immediate cost to vision, resulting in blurriness and inability to focus on close objects. Though this would wear off over time, prolonged use of belladonna could cause permanent vision distortion or blindness. It also carried the side effect of increased heart rate because, let's not forget, this tincture was made of poison

Exhibit 1. Interesting facts from history of cosmetics [33-36], [64,65]

Women are susceptible to the societal pressures of using cosmetics to beautify themselves. One theory behind the origins of the ♀ symbol used to denote "woman" is that it represents the hand mirror used by the Roman goddess Venus or the Greek goddess Aphrodite. In their efforts to look beautiful, both men and women apply cosmetics to hide their flaws and accentuate their features. Cosmetics have been a part of human history as far back as the ancient Egyptians. The ancient Egyptians, Romans, and Greeks used various ingredients to soften, improve, exfoliate, and detoxify skin. The ancient Romans and Greeks used walnut extracts as hair dye, antimony (a known toxic heavy metal) as eye shadow, white lead carbonate as a skin lightener, charcoal crocodile excrement as a skin darkener, and cinnabar as rouge. *Atropa Belladona* is a poisonous plant called deadly nightshade. The name belladonna comes from the Italian, meaning beautiful lady, originating either from its use as a facial cosmetic, or, more probably, from its use to increase pupil size in women because during the Renaissance the herb was used in eye-drops by women to dilate the pupils of the eyes to make them appear seductive (**Figure 4**). In Elizabethan England, dyed red hair comes into fashion. Society women wear egg whites over their faces to create the appearance of a paler complexion. Women in Ancient Egypt used kohl, a substance containing powdered galena (lead sulphide—PbS) to darken their eyelids, and Cleopatra is said to have bathed in milk to whiten and soften her skin. By 3000 B.C men and women in China had begun to stain their fingernails with colors according to their social class. The Chinese stained their fingernails with gum arabic, gelatin, beeswax, and egg. Chou dynasty royals wear gold and silver, with subsequent royals wearing black or red. Lower classes were forbidden to wear bright colors on their nails. Greek women used poisonous lead carbonate ($PbCO_3$) to achieve a pale complexion. Clays were ground into pastes for cosmetic use in traditional African societies and indigenous Australians still use a wide range of crushed rocks and minerals to create body paint for ceremonies and initiations.

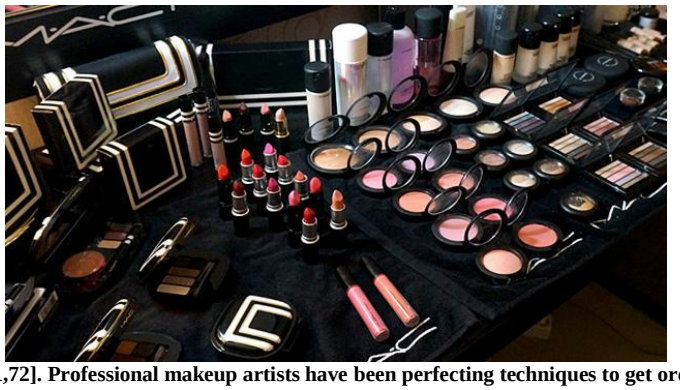

Fig-5: Modern Day Cosmetics [71,72]. Professional makeup artists have been perfecting techniques to get ordinary beauty products to multi-task for years. Cosmetics companies are now using advanced technology to develop multi-purpose products that emulate these techniques. Foundations are no longer designed to simply smooth complexions. Many now boast different ingredients to target varying skin needs, such as salicylic acid for acne or jojoba oil for dry skin. Numerous brands have also created multipurpose stains with a creamy consistency and a neutral color that can be used on cheeks, lips and eyes. Some shades of these creamy all-over-color sticks also offer a little shimmer or gold sparkle, so that it can glide across eyebrow bones, shoulders or cleavage as a highlighter -- Lauren Balukonis, beauty division at 5W Public Relations.

Products classified as Cosmetics

- *Skin Creams* be considered pharmaceutical products as even cosmetic creams are based on techniques developed by pharmacy and un-medicated creams are highly used in a variety of skin conditions in ancient times, creams were simply prepared by mixing of two or more ingredients using water as the solvent. With the advancement in technology, newer methods are used for formulation of creams. These semisolid preparations are elegant to use by the public and society. They show versatility in their functions. Creams can be applied to any part of the body with ease. It is convenient to use cream by all the age group of people. Although it may be equally well applied to non-aqueous products such as wax-solvent based mascaras, liquid eye shadows and ointments. If an emulsion is sufficiently low viscosity to be pourable (flow under influence of gravity alone) is referred to as lotion. Creams are emulsions of oil and water. In coming future, more advanced technologies and methods will be used for preparation, formulation and evaluation of creams. Also, the demand of herbal constituents-based creams is increasing day by day [74-79].

Fig-6: Skin Creams [168]. In general, creams for the skin should protect it from the sun and environmental pollutants, while also treating any specific problems. Look for the highest quality ingredients to ensure a cream's ability to live up to its claims. Enhance the circulation of blood flow by massaging creams into your skin several times a day.

- *Lips makeup*- Lipstick, lip gloss, lip liner, lip plumper, lip balm, lip stain, lip conditioner, lip primer, lip boosters, and lip butters. Lipsticks are intended to add color and texture to the lips and often come in a wide range of colors, as well as finishes such as matte, satin, gloss and luster. Lip stains have a water or gel base and may contain alcohol to help the product stay on leaving a matte look. They temporarily saturate the lips with a dye. Usually designed to be waterproof, the product may come with an applicator brush, directly through the applicator, rollerball, or could be applied with a finger. Lip glosses are intended to add shine to the lips and may add a tint of color, as well as being scented or flavored for a pop of fun. Lip balms are most often used to moisturize, tint, and protect the lips. Some brands contain sunscreen. Using a priming lip product such as

lip balm or chapstick can prevent chapped lips [6-8, 73].

Fig-7: Lip Color [169,170, 181]. Makeup artists and advertisements for cosmetics often claim that lip color can influence facial skin's apparent lightness. Currently, we do not have scientific evidence to either support or deny these claims. The luminance contrast between facial features and facial skin is greater in women than in men, and women's use of make-up enhances this contrast. In black-and-white photographs, increased luminance contrast enhances femininity and attractiveness in women's faces, but reduces masculinity and attractiveness in men's faces. In Caucasians, much of the contrast between the lips and facial skin is in redness. Red lips have been considered attractive in women in geographically and temporally diverse cultures, possibly because they mimic vasodilation associated with eternal desire

Primers are so beloved by experts because they can do so much more than just make foundation go on smoother. Primers are sort of like insurance for makeup. Although they often wear many hats — smoothing, concealing, protecting and prepping — their main roles are to keep makeup on longer and give skin a smooth, flawless finish. This creates another layer between skin to prevent acne and makeup clogging up pores. Primer creates an even tone throughout the skin and makes makeup last longer. Primer is applied throughout the face including eyes, lips, and lashes. This product has a creamy texture and applies smoothly. Many makeup primers are formulated with silicone-based polymers, like dimethicone, because of their ultra-smoothing effects. Photoaged skin results from various environmental factors, most importantly chronic sun exposure. Dyschromia and fine lines/wrinkles are common clinical manifestations of photodamaged skin. The facial primer was shown to be effective and well tolerated for immediate and long-term improvement in the appearance of mild-to-moderate hyperpigmentation and fine lines associated with photodamage when used over a 12-week period [82-85].

Fig-8: Comparison between Before and After Use of Mineral Primer [84, 171]. Photoaged skin is largely a result of chronic exposure to UV radiation. Photoaging, which causes premature aging in the appearance and function of the skin, is similar to chronological aging in that it is cumulative over time. Women frequently seek effective treatment for their irregular pigmentation as well as other clinical manifestations of photodamaged skin. The facial primer improved scores for the appearance of hyperpigmentation and other photoaging parameters immediately after the first application.

- *Concealer* covers imperfections of the skin. Many people try to manage acne by squeezing pimples, following a thorough skin care routine or wearing foundation. Others hope things will improve if they change their diet or expose their skin to sunlight. Concealer is often used for any extra coverage needed to cover acne/pimple blemishes, undereye circles, and other imperfections. Concealer is often thicker and more solid than foundation, and provides longer lasting, more detailed coverage as well as creating a fresh clean base for all the rest of the makeup. This product also brightens up the skin and applying under the foundation can remove blemishes and discoloration because of acne scars. In females, in particular, there is a need for cosmetic products that can effectively cover the signs of this highly visible skin condition to reduce the emotional impact of the disease. Use of cosmetics can also increase acne patients' adherence with their medical regimen, which is estimated to be poor in 50% of patients. Perhaps the most important type of concealer is the corrective type, and is most effective in a liquid formula, like La-Roche Posay Toleriane Teint Corrective Pen, which has corrective colors to help tone down ruddiness, fade the appearance of hyperpigmentation, and yes, even cover up any more irritating blemishes [86-90].

Fig-9: Pimpled and no pimpled Britney Spears [185,186]. At glamorous, Hollywood events, the "…. baby one more time" star Britney Spears' skin seems flawless, but in reality, this is far from the truth: redness, pimples, rashes – the singer knows all of these problems too well, first hand. However, Girls and women often use concealer or foundation to cover up their pimples. This makes them feel more comfortable in public. Young men sometimes use subtle foundation, powder and concealer as well

- *Foundation* is used to smooth out the face by covering spots, acne, blemishes, or uneven skin tone. These are sold in a liquid, cream, or powder, or more recently in a mousse. Foundation provides sheer, matte, dewy or full coverage. Foundation primer is applied before foundation to fill out pores, create a dewy look or create a smoother finish. They usually come in cream formulas to be applied before foundation as a base. The most classic form of foundation, liquid, offers medium to full coverage for all skin types, and is a sure-fire way to achieve a smooth base [2, 91-94].
- *Face powder* sets the foundation and under eye concealer, giving it a matte finish while also concealing small flaws or blemishes. It can also be used to bake the foundation, so that it stays on longer and create a matte finish. Tinted face powders may be worn alone as a light foundation so that the full face does not look as caked-up as it could. Loose powder comes in a jar, has smaller particles (and therefore a finer consistency), and usually gives lightweight coverage. It's also messy and hard to transport, so this guy is meant to stay at home. The difference between setting powder and finishing powder is a little nebulous. Many companies use these terms interchangeably, so it's partially a matter of marketing [6-8, 95-97].
- *Rouge, blush, or blusher* is cheek coloring to bring out the color in the cheeks and make the cheekbones appear more defined. Blush is having a major moment, graduating from makeup bag staple to a starring role in almost every red-carpet beauty look. Rouge comes in powder, cream, and liquid forms. Different blush colors are used to compliment different skin tones. The ancient Egyptians were the first to incorporate blush into their beauty rituals. The middle Ages saw a drop in the use of blush, as red cheeks were associated with prostitutes. During the 1500s to the 1700s, blush was made with toxic chemicals. Starting in the 1900s, as America became industrialized; blush began to be mass produced and became much safer to use [98-100]

Fig-10: Disney princess, Snow White (Fairy Tale) [172,173]. In the time that Snow White was released it was a common for the majority of women desired to have blush in their faces like her. Rouge originated as a thick paste, and was made from a range of things: from strawberries, to red fruits and vegetable juices, to the powder of finely crushed ochre. As nouns the difference between blush and rouge. is that blush being an act of blushing or blush can be the collective noun for a group of boys while rouge is red or pink makeup to add color to the cheeks; blusher. Blushers, those versatile successors to rouge, help light up a complexion and accent face structure and best features.

- *Highlighter*, used to draw attention to the high points of the face such as the cheekbones, below the eyebrows, nose, upper lip, and collar bones. This product also adds a glow; comes in liquid, cream, and powder forms. It often contains a substance to provide shimmer. Alternatively, a lighter-toned foundation/concealer can be used [101].
- *Bronzer* gives skin a bit of color and contours the face for a sharper definition or creates a tan-look. Bronzer is considered to be more of a natural look and can be used for everyday wear. Bronzer enhances the color of the face. It comes in either matte, semi-matte/satin, or shimmer finishes [102-104].

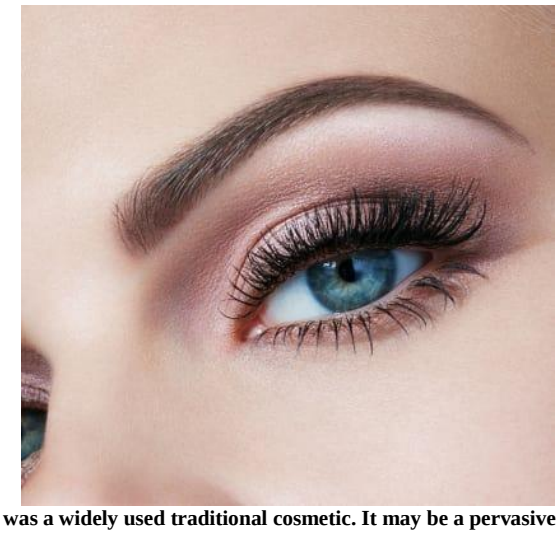

Fig-11: Eye Makeup [174-176]. Kohl was a widely used traditional cosmetic. It may be a pervasive source of lead poisoning in those areas and among individuals from those areas who have immigrated to developed nations. Despite the fact that cosmetic products undergo rigorous testing to ensure they are safe for human use; some users report mild discomfort following their application. The cutaneous changes, such as allergic dermatitis, are well reported, but the ocular changes associated with eye cosmetic use are less so. Some pigmented cosmetic products may accumulate within the lacrimal system and conjunctivae over many years of use, but immediate reports of eye discomfort after application are most common. Changes to the tear film and its stability may occur shortly after application, and contact lens wearers can also be affected by lens spoliation from cosmetic products. Additionally, creams used in the prevention of skin aging are often applied around the eyes, and retinoids present in these formulations can have negative effects on meibomian gland function and may be a contributing factor to dry eye disease

- *Mascara* is used to darken, lengthen, thicken, or draw attention to the eyelashes. It is available in various colors. Some mascara includes glitter flecks. There are many formulas, including waterproof versions for those prone to allergies or sudden tears. It is often used after an eyelash curler and mascara primer. Many types of mascara have components to help lashes appear longer and thicker [105-107].
- *Eye shadow* is a pigmented powder/cream or substance used to accentuate the eye area, traditionally on, above, and under the eyelids. Many colors may be used at once and blended together to create different effects using a blending brush. This is conventionally applied

with a range of eyeshadow brushes, though it isn't uncommon for alternative methods of application to be used such as fingers. However, it is important to have clean fingers because oils from skin can result in pimples [108,109].

- *Eye liner* is used to enhance and elongate the apparent size or depth of the eye. For example, white eyeliner on the waterline and inner corners of the eye makes the eyes look bigger and more awake. It can come in the form of a pencil, a gel, or a liquid and can be found in almost any color. Conversely, black eyeliner makes eyes look smaller, brightens up the face and draws attention to the eyes [108,109].
- *Eyebrow pencils, creams, waxes, gels, and powders* are used to color, fill in, and define the brows. Popular in recent years, the "Instagram look" is creating fuller eyebrows by filling it, sharper angles, and adding gel to set it [110].
- *Nail polish* is used to color the fingernails and toenails. Transparent, colorless versions may strengthen nails or be used as a top or base coat to protect the nail or polish. This can be found in gloss, matte, and powder [110].
- *Setting spray* is used as the last step in the process of applying makeup. It keeps applied makeup intact for long periods. An addition to setting spray is setting powder, which may be either pigmented or translucent. Both of these products claim to keep makeup from absorbing into the skin or melting off [111].
- *False eyelashes* are used when exaggerated eyelashes are desired. Their basic design usually consists of human hair, mink hair, or synthetic materials attached to a thin cloth-like band, which is applied with glue to the lash line. Designs vary in length and color. Rhinestones, gems, and even feathers and lace occur on some false eyelash designs. Eyelashes can be purchased in several drug or beauty supply stores and can be applied with eyelash glue. These eyelashes are not permanent and can be taken off easily by gently taking them off with fingers [108,109].
- *Contouring* is designed to give shape to an area of the face. The aim is to enhance the natural shading on the face to give the illusion of a more defined facial structure which can be altered to preference. Brighter skin colored makeup products are used to 'highlight' areas which are wanted to draw attention to or to be caught in the light, whereas darker shades are used to create a shadow. These light and dark tones are blended on the skin to create the illusion of a more definite face shape. It can be achieved using a "contour palette" - which can be either cream or powder [102], [112].
- *Cleansers* or foaming washes are used to remove excess dirt, oil, and makeup left on the skin. Different cleansing products are aimed at various types of skin, such as sulfate-free cleansers and spin brushes. Cleansing oil or oil cleanser is an oil-based solution that can contain, but not necessarily, an emulsifier to allow for the oils to gently emulsify on the skin. Cleansing Oils allowing providing essential fatty acids to the skin [113,114].
- *Toners* are used after cleansing the skin to freshen it up, boost the appearance of one's complexion, and remove any traces of cleanser, mask, or makeup, as well to help restore the skin's natural pH. They are usually applied to a cotton pad and wiped over the skin, but can be sprayed onto the skin from a spray bottle. Toners typically contain alcohol, water, and herbal extracts or other chemicals depending on skin type whether oily, dry, or combination. Toners containing alcohol are quite astringent, and usually targeted at oily skins [108, 115].
- *Facial masks* are treatments applied to the skin and then removed. Typically, they are applied to a dry, cleansed face, avoiding the eyes and lips. Clay-based masks use kaolin clay or fuller's earth to transport essential oils and chemicals to the skin, and are typically left on until completely dry. As the clay dries, it absorbs excess oil and dirt from the surface of the skin and may help to clear blocked pores or draw comedones to the surface. Because of its drying actions, clay-based masks should only be used on oily skins. Peel masks are typically gel-like in consistency, and contain acids or exfoliating agents to help exfoliate the skin, along with other ingredients to hydrate, discourage wrinkles, or treat uneven skin tone. They are left on to dry and then gently peeled off. They should be avoided by people with dry or sensitive skin, as they tend to be very drying. Sheet masks are a relatively new product that are becoming extremely popular in Asia. Sheet masks consist of a thin cotton or fiber sheet with holes cut out for the eyes and lips and cut to fit the contours of the face, onto which serums and skin treatments are brushed in a thin layer; the sheets may be soaked in the treatment. Masks are available to suit almost all skin types and skin complaints. Sheet masks are quicker, less messy, and require no specialized knowledge or equipment for their use compared to other types of face masks, but they may be difficult to find and purchase outside Asia [116-118].

Fig-12: Facial Treatment [177-180]. Facial masks are the most prevalent cosmetic products utilized for skin rejuvenation. Facial masks are divided into four groups: (a) sheet masks; (b) peel-off masks; (c) rinse-off masks; and (d) hydrogels. Each of these has some advantages for specific skin types based on the ingredients used. Peel-off facial masks are known for their unique characteristics inherent to the use of film-forming polymers that, after complete drying, create a very cohesive plastic layer allowing for the manual removal of the product without leaving any residue. Most clay-based products on the market consist only of dried clay powder that needs to be moistened prior to use. After facial application, the product dries naturally, forming a sandy-cracked material due to the low cohesion between the dried particles. The most interesting effects of aloe vera in topical use are anti-inflammatory, antiseptic, antioxidant, and regenerative. It has been demonstrated that the association of green clay and aloe vera exerts a beneficial synergistic effect when it comes to developing a facial mask as a regenerative aid

- *Exfoliants* are products that help slough off dry, dead skin cells to improve the skin's appearance. This is achieved either by using mild acids or other chemicals to loosen old skin cells, or abrasive substances to physically scrub them off. Exfoliation can even out patches of rough skin, improve circulation to the skin, clear blocked pores to discourage acne and improve the appearance and healing of scars. Chemical exfoliants may include citric acid (from citrus fruits), acetic acid (from vinegar), malic acid (from fruit), glycolic acid, lactic acid, or salicylic acid. They may be liquids or gels, and may or may not contain an abrasive to remove old skin cells afterwards. Abrasive exfoliants include gels, creams or lotions, as well as physical objects. Loofahs, microfiber cloths, natural sponges, or brushes may be used to exfoliate skin, simply by rubbing them over the face in a circular motion. Gels, creams, or lotions may contain an acid to encourage dead skin cells to loosen, and an abrasive such as microbeads, sea salt, sugar, ground nut shells, rice bran, or ground apricot kernels to scrub the dead cells off the skin. Salt and sugar scrubs tend to be the harshest, while scrubs containing beads or rice bran are typically very gentle [116], [119].
- *Moisturizers* are creams or lotions that hydrate the skin and help it to retain moisture; they may contain essential oils, herbal extracts, or chemicals to assist with oil control or reducing irritation. Night creams are typically more hydrating than day creams, but may be too thick or heavy to wear during the day, hence their name. Tinted moisturizers contain a small amount of foundation, which can provide light coverage for minor blemishes or to even out skin tones. They are usually applied with the fingertips or a cotton pad to the entire face, avoiding the lips and area around the eyes. Eyes require a different kind of moisturizer compared with the rest of the face. The skin around the eyes is extremely thin and sensitive, and is often the first area to show signs of aging. Eye creams are typically very light lotions or gels, and are usually very gentle; some may contain ingredients such as caffeine or Vitamin K to reduce puffiness and dark circles under the eyes. Eye creams or gels should be applied over the entire eye area with a finger, using a patting motion. Finding a moisturizer with SPF is beneficial to prevent aging and wrinkles [116], [120].
- *Soaps* composed of long chain fatty acid alkali salts with a pH of between 9 and 10. Use of soap with high pH causes an increase in skin pH, which in turn causes an increase in dehydrative effect, irritability and alteration in bacterial flora. The majority of soaps and shampoos available in the market do not disclose their pH. Glycerin bars/transparent bars: used rampantly in our country in winter. They contain humectant–glycerin to counter the drying effects of soap. Super-fatted soaps: contain greater amount of lipids such as triglycerides, lanolin, paraffin, stearic acid, or mineral oils which provide a protective film on the skin. Deodorant soaps/antibacterial soaps: contain antibacterial agents such as triclosan, triclocarban, or carbanile to inhibit the growth of bacteria and thereby odor [80,81].
- *Shampoos* are used primarily to clean the scalp of dirt and other environmental pollutants, sebum, sweat, desquamated corneocytes (scales), and other greasy residues including

previously applied hair care products such as oils, lotions and sprays. It is easy to formulate a shampoo which will remove all of the sebum and dirt from the hair and scalp, but this will leave the hair, frizzy, dry, unmanageable and unattractive. Shampoo now is also supposed to have a secondary function which serves to condition and beautify hair and to soothe the irritated scalp skin in conditions like seborrheic dermatitis. The challenge is to remove just enough sebum to allow the hair to appear clean and leave behind enough conditioning agents to leave the hair soft, shiny and manageable. This balancing act between good cleaning and beautifying the hair is an art achieved by mixing various ingredients in the correct proportion in the shampoo preparation. The modern advances in chemistry and technology have made it possible to replace the soap bases with complex formulation which contain cleansing agents, conditioning agents along with functional additives, preservative, aesthetic additives and sometimes even medically active ingredients [121-125].

Fig-13: Woman with long beautiful hair [187,188]. The main purpose of shampoo is to remove dirt and oil from the surface of the hair fibers and the scalp, while the main purpose of conditioner is to ensure that the hair is smooth for combing. Shampoos typically contain a primary and a secondary surfactant for thorough cleaning, a viscosity builder, a solvent, conditioning agents, pH adjuster and other non-essential components such as fragrance and color for commercial appeal. Conditioners usually contain silicone polymers to increase shine and soften hair, cationic polymers such as quaternary nitrogen compounds to reduce static electricity, bridging agents to increase absorption, viscosity builder, pH adjuster and components for commercial appeal.

- *Conditioners* are used to decrease friction, detangle the hair, minimize frizz and improve combability. Conditioners act by neutralizing the electrical negative charge of the hair fiber by adding positive charges and by lubricating the cuticle that reduces fiber hydrophilicity. They contain anti-static and lubricating substances that are divided into 5 main groups: Polymers, oils, waxes, hydrolyzed amino acids and cationic molecules. The most active and used conditioner agent is a silicone. There are different types of silicones with different deposition, adherence and wash out capacity which will lead to different performances of the conditioner. The ideal conditioner is capable of restore the hydrophobicity of the fiber and neutralize the static electricity. Depending on the capacity of entering the fiber, the conditioner may reach the cuticle surface or the inner part of the cortex [122, 125].
- *Deodorant* is one of the most commonly used cosmetic products, with millions of consumers applying these products to their axilla every day. Deodorants are used to mask odor; whereas, antiperspirants are used to reduce the amount of sweat produced. These two activities are often combined into single products. While deodorants are considered cosmetic products because they do not change the function of the skin, antiperspirants are classified as drugs and are therefore subject to rules and regulations set forth by the FDA. The active ingredient in antiperspirants is usually aluminum based, which reduces sweat by causing obstruction of the eccrine glands. Deodorants work by two different mechanisms—antimicrobial agents decrease the number of bacteria that produce volatile odoriferous substances and fragrances cover any odors that are produced. Recently, naturally occurring zeolite minerals, in the form of potassium alum or ammonium alum crystals, have been marketed as all-natural alternatives to deodorants and antiperspirants. These products are sold in solid crystal form. The consumer is instructed to wet the crystal and apply the product to the underarm area to prevent odor. Although no research has been published evaluating the mechanism of action of these products, the company that markets them, Crystal Body Deodorant (French Transit, Ltd., Burlingame, California), claims that the mineral salts create an environment in which bacteria cannot survive [126,127].

- *Contouring* is intended to offer shape to a zone of the face. The point is to upgrade the normal shading on the face to give the fantasy of a more characterized facial structure which can be adjusted to inclination. More brilliant skin colored makeup items are utilized to 'feature' regions which are needed to attract thoughtfulness regarding or to be gotten in the light, while darker shades are utilized to make a shadow. These light and dark tones are mixed on the skin to make the deception of a more unequivocal face shape. It very well may be accomplished utilizing a "shape palette" - which can be either cream or powder [102, 112].

Fig-14: Contouring [182] Contouring is the newest makeup craze that people just can't get enough of! This trend, made famous by none other than the Kardashian sisters, was created to make your face appear slimmer and more sculpted. The basic premise of it is to highlight the areas of face that someone would like to bring out, while shading in the parts she wants to make thinner.

Products classified as therapeutics

- *Antiperspirants* help to reduce the production of sweat. Aluminum salts – the active ingredient found in antiperspirants – dissolve into the moisture on the skin's surface. This forms a gel, which temporarily sits on top of the sweat gland, reducing the amount of sweat released. Antiperspirants that contain alcohol also help the active ingredient to dry faster and create a pleasant, cool feeling. An antiperspirant can also be a deodorant, because it can help to control sweat and contain a fragrance at the same time. But deodorants only mask body odor; they don't help to prevent sweating [121], [128, 129].
- *Anti-dandruff shampoo*- Dandruff (pityriasis capitis) is a chronic scalp condition characterized by scaling and sometimes itching and redness. Shampoos containing antifungal agents are used to control the scaling condition. Regular use of anti-fungal shampoos represents a proven therapeutic strategy to improve the most common symptoms of flakes and itch. The therapeutic efficacy of a product based on a complex delivery vehicle such as a shampoo must be considered from a full-product perspective rather than just the active system as the non-active components of the composition will often play a significant role in the overall product pharmacology and resultant efficacy [130-132].

Household products

- Toothpaste is a paste or gel to be used with a toothbrush to maintain and improve oral health and aesthetics. Since their introduction several thousand years ago, toothpaste formulations have evolved considerably - from suspensions of crushed egg shells or ashes to complex formulations with often more than 20 ingredients. Fluoride is the most important therapeutic substance used in toothpastes, adding to the effect of mechanical toothbrushing on dental caries control. The use of fluoride toothpaste to reduce caries in children and adults is strongly based on evidence, and is dependent on the concentration (minimum of 1000 ppm F) and frequency of fluoride toothpaste use (2'/day or higher). The risk of dental fluorosis due to toothpaste ingestion by children has been overestimated, since there is no evidence that: 1) fluoride toothpaste use should be postponed until the age of 3-4 or older, 2) low-fluoride toothpaste avoids fluorosis and 3) fluorosis has a detrimental effect on the quality of life of individuals exposed to fluoridated water and toothpaste. Among other therapeutic substances used in toothpastes, there is evidence that triclosan/copolymer reduce dental biofilm, gingivitis, periodontitis, calculus and halitosis, and that toothpastes containing stannous fluoride reduce biofilm and gingivitis [133-136].
- A *mouthwash* may be defined as a nonsterile aqueous solution used mostly for its deodorant, refreshing, or antiseptic effect. Mouthwashes or rinses, when used as an adjunct to regular oral hygiene methods such as flossing. The first reference to mouth rinse as a formal practice is credited to Chinese medicine, about 2700 B.C.E., to treat the diseases of the gums. Mouthwashes exert adverse effects on teeth, gums and mucous membrane of oral cavity and their extensive use is being criticized. Study revealed that damage to DNA increases many folds when different mouthwashes are combined. Essential oils of six spice plants (black pepper, clove, black seasam, cinamon, carom seeds and cumin) were evaluated for possessing anti-mutagenic property. These essential oils were found effectively protective against the DNA damaging effect of

mouthwashes but could not inhibit it completely. Black pepper, clove, black seasam, cinamon, and cumin were stronger protective as compared to carom seeds [79, 137-140].

- *Detergents*- Performing household-cleaning chores involves the use of chemical detergents; these are commonly believed to provide cleaner and safer households. Occupational health studies have associated health risks with detergents, including respiratory and skin problems. Women are the major users of household detergents, as they are in general the primary homemakers. Detergent-handling strategies including storage, use, and precautionary measures affect women's exposure to chemical detergents and thus affect their health. Studies investigating the behavioral component of chemical exposure to detergents at the domestic level are scarce. The different classes of raw materials are surfactants, builders, bleaching agents, enzymes, and minors which remove dirt, stain, and soil from surfaces or textiles gave them pleasant feel and odor. The physico-chemical properties of surfactants make them suitable for laundry purposes. Laundry detergent has traditionally been a powdered or granular solid, but the use of liquid laundry detergents has gradually increased over the years, and these days use of liquid detergent equals or even exceeds use of solid detergent. This review paper describes the history, composition, types, mechanism, consumption, environmental effects and consumption of laundry detergents. Frequent exposure to antimicrobial household products has been hypothesized to lead to allergic diseases in children [141-145].
- *Baby Products*- Although the U.S. pediatric skin care market is a $1.7 billion industry, little is known regarding the usage pattern of skin care products in very young children. The natural baby skin-care products were well tolerated by infants and toddlers when used alone or as part of a skin-care regimen. Immediately after birth, the skin barrier of healthy, full-term neonates is competent, yet skin-barrier function continues to develop through at least the first year of life. This developing state of infant skin results in infant skin being susceptible to dryness and irritation from external factors, such as cold weather and wind, as well as harsh topical skin-care products. Therefore, it is critical that infant cleansers and moisturizers be well tolerated and not disrupt the stratum corneum. Infant skin is also exposed to other factors, such as saliva, nasal secretions, urine, feces (including fecal enzymes), and dirt, which can be irritants and result in disruption of the skin barrier. Lower-income households reported a higher frequency of product use and were less likely to purchase fragrance-free products or ones that were made for sensitive skin. As a result of normal daily exposure to these external factors, proper skin cleansing and protection of the infant skin barrier are essential to the maintenance of skin-barrier function. Recent studies suggest that some phthalates can alter human male reproductive development, association was strongest in young infants, who may be more vulnerable to developmental and reproductive toxicity of phthalates given their immature metabolic system capability and increased dosage per unit body surface area. There was some evidence to suggest that daily use of full-body emollient therapy may help to reduce the risk of atopic eczema in high risk babies with a genetic predisposition to eczema; however, the use of olive oil or sunflower oil for baby dry skin may adversely affect skin barrier function [146-152].
- *Toiletries*- Greater emphasis on cleanliness has led to widening use of disinfectants and other cleaning agents in the home. Real picture is, an estimated 2.3 billion people lacked access to improved sanitation facilities, worldwide found in a 2017 study. Inadequate access to sanitation and hygiene facilities is known to be a leading cause of morbidity and mortality, particularly in low-income countries. In fact, approximately 10% of the global burden of disease is thought to be attributed to inadequate Water, Sanitation, And Hygiene (WASH), which is largely driven by increased exposure to human pathogens transmitted via the fecal-oral route. An undesirable effect (UE) of a cosmetic product is a harmful reaction attributable to its normal or reasonably foreseeable use. However, the knowledge of UEs, at the population level, is limited by the absence of formal and reliable cosmetovigilance systems, which nevertheless are characterized by underreporting. Triclosan is a widely used antimicrobial pesticide; in fact it's so widely used that there is concern that triclosan could be contributing to making bacteria resistant to antibiotics. Triclosan not only irritates the skin; it may also promote cancer and disrupt the endocrine system. Toluene is a toxic chemical commonly found in nail products and hair dyes. It is also listed on labels as benzene, toluol, phenylmethane, or methylbenzene. Toluene can affect the respiratory and central nervous systems, damage the liver and kidneys, and cause birth defects and spontaneous abortion. Most cosmetics and toiletries products contain scents, which are typically labelled as 'fragrances,' and do not include the list of chemicals they are comprised of. Fragrances can contribute to air pollution and health issues such as hormone disruption, asthma, allergies, and migraines. Parabens are oestrogen-mimicking preservatives found in many cosmetics and other body-care products. A study by the Centers for Disease Control and Prevention showed that most of the participants tested for paraben exposure came up positive. Studies have shown a potential link between paraben exposure and the proliferation of breast cancer cells. The European Union deemed butylated hydroxyanisole (BHA) unsafe for use in fragrance, but BHA can still be found in cosmetics and other personal care products in the United States. The National Toxicology Program considers BHA a carcinogen, and animal studies have indicated it damages the reproductive system. Found in hundreds of personal care products and other merchandise, from shower curtains to wood finishes. Most Americans tested by the

Centers for Disease Control and Prevention in the National Health and Nutrition Examination Survey during 2003 to 2004 showed the metabolites of several phthalates in their urine. Phthalates are considered toxic to normal development and the reproductive system, and can potentially cause endocrine disruption and cancer. Much of the market is dominated by big brand owners. The type of products in the household sectors often directs the packaging material choice with some more aggressive bleach-based products having to use HDPE. Plastic waste is also generated as a non-biodegradable waste, which can cause environmental pollution from unsanitary disposal and toxic leachates and gases, especially carbon monoxide and black smoke produced from open burning [153-165].

Safety issues of cosmetics

Cosmetic products are frequently applied to the skin by a large number of people, but some contain compounds that are potentially toxic, if absorption through the skin is sufficient. Makeup, shampoo, skin lotion, nail polish, and other personal care products contain chemical ingredients that lack safety data. Moreover, some of these chemicals have been linked in animal studies to male genital birth defects, decreased sperm counts, and altered pregnancy outcomes. There is no definitive evidence for the same effects in humans, but widespread exposure, primarily to phthalates, has been shown to occur. Phthalates, as key components in plastics, appear in many consumer products. The main phthalates in cosmetics and personal care products are dibutyl phthalate in nail polish, diethyl phthalate in perfumes and lotions, and dimethyl phthalate in hair spray. Often, their presence is not noted on labels [9]. For serious health problems to arise, exposure to these rapidly-clearing compounds must occur on a daily basis. Two such classes of compounds are the phthalate plasticizers and parabens, both of which are used in many personal care products, some medications, and even foods and food preservation. The phthalates are commonly found in foods and household dust. Even though they have relatively short half-lives in humans, phthalates have been associated with a number of serious health problems, including infertility, testicular dysgenesis, obesity, asthma, and allergies, as well as leiomyomas and breast cancer. Parabens, which can be dermally absorbed, are present in many cosmetic products, including antiperspirants. Their estrogenicity and tissue presence are a cause for concern regarding breast cancer. Fortunately, these compounds are relatively easy to avoid and such steps can result in dramatic reductions of urinary levels of these compounds [23]. An extensive number of cosmetic products are applied topically on and around the human breast on a daily basis, often multiple times a day, including not only underarm anti-perspirant/deodorant products but also body lotions, body sprays, moisturizing creams, breast firming/enhancing creams and sun care products. These products are not rinsed off but left on the skin, allowing for continuous dermal exposure, absorption and deposition into underlying tissues, which may be further increased by abrasions in the skin created by shaving. Clinical studies dating back decades report a disproportionately high number of female breast cancers originating in the upper outer quadrant of the breast, and although this is attributed to a greater amount of epithelial tissue in that region, it is also the area to which underarm cosmetic products are applied. Early studies reported 31% of cancers in the upper outer quadrant, but later studies in the 1990s report up to 61%. On the basis that antiperspirant formulations are designed to block underarm sweat ducts and breast cysts arise from blocked breast ducts in the adjacent region of the body [29]. The percutaneous absorption of N-nitrosodiethanolamine (NDELA), an impurity in many cosmetic products, has been evaluated in diffusion cells using excised human skin [39]. The Cosmetic Ingredient Review (CIR) program was established in 1976 by the Cosmetics, Toiletry, and Fragrance Association, with the support of the Food and Drug Administration (FDA) and the Consumer Federation of America (CFA). CIR performs independent, expert reviews to determine if ingredients used in cosmetics are safe. CIR staff prepares summaries of available data and the CIR Expert Panel reviews the data in open, public meetings. If more data are needed, requests are made. Unpublished studies may be provided, but become public and available for review once summarized in CIR safety assessments. Tentative conclusions are supported with a rationale and public comment is sought. Taking any input into consideration, a final safety assessment monograph is issued. These monographs are submitted for publication in the peer-reviewed International Journal of Toxicology. Hair dyes represent an important product category reviewed by CIR. In considering hair dyes, the CIR Expert Panel reviews experimental and clinical data specific to the particular chemical structure of each hair dye and reviews epidemiologic studies that address hair dye use that are less specific. CIR Expert Panel concluded that the available epidemiologic studies are insufficient to conclude there is a causal relationship between hair dye use and cancer and other end points. It is inevitable that new information will become available concerning ingredients for which safety assessments were completed in the early days of the program. To consider new data, the CIR Expert Panel has instituted a re-review program. Sodium lauryl sulfate (SLS), formaldehyde, and parabens are discussed as examples. Safety assessments currently underway are listed, along with high-priority ingredients from which new work will be chosen. Although supported by the cosmetics industry, the CIR program has remained independent in its decision making, based on its open, public process; the integrity of the expert panel members; the participation of the FDA and the CFA; and the cooperation of the cosmetics industry [10]. Over the years, some activist groups have targeted cosmetics as possible human health threats, claiming that cosmetic ingredients are not adequately tested for safety and may

pose risks to consumers. The groups allege that industry practices related to safety testing are flawed, that there is little government oversight, and that cosmetics contain cancer-causing chemicals and other toxicants. A critical review of the scientific data related to these claims indicates:

- Industry has the primary responsibility to ensure that all ingredients, preservatives, and co-formulants used in products are safe for their intended uses.
- The US FDA has regulatory oversight of the cosmetic industry. Its authority includes the banning or restriction of ingredients for safety reasons.
- The Cosmetic Ingredient Review (CIR), an independent, scientific review board, critically evaluates chemical ingredients used in cosmetics and publishes the results of its findings in the peer-reviewed literature.
- Health-related allegations about cosmetic ingredients are generally based on the results of high-dose laboratory testing in animals and have little relevance for humans. As true now as when Paracelsus said it in the 16th century, "It is the dose that makes the poison."
- Chemicals such as phthalates, parabens, bisphenol A (BPA) and triclosan (TCS), used in a wide variety of consumer products, are suspected endocrine disrupters although their level of toxicity is thought to be low. Combined exposure may occur through ingestion, inhalation and dermal exposure, and their toxic as well as combined effects are poorly understood.
- Animal and human physiology differs in crucial ways, further invalidating simplistic attempts to extrapolate rodent testing to human health risks.

The cosmetic industry should be encouraged to publish more of its toxicity studies and safety evaluations, which would aid in dispelling the uncertainty that some consumers have about cosmetic safety [21, 22]. Since the FDA does not specify acceptable levels, the cosmetic industry generally follows the guidelines of the Personal Care Products Council (PCPC) (formerly the Cosmetic, Toiletry, and Fragrance Association (CTFA)) regarding the level of microbial contamination and the absence of pathogens [52].

Exhibit 2. FDA in Action [44-51]

- Under a structure originally established in 1938 that places regulation of cosmetics under the Food and Drug Administration (FDA), cosmetics manufacturers in the United States are not required to register their products or forward consumer complaints to the FDA, leading to broad under-reporting of adverse events. The FDA has limited authority to mandate product recalls.
- In July 2018, Johnson & Johnson was ordered to pay a $4.96 billion settlement to 22 women who found asbestos in talc in baby powder caused their ovarian cancer.
- Guthy-Renker, the manufacturer of WEN hair products, settled a class-action lawsuit for $26 million after consumers said it caused rashes and hair loss.
- After decades of use in soaps, the FDA finally banned triclosan from soap in 2016 over concerns about its long-term safety and contribution to antibiotic-resistant bacteria. Unfortunately, it is still used in many products like toothpaste, mascara, and foundation.

Skin and other sensitivity issues of cosmetics

Human skin is the front line of defenses against external infectious or toxic substances, and is an environmental habitat that various microorganisms, including bacteria, fungi, yeasts, and viruses, can colonize. Human skin is a complex ecosystem with various microenvironmental conditions, and thus, skin microbial communities are very diverse and complex. Skin structures such as hair follicles, sebaceous glands, eccrine and apocrine sweat glands as well as subepidermal skin compartments, provide distinct biological niches that are colonized by their own unique skin microbiota. The current understanding is that most of these skin microbes are harmless or commensal organisms that play essential roles in inhibiting colonization by pathogenic microbes or modulating innate and adaptive immune systems [11]. Skin sensitivity is not the only issues with cosmetics. 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 but it remains on the market because the FDA is not authorized to recall cosmetics [12]. Sensitive skin is less tolerant to frequent and prolonged use of cosmetics and toiletries. It is self-diagnosed and typically unaccompanied by any obvious physical signs of irritation. With the change in lifestyle and also with increased opportunity to use many new brands of cosmetics and toiletries, there has been an increase in females complaining of unique sensation in their facial skin. Sensitive skin presents as smarting, burning, stinging, itching, and/or tight sensation in their facial skin. 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. Good numbers of invasive and non-invasive tests are designed to evaluate and predict the sensitive skin. Management includes guidelines for selecting suitable cosmetics and toiletries in sensitive skin individuals [13]. In Europe, 1% of the population is estimated to be allergic to fragrances and 2-3% to ingredients of cosmetics; 10% of outpatients patch-tested for cosmetics allergy were

found to be positive. Allergenic ingredients of cosmetics can be fragrances, hair dye, preservatives, antioxidants, emollients, surfactants, UV absorbers, pigments or resins used in nail cosmetics. Among standard allergen series, eight substances are related to cosmetics; in Japan in 2003, p-phenylenediamine (hair dyes) induced allergic reactions with the highest rate of 7.9% in outpatients' patch-tested. Cosmetic allergy symptoms tend to be mild except those caused by hair dye [42].

Natural Products for cosmetic uses

Some natural products have been shown to benefit the skin, especially for the restoration of skin barrier. Dead Sea mud and water, balneotherapeutic water preparations, deep sea sponges, milk, and pearl, for examples, have been used in ancient to modern formulations for topical application to provide healthy ageless skin. Results were not always well documented, but the effects have been observed and triggered many investigations. The Dead Sea, the deepest and most saline lake on earth, has been known from biblical times for its healing properties. The aim of this systematic review was to present critically the level of evidence for the claims of therapeutic effects of Dead Sea treatments in several rheumatologic diseases and psoriasis as well as to review these treatments' safety [14]. Among many components within these materials, calcium is one notable ingredient in common. Plants and natural products with skin-whitening effects are gaining interest among consumers and researchers because they are perceived to be milder, safer, and healthier than synthetic alternatives [15]. Biological activities of plants and natural extracts are therefore available for cosmetic formulators and dermatologists interested in naturally derived ingredients for skin hyperpigmentation treatment and in accordance with the consumers' preferences and expectations upon natural cosmetic products. Photoaging is a leading concern for patients and many of these patients will express a desire to utilize natural ingredients as treatment. Mushrooms, feverfew, green tea, licorice, olive oil, soy, and coffee berry have been shown to have antioxidant properties and may play a role in the treatment and prevention of photoaging [16]. Botanical compounds for which dermatologic and cosmetic applications have emerged include: olive oil, chamomile, colloidal oatmeal, oat kernel extract, feverfew, acai berry, coffee berry, curcumin, green tea, pomegranate, licorice, paper mulberry, arbutin, and soy. Many of these botanical sources offer biologically active components that require further in vitro and in vivo investigation regarding over-the-counter products based on these ingredients [17]. The natural baby skin-care products were well tolerated by infants and toddlers when used alone or as part of a skin-care regimen. Although traditional skin-cleansing, lotion, and shampoo products still comprise a large share of the personal care market, increasing numbers of consumers and health care professionals have begun scrutinizing products and product labels, which has created a sizeable market for products that contain natural ingredients. Immediately after birth, the skin barrier of healthy, full-term neonates is competent, yet skin-barrier function continues to develop through at least the first year of life. This developing state of infant skin results in infant skin being susceptible to dryness and irritation from external factors, such as cold weather and wind, as well as harsh topical skin-care products. Therefore, it is critical that infant cleansers and moisturizers be well tolerated and not disrupt the stratum corneum. Infant skin is also exposed to other factors, such as saliva, nasal secretions, urine, feces (including fecal enzymes), and dirt, which can be irritants and result in disruption of the skin barrier. As a result of normal daily exposure to these external factors, proper skin cleansing and protection of the infant skin barrier are essential to the maintenance of skin-barrier function [18]. Nutraceuticals represent a promising strategy for preventing, delaying, or minimizing premature ageing of the skin and also to alleviate certain skin disorders. Among them, bioactive peptides and oligosaccharides, plant polyphenols, carotenoids, vitamins and polyunsaturated fatty acids are the most widely used ingredients. Supplementation with these products has shown evidence of having an effect on the signs of ageing and protection against UV radiation ageing in several human trials [19]. Traditional formulation techniques have focused on creating the best performing products at the lowest cost. Little regard has been given to the source of the starting raw materials. However, issues of sustainability, consumer desires and regulatory pressures have led to the need for the development of cosmetics using primarily plant-based, renewable resourced raw materials. This presents a special challenge to formulators as the starting materials often do not work as well as traditional synthetic ingredients. Since the cosmetics and personal care industry is not regulated, various organizations have offered conflicting positions on standardized guidelines for natural and organic claims. To improve communication on this topic, it will therefore become important to dissociate claims regarding the naturalness of ingredients from the perception of safety. Safety is inherent in the raw materials used for formulating, regardless of their origin and in the synergies among ingredients—for more than 50 years, the industry has worked hard to monitor the safety of products on the market, supported by the US Food and Drug Administration (FDA). And recently, more governmental agencies such as the FDA, the US Department of Agriculture (USDA) and the Council of Europe's Committee of Experts on Cosmetic Products have taken a proactive role in sorting out the meanings of natural and organic for the cosmetics and personal care industry. Such organizations act as a clearer scientific focal point in deciding what ingredients are safe for use in cosmetic products. In addition, several organizations currently are monitoring the safety of

cosmetics and personal care ingredients, such as the Cosmetic Ingredient Review (CIR) panel [53].

Targeted cosmetics

Skin compartments traditionally targeted by cosmetic actives - epidermis and dermis - are anchored and nourished by the underlying hypodermis, which therefore should be a key target for skin-rejuvenating formulations. However, given the difficulty to reach even the superficial layers of the skin, and to its 'unglamorous' fatty composition, the regenerative potential of hypodermis remains largely untapped. Nutraceutical grade cosmetics have potential to induce signal transduction pathways in facial hypodermis, resulting in anti-aging effects throughout all skin compartments, including dermal and epidermal layers [20]. Skin whitening products are commercially available for cosmetic purposes in order to obtain a lighter skin appearance. They are also utilized for clinical treatment of pigmentary disorders such as melasma or post-inflammatory hyperpigmentation. Whitening agents act at various levels of melanin production in the skin. Many of them are known as competitive inhibitors of tyrosinase, the key enzyme in melanogenesis. Others inhibit the maturation of this enzyme or the transport of pigment granules (melanosomes) from melanocytes to surrounding keratinocytes. In the Western culture it is still considered desirable to obtain a (bronze) tan. Despite warnings about the consequences of excessive sun or UV exposure, the artificial tanning business has expanded strongly in the last decades. In the Eastern world, however, a centuries long tradition exists whereby a light complexion is regarded as equivalent to youth and beauty. Development of preparations for bleaching hyperpigmented lesions or to safely achieve overall whitening is one of the challenges for cosmetic industry. In recent years, the interest in skin whitening has grown tremendously [24]. It is estimated approximately 15% of the world population invest in skin whitening agents with Asia is being dominated. Global industry analysts (GIA) have predicted that the universal market for skin lighteners will reach $23 billion by 2020, driven by new markets in Asia, particularly India, Japan and China. According to the SIRONA biochem (a biotechnology company, Vancouver, British Columbia) report, approximately $13 billion spent on skin care products and cosmetics in Asia Pacific's. In India alone, it is estimated that $432 million was spent in 2010 on skin lightening creams and skin care agents. A recent survey showed that 80% of Indian men use fairness creams and the number of consumer's are growing 18% annually. The molecular mechanism of these skin lightening agents is to reduce the melanin, which is the main source of skin color [25, 26]. The number of patients that visit dermatologists with pigmentary disorders is significant. Patients are often overwhelmed with numerous over-the-counter skin lightening agents, many without clinical evidence of efficacy. Botanical and natural ingredients have become popular as depigmenting products and provide an alternative to the current gold standard, hydroquinone. Despite the need for more long-term, well-designed, randomized, controlled studies, several botanical and natural ingredients do show initial promise in treating disorders of hyperpigmentation based on the results of clinical trials. These ingredients are AA, soy, lignin peroxidase, ascorbic acid iontophoresis, arbutin, ellagic acid, licorice extracts, niacinamide, and mulberry. In addition to showing promise in treating hyperpigmentation, these agents also provide greater insight into the pathogenesis of dyschromia, thus enhancing our understanding of the many complexities of pigment disorders [27]. Cellulite is a serious cosmetic concern for most of the 90% of women affected by it. The phenomenon is most commonly seen on hips, buttocks, and thighs but can also touch other areas, including the abdomen. Up to 90% of woman, over 20 years of age, are affected at various degrees, against only 2% of men. Cellulite is seen as a normal condition by the medical community, but it is a serious cosmetic concern for most women affected by it. It is a complex phenomenon that requires a complex approach, and it is likely that no single ingredient is solely responsible for the benefits reported. Some disorders have also been associated with cellulite, such as venous insufficiency, kidney problems, metabolic perturbations, and gastrointestinal alterations [28]. Many cosmetic products are available in spray form. Even though the principal targets of these products are the skin and hair, spraying leads to the partitioning of the product between the target and the surrounding air [30]. Aluminium chlorohydrate and aluminium zirkonium tetrachlorohydrate glycine complex are the most frequently used active ingredients in commercial antitranspirants today. Aluminium chloride and propantheline bromide, the anticholinergic substance, are important alternatives although less common. Active ingredients of deodorants are mainly perfuming or bactericidal/bacteriostatic substances, such as triclosan. In addition, there are substances which are meant to bind offending smells (e.g. zinc ricinoleate) or to influence the skin surface pH (e.g. triethyl citrate) [31]. A shampoo not only provides the cleaning of the scalp skin and hair as its primary function, but in addition also serves to condition and beautify hair and acts as an adjunct in the management of various scalp disorders. To achieve this, various ingredients in the correct proportion are mixed to provide a shampoo which is suitable for individuals having different hair types and hair need. Among the ingredients that go into the making of a shampoo are detergents, conditioners, thickeners, sequestering agents, pH adjusters, preservatives and specialty additives. Hair conditioners are designed to improve hair manageability, decrease hair static electricity and add luster. They are used in several ways depending upon the state of hair and requirement of the individual [32]. In the 2000s, nail polish manufacturers started promoting "3-Free" products, phasing out three widely

publicized toxic chemicals: toluene, formaldehyde, and dibutyl phthalate (DnBP). However, DnBP was sometimes replaced by another endocrine-disrupting plasticizer, triphenyl phosphate (TPHP). Many new "n-Free" labels have since appeared, without any standardization on which n chemicals are excluded. This study aimed to compare measured plasticizer content against nail polish labels. The limited regulation of ingredients in nail polish may leave nail polish users and nail salon workers vulnerable. Consumers that use nail polish mostly consist of women, often of child-bearing age, and even children. Market research suggests that consumers apply nail polish two to six times per month on average, or as much as once per day [33]. Lipsticks may not only increase the contrast between lips and facial skin but may also influence perceived lightness of skin. Therefore, it would be both scientifically interesting and beneficial for practical purposes to test the effect of lip color on facial skin's perceived lightness. Kobayashi *et al*. 2017 reviewed that lip color was assimilated into facial skin's perceived color. For example, they found that orange lip color makes facial skin appear yellowish, and reddish lip color makes facial skin appear reddish and lighter [37]. Acceptable lipstick for the consumers should have a suitable texture and spreadability. Descriptive sensory profiling is an essential tool in this process as it allows an experienced panel to assess the qualitative and quantitative characteristics of a product [38].

Cosmetics Vehicles

Consumers will pay a premium for high-performance skin and hair care products. The demand exists, and in return for the high cost, consumers expect the product to perform as claimed and to meet aesthetic standards beyond many products found in the mass market. To be successful in this highly competitive market, products must function as claimed or consumers will not repurchase. Effective contemporary high-end products must be properly formulated in nonirritating vehicles that consumers will perceive as elegant [40]. Cosmetic products mean any substance or mixture intended to be placed in contact with the external parts of the human body (eg, epidermis, lips) and should not pass to the lower parts and penetrate to the skin [41]. In cosmetics, the term "active ingredient" is a marketing term for an ingredient that people believe has some effect but is not legally allowed to. For example, some marketers say Vitamin C is an active ingredient for skin lightening. While there may be some lab studies to show this ingredient may have an effect it is not an approved ingredient for skin lightening, so it's not really an active ingredient. In fact, if it had an effect on skin like that it would be a mislabeled drug. Basically, there is no such thing as an active ingredient in cosmetics. If a product has an active ingredient, it is a drug. Functional cosmetic ingredients are those whose main purpose in the formula is to deliver a benefit to a consumer. They may have some secondary effect of improving the feel of the product when it's applied or stabilizing the formula but the primary reason, they are added is for the effect they have on skin or hair [43]. Cosmetic surfactant performs detergency, wetting, and emulsifying, solubilizing, dispersing and foaming effects. Adverse reactions of chemical synthesis surfactant have an effect on environment and humans, particularly severe in long term. Biodegradability, low toxicity and ecological acceptability which are the benefits of naturally derived surfactant that promises cosmetic safety are, therefore, highly on demand. Biosurfactant producible from microorganisms exhibiting potential surface properties suitable for cosmetic applications especially incorporate with their biological activities. Sophorolipids, rhamnolipids and mannosylerythritol lipids are the most widely used glycolipids biosurfactant in cosmetics. Indeed, many of these biosurfactants could exhibit a "prebiotic" character [54,55]. In addition to their surfactant capacity, many biosurfactants can act as good emulsifiers, which is an extra advantage in the preparation of green cosmetic products. In this work, a biosurfactant obtained from *Lactobacillus paracasei* was used as a stabilizing agent in oil-in-water emulsions containing essential oils and natural antioxidant extract [56]. Surface-active polysaccharides typically have to be used at relatively high levels to produce small droplets, but the droplets formed are highly resistant to environmental changes. Conversely, surface-active proteins are typically utilized at low levels, but the droplets formed are highly sensitive to changes in pH, ionic strength, and temperature. Certain phospholipids are capable of producing small oil droplets during homogenization, but again the droplets formed are highly sensitive to changes in environmental conditions. Biosurfactants (saponins) can be utilized at low levels to form fine oil droplets that remain stable over a range of environmental conditions. Some nature-derived nanoparticles (e.g., cellulose, chitosan, and starch) are effective at stabilizing emulsions containing relatively large oil droplets. Future research is encouraged to identify, isolate, purify, and characterize new types of natural emulsifier, and to test their efficacy in food, cosmetic, detergent, personal care, and other products [57].

Cosmetics Regulations

The regulatory framework, compliance requirement, efficacy, safety, and marketing of cosmetic products are considered the most important factors for growth of the cosmetic industry. The two most important laws pertaining to cosmetics marketed in the United States are the Federal Food, Drug, and Cosmetic Act (FD&C Act) and the Fair Packaging and Labeling Act (FPLA). FDA regulates cosmetics under the authority of these laws. In the United States, federal laws are enacted by Congress. In order to make the laws work on a day-to-day level, Congress authorizes certain government agencies. Such as FDA, to create regulations, A change in FDA's legal authority over

cosmetics would require Congress to change the law [58].There are different regulatory bodies across the globe that have their own insights for regulation; moreover, governments such as the United States, European Union, and Japan follow a stringent regulatory framework, whereas cosmetics are not so much strictly regulated in countries such as India, Brazil, and China [59]. The alignment of a regulatory framework will play a significant role in the removal of barriers to trade, growth of market at an international level, innovation in the development and presentation of new products, and most importantly safety and efficacy of the marketed products. Unfortunately, despite the efforts of European Authorities, the current legislation is still stratified and several criticisms remain because of the lack of well-established scientific knowledge on nanomaterials. Although the regulatory framework for cosmetic products is almost complete, the efficacy and/or safety assessment of nanomaterials in medicinal products and medical devices is still based on case-by-case evaluation because of the complexity of such systems [60]. The United States (U.S.) and European Union (EU) share a common goal of ensuring the safety of cosmetics for consumers through rigorous science-based regulation. The manner by which each regulates the safety of cosmetics is quite similar. The present contribution gives insight into the important cosmetic regulations in areas of premarket approval, ingredient control, and labeling and warnings, with a special focus on the cosmetic regulatory environments in the United States, European Union, Japan, and India. The European Union's framework of chemical and cosmetics regulations are binding on all Member States Regulations and are enforced at the national level. Under the EU Commission, Regulation (EC) No. 1223/2009 is the key European legislation governing finished cosmetics products in the EU Each country in the EU has a competent authority that is responsible for upholding compliance [59], [61]. In India, cosmetics are regulated as per Drugs and Cosmetics Act 1940 and Rules 1945. Part-XIII (regulates import and registration of cosmetics), part-XIV (manufacture of cosmetic for sale or for distribution) and part-XV (regulates labelling, packing and standards of cosmetics) [62]. In Japan, cosmetics are regulated by the Ministry of Health, Labor, and Welfare (MHLW) under the Pharmaceutical Affairs Law (PAL). For legal reasons, cosmetics are divided into quasi-drugs and cosmetics [63]. In Australia, the importation, manufacture and use of chemicals—including those used in cosmetics—are regulated by the Australian Government's National Industrial Chemicals Notification and Assessment Scheme (NICNAS). NICNAS works to ensure that chemicals used in consumer products do not cause significant harm to users or to the environment [65].

Epilogue

Civilizations have used cosmetics – though not always recognizable compared to today's advanced products – for centuries in religious rituals, to enhance beauty, and to promote good health. Cosmetics usage throughout history can be indicative of a civilization's practical concerns, such as protection from the sun, indication of class, or conventions of beauty. People use cosmetics to keep clean and enhance their beauty. These products range from lipstick and nail polish to deodorant, perfume, hairspray, shampoo, shower gel, tattoos, hair adhesives, hair removal products, hair dyes, most soaps, some tooth whiteners, and some cleansing wipes. Physical appearance is an integral component of self-presentation in all social situations, including that of applying for a job. Cosmetics contain a vast number of chemicals, most of which are not under the regulatory purview of the Food and Drug Administration. Only a few of these chemicals have been evaluated for potential deleterious health impact: parabens, phthalates, polycyclic aromatic hydrocarbons, and siloxanes. While the current scientific thinking on many of these chemicals is that they are safe to use, it is up to each consumer to make their own decision as to whether they purchase and use a product containing certain ingredients or not. Consumers should also try to purchase reputable brands from established sellers—cheap imports or copies bought online may not have been through the proper testing and assessment process and may not contain what they claim to.

Article Summary

Cosmetology incorporates the most advanced scientific knowledge and technology including chemistry, pharmacology, molecular biology, genetic/new materials engineering, immunology, and neurology, etc. Cosmetics are readily available today in the form of creams, lipstick, perfumes, eye shadows, nail polishes, hair sprays etc. Other cosmetics like face powder give glow to the skin after applying the base cream. Cosmetic ingredients/excipients are incorporated to obtain detergency, wetting, and emulsifying, staining and soothing effects. Adverse reactions of chemicals have effects on environment and humans, particularly severe in long term. Many cosmetics have therapeutic effects in use. Again, different population has different profile of cosmetics use. As a consequence of this increasing application of science to beauty, the line between cosmetic and medical research is becoming blurred; the laboratories of major cosmetic companies perform cutting-edge research in areas such as matrix biology, antioxidants and ageing processes. Proper rules and regulation should be imposed on their manufacturing, marketing and distributions along with pricing.

Abbreviations: The Cosmetic Ingredient Review (CIR); Consumer Federation of America (CFA); Sodium lauryl sulfate (SLS); Global industry analysts (GIA); dibutyl phthalate (DnBP); triphenyl phosphate (TPHP); N-nitrosodiethanolamine (NDELA); Ministry of Health, Labor, and Welfare (MHLW); Pharmaceutical Affairs Law (PAL); National Industrial Chemicals Notification and Assessment Scheme

(NICNAS), Water, Sanitation, And Hygiene (WASH), High Density Polyethylene (HDPE)

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