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SUBJECT NAME:COSMETIC SCIENCE

SUBJECT CODE: BP809TP

UNIT I: Classification of cosmetic and cosmeceutical product

A. Based on widely used body parts

- Hair cosmetics
- Face cosmetics
- Eye make up
- Nail cosmetics
- Skin cosmetics
- Lip decorators

B. Based on physical form

Emulsion: Cold cream, vanishing creamPowders: Face powder, talcum powder, tooth powder

Sticks: Lipsticks, deodorant sticks

Oils: Hair oils

Jellies: Hand jellies Paste: Toothpaste, deodorant paste

Soap: Shampoo, Shaving soap

Solution: After shave solution Aerosol: After shave spray

C Based on their function

- Skin whitening and/or depigmenting cosmeceuticals
- Moisturizing cosmeceuticals
- Antiwrinkle cosmeceuticals
- Sunscreen cosmeceuticals
- Anti Photoaging cosmeceuticals

D. Based on various products presently in the market

- Antioxidants
- Growth factors
- Peptides Metals
- Anti Inflammatories/botanicals
- Polysaccharides
- Pigment Lightening agents

E. Based on colour cosmetics

Lip makeup products:

- Lipstick,

- lip gloss,
- lip balm, and
- lip liner

Eye makeup products:

- Mascara,
- eye liner,
- eye shadow,
- eye makeup

Facial make-up products:

- Facial foundation,
- blush,
- concealer
- remover

Nail care products:

- Nail polish,
- nail hardener,
- nail moisturizer,
- cuticle remover.
- artificial nail,
- nail polish remover

F. Based on personal care products

Skin care products:

- Cleansers,
- Moisturizers,
- products for special skin concerns,
- sunscreens,
- deodorants and
- antiperspirants

Hair care products:

- Shampoo,
- conditioners,
- styling products,

- permanent waving and
- straightening products

Oral and dental care products:

- Toothpaste,
- mouthwash, and
- dental floss

Other products:

- Hair removal,
- baby care products,
- sunless tanners,
- feminine
- hygiene products

1.4 COSMETIC AS PER INDIAN REGULATIONS

As per section 3(aaa) of the drugs and cosmetics act 1940 and rules 1945 **cosmetic means** any article intended to be rubbed,poured, sprinkled or sprayed on, or introduced into or otherwise applied to the human body or any part thereof for cleansing, beautifying. promoting attractiveness or altering the appearance and includes any article intended for use as a component of cosmetics.

1.5 COSMETIC AS PER EUROPEAN UNION REGULATIONS

The European Union (EU) cosmetics directive **defines a cosmetic as** "any substance or preparation intended to be placed in contact with the various external parts of the human body (epidermis, hair system, nails, lips and external genital organs) or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly to cleaning them, perfuming them, changing their appearance and/or correcting body odors and/or protecting them or keeping them in good condition.

The European Union requires that cosmetic products placed on the EU market be safe, that is, they must not cause damage to human health when applied under normal or reasonably foreseeable conditions of use. Manufacturers are responsible for ensuring that cosmetic products comply with the law before they are marketed.

The manufacturer or importer of cosmetics is responsible for demonstrating that the product is safe for its intended use. Regulations are enforced at the national level and

each country in the EU has an authoritative body that is responsible for upholding compliance.

1.6 EVOLUTION OF COSMECEUTICALS FROM COSMETICS

Cosmetics were an inherent part of Egyptian hygiene and health. Oils and creams were used for protection against the hot Egyptian sun and dry winds. **Myrrh,thyme, marjoram, chamomile, lavender, lily, peppermint rosemary, cedar, rose, aloe, olive oil, sesame oil and almond oil** provided the basic ingredients of most perfumes that were used in religious ritual and embalming the dead.

The ancient Egyptians took great pride in their appearance and cleanliness. Most Egyptians bathed daily in the river or out of a water basin at home. Wealthy homes had a bathroom where servants would pour jugs of water over master (equivalent to a modern day shower). The runoff was drained through a pipe to w the garden.

A cleansing cream made of animal or vegetable oil mixed with powdered lime and perf was used instead of soap. People rub themselves daily with perfumed unguent oil that has been soaked in scented wood. The mixture was left in a pot until the oil absorber wood scent. Perfumed Oil was used to prevent the skin from drying out in theharsh clir. At parties servants would place a cone of perfumed grease on the head of each e Thegrease had a cooling effect as it melted and ran down the faces of each guest.

Ever regardless of age or gender wore makeup. Highly polished silver and copper mirrors the application of makeup. Smell was incomprehensibly fundamental in Egyptian society perfumery began as a secret art in Egypt that was perfected by 2500 BC. Few evidence of cosmetic usage have been found in Chinaaround 3000 BC. Chinese people began to fingernails with **gum Arabic, gelatin, beeswax and egg**. The Colors used repres social class.

The Chou dynasty royals were gold and silver and later royals wore black or TheChinese used one word to represent perfume, incense and fragrance. That word is heang.

Heang was divided into six aesthetic moods:

- Tranquil,
- reclusive,
- Luxu
- beautiful
- refined
- or noble.

Their bodies,baths, clothing, homes and temples were all scented, as was ink, paper, cosmetics and sachets tucked into their garments. China imports jasmine-scented sesame oil from India, Persian rosewater via the silk route eventually, Indonesian aromatics-cloves, gum benzoin, ginger, nutmeg and patchouli th India.

The famous **Materia MedicaPen Ts'ao** was published in China during the century. It Discusses almost 2000 herbs and contains a separate section on 20 essentia Jasmine was used as a general tonic, rose improved digestion, liver and blood, chan reduce headaches, dizziness and colds ginger treated coughs and malaria. Henna has been used in India since around the 4th or 5th centuries. It is used either as a hair dye or in mehndi, in which complex designs are painted on to the hands and feet, especially b Hindu weddings.

Henna is also used in some North African cultures. African henna designs tend to be and Indian designs more complex. India was famous in the earlier days for using similar to the modern scents marketed by various companies but was in a concentrate These were made from various Indian flowers fragrances. These are popular during festive occasions. The use of kohl or kajal has a long history in the Hinducultu use of traditional preparations of kohl on children and adults was considered to have benefits, although in the United States, it has been linked to lead poisoning and is pro Cosmetic deodorant was invented in 1888 by an unknown inventor from Philadelp was trademarked under the name Mumm.

During the early years of the 20th century makeup became fashionable in the United States of Americaand Europe owing to the influence of ballet and theatre stars. But the most influential new development of all wasthat of the movie industry in Hollywood. In 1900 blackentrepreneur Annie Turnbo began selling hair treatments including non damaging hair straighteners, hair growers and hair conditioners door-to-door.

In Los Angeles, Max Factorstarted selling makeup to movie stars in 1904 that did not cake or crack. Modern synthetic hair dye was invented in 1907 by Eugene Schueller founder of L'Oréal. He also invented sunscreen in 1936. In 1914, T. J. Williams founded Maybelline, the specialized mascara manufacturing company. In 1961 the term cosmeceuticals was coined by Raymond Reed, founding member of the United States society of cosmetic chemists.

Albert Kligman in 1971 developed a formula to improve the appearance of UV damaged and wrinkled skin using retinoic acid thereby reactivated interest of the people in cosmeceuticals.World renowned dermatologist Dr. Kligman made a long lasting contribution to the world of skincare by discovering that topical retinoic acid (or tretinoin) can be used for both an acne and wrinkle treatment. Kligman may be described as the father of cosmeceuticals, a term he popularized but cosmeceuticals first appeared in the world market in 1996,

1.7 COSMETICS AS QUASI DRUGS

In Japan Cosmetics are regulated by the ministry of health, labour and welfare (MHLW) under the pharmaceutical affairs law (PAL). For legal purposes beauty products are divided into quasi-drugs and cosmetics, Japan accommodates cosmeceuticals by calling quasi-drugs. These are products that exert mild actions on the human body. The ingredients included in quasi drugs must be pre approved before being marketed in Japan.
All products claiming to be cosmeceuticals are considered quasi drugs and require pre approval before selling in market. Their regulations differ slightly but the difference between cosmetics and quasi drugs remains ambiguous.

In practice, this distinction is made based on differences in the effects assigned to each product. The distinction is also influenced by a set of criteria, such as the **nature and the quantity of ingredients used, application method, dosage, and appearance of the product**. The pharmaceutical affairs law defines quasi-drugas an item for the purpose of

a. Preventing nausea and other discomfort
b. Preventing heat rash, soreness, etc.
C Encouraging hair growth or removing hair
d. Exterminating and preventing mice, flies, mosquitoes, fleas, etc.

Among the quasi-drugs are **deodorants, depilatories, hair growth treatments, hair dyes, perm and straightening products, as well as medicated cosmetics, such as whitening products, anti-aging products and oily skin or acne treatment products**.

Besides, the item shall have mild effects on the human body, shall not be a utensil or device, and shall be designated by the MHLW based on these characteristics. The approval for primary distribution is not always necessary for cosmetics; however, this pre approval is mandatory in the case of quasi-drugs because they contain active ingredients that need to be appre by the MHLW.

Pre approval is granted by the competent authorities if they judge that product answered all sanitary requirements. Items such as formula, manufacturing method application method and claimed effects are checked on this occasion. Having an active ingredient approved by the MHLW allows the product to display its effectiveness for results that have yet to be recognized. This allows companies to indicate that the produce is medicated. This process takes approximately six month for the MHLW to carry out the appropriate examination

In Japan, sunscreens are classified as quasi-drugs, therefore, they require approval of their formulations, ingredients, use levels and functionalities, in addition to stability testing and a certificate showing no animal derived materials were used. Product evaluations should be based on 150 24442 in vivo testing and labeling. Also, an SPF of 50+, corresponding to PA+++, is the maximum level allowed on the label. The importation of quasi-drugs is much more expensive than cosmetics, the whole price,

including the various tests, notifications, approbations and so on. could be as high as a few million JPY (tens of thousands euros).

Figurel.1: The two legal categories of personal care products in the US

Table1.1 summarizes the legal distinction between a cosmetic and a quasi drug. Comprehensive manufacturing and sales approval are required for both items. For quasi drug manufacturing, sales and formulation of ingredients in each item are subject to the requirement of the Japanese ministry of health, labour and welfare.

Table 1.1: Regulation for cosmetic or quasi

Regulations	Cosmetics	Quasi drugs
Approval for manufacturing and sales	Required	Required
Approval for manufacturing and item	Not required	required
Approval for ingredients	Not required (Excluding UV filters,preservative, tar colorants etc)	required (Excluding previously approved ingredients)
Ingredients labeling	Required for all ingredients	Required specified ingredients (Japan voluntary standards required for all ingredients)

1.8 COSMETICS AS OTC DRUGS

When producing a cream or lotion if you add an active ingredient or make a drug claim and the intended use is to provide a physiological benefit beyond a purely cosmetic effect, it is considered an OTC (over the counter) product. There are products which are cosmetic products containing drug ingredients (cosmetic drugs) and as such, fall into both definitions; cosmetics and drugs.

There are products that have multiple effects (cosmetic and pharmacological) and are cosmetic products that contain active pharmaceutical ingredients that have a pharmacological effect.

For example, an anti-dandruff shampoo is a cosmetic and pharmacological (drug) product because it is being used to clean the hair as well as to treat dandruff. Additional combinations of cosmetic and drug products are toothpastes to prevent cavities, chap-sticks intended to heal, antiperspirant deodorants, moisteners, suntan lotions claiming sun protection factors (SPF), medicated shampoos and soaps for dry skin, dry scalp or dandruff, anti-aging facial creams.

Cosmetics drugs and OTC products require FDA premarket approval via new drug application (NDA) procedure or conform to a monograph as specified by FDA's OTC drug review. These monographs define the analysis process of OTC drug ingredients which will be identified for assuring safe and effective and not misbranded cosmetic OTC products.

You will need to assure OTC drug monograph compliance for more than just your product labeling. The manufacturer will need to provide testing of the active ingredients, stability data, good manufacturing practice (GMP) compliance and process validation as well as FDA facility and product registrations. Cosmetics products are not subject to the same regulation efforts, complexity, time, registration and approval as drugs products.

Moreover, cosmetics products manufactured in general and cosmetics OTC products manufactured in particular, will need to upgrade their manufacturing facility, quality assurance and documentation system, machinery and in addition to adopt good manufacturing, storage, engineering practices and validations in order to register the facility and enter the cosmetics drugs combination products.

As part of the cosmetic drug and OTC products manufacturers will have to report their products adverse effects to the FDA. The FD&C act (federal food, drug and cosmetics act) restricted adulterated and /or misbranded cosmetic products and strongly recommends to follow GMP standards, self and/or external inspections and audits in addition to an effective quality system, in order to minimize these kind of risks and to

assure cosmetic products meet the quality and their intended use consistently. According to the FD&C act cosmetic products do not require FDA approval before marketing, unless they contain color additives or may contain restricted ingredients. Drugs, however, require registration in the US including new drug application submission to the FDA. Cosmetic-drug combination products are subjected to cosmetic and drug FDA regulation and should comply with OTC and drug-cosmetic labeling requirements.

The determination of whether a cosmetic is also a drug and therefore subject to the additional statutory requirements that apply to drugs is based on the distributor's intent or the intended use. The intended use of a product may be established in several ways

such as claims on product labeling or in advertising /promotional materials or through the inclusion of ingredients that will cause the product to be considered a drug because of a known

therapeutic use The FDA has published several OTC categories monographs of nonprescription drugs treatments such as acne, dandruff, seborrheic dermatitis, psoriasis medications and sunscreens. Cosmetic products formulation registration is not mandatory but for cosmetic OTC products manufacturers are obligated to register their drug products (FDA) including drug active material being added to the cosmetic product.

Cosmetic products manufacturers are solely responsible for both ingredients and finished cosmetic products safety before marketing. Ingredients safety can be tested on several animal models using the cosmetic ingredients and monitoring irritation (skin, eye), allergic and toxicity following ingredients exposure in order to prove the cosmetic product is safe for use.

Cosmetic drug and OTC products should be manufactured in a facility that complies with all current good manufacturing practices. The facility should be designed according to GMP standards including proper construction material and facility design.

OTC drug products monographs will include information to be labeled on the product package in order to assure the product will not be misbranded. Label will contain a drug facts panel such as a list of active ingredients, Drug purposes, uses and applicable warnings, directions, inactive ingredients, consumer service telephone number and other relevant information.

1.9 COSMETIC EXCIPIENTS

Focusing on their primary purpose for being in the formula makes the most sense. This isn't perfect, since some ingredients have multiple functions but it provides a good framework for the discussion. Basically, there are three reasons to use an ingredient in a formula, **functionality, aesthetics and marketing**. Functional ingredients provide the primary benefit to consumers who use the product. These are the ingredients that clean the **skin condition hair, and provide moisturization or even color.** They are also the so-called active ingredients that make over-the-counter drugs work.
The problem with many functional ingredients is that they do not feel nice or apply well on their own. They may even smell bad. Aesthetic ingredients are technologies that make formulas look and feel better, they improve the overall experience of using cosmetics,

Marketing ingredients are ingredients that are not expected to do anything in the formulation but are added specifically to **help support the marketing story** Such ingredients are important, since they often provide the entire **reason for purchasing a product** but they are **not actually expected to have a significant impact** on the formula's performance.

For example, consumers prefer to buy moisturizing products with **aloe vera** rather than **petrolatum** even though the latter is the ingredient that actually provides the benefit. The cosmetic ingredients that have the most impact on the way cosmetics work are the functional ingredients. These include:

- **Surfactants**
- **Rheology modifiers**
- **Humectants**
- **Emollients**
- **Preservatives**

19.1 SURFACTANTS

Surfactants can be grouped by the charge characteristic of their polar (hydrophilic) head groups. The four groups includes,

A) Anionic Surfactants

These surfactants have good foaming property hence they are used as principal surfactant.They are considered as main ingredient of shampoo formulation Examples of anionic surfactants:

i) Alkyl Sulphates

When fatty acids are subjected to catalytic reduction, it results in information of long chain sulfated derivatives called alkyl sulphates. **(example: lauryl sulphate, myristyl sulphate).**
A combination of above two compounds is most widely used because they give foam. Sulphates with lauryl chains are widely used when compared to octyl decyl chain.Previously, sodium lauryl sulphate was used but now triethanolamine lauryl sulphate is widely used.

ii) Alkyl polyethylene Glycol Sulphates

These anionic surfactants exhibit good cleaning as well as good foaming property. They are alkyl ether sulphate which forms water soluble sodium salt. Solubility of this salt is greater than sodium lauryl sulphate, hence also serves as a solvent for nonpolar ingredients. Because of low cost they are widely used by small manufacturers.

iii) Alkyl Benzene Sulphonates

These surfactants are most widely used in the preparation of washing powder but not in cosmetics (ie. shampoo). Because they cause excessive cleaning this may lead to damage of scalp and hair. They may also lead to hair fall and skin irritation. Although they have deleterious effects, they used for cleaning of greasy hair

iv) α- Olefin Sulphate

It is an alkyl sulfonate obtained by sulfonation of linear olefin. It Produces excellent foam and the property of foaming is unaffected by sebum and hard water. It produces a mild detergent effect without harming the scalp. It is stable at both acid and basic pH and widely used to prepare low pH shampoo. It has a low cloud point hence also used to prepare clear liquid shampoo. Apart from the above, other anionic surfactants such as sulfosuccinates,Acyl lactylates are also used.

B) Nonionic Surfactant

These are considered as secondary surfactants. They are not used to produce foam but used as foam boosters, viscosity inducers, emulsion stabilizers and pacifiers. This is because they have less foaming power. Even though they have good cleaning properties, they are not used as principal surfactant.

Examples of non-ionic surfactants:

i) Poly Alkoxylated Derivatives

These are ethoxylated alcohols and phenols, block polymers, sorbitol ester (polyethoxylated) and polyglyceryl ethers. These derivatives are obtained when hydrogen (labile) containing hydrophobic compounds is subjected to polyaddition reaction with either ethylene or propylene oxide. They are stable at a wide range ofpH. They have stabilizing, emulsifying. pearlescent and foaming properties. They are available at low cost and cause irritation to eye mucosa. However, they are used as mild detergents and impart a good rinsing property.They can also be used in high concentration.

ii) Fatty Acid alkanolamides

These include mono alkanolamides and ethanolamines etc. Mono Alkanolamides are made from long chain fatty acids (ie C14-C16). They are insoluble in water due to their waxy nature. Hence they are added directly to detergent solution and dissolved by gentle warming. The detergent solution is made by using principle surfactant to which various ethanolamides are added to serve as.

- **Solubilising agent:** Example: Lauric monoethanolamide,
- **Viscosity inducing agent:** Example: Lauric monoethanolamide
- **Pearlescent and thickening agent** Example: Stearic ethanolamide
- **Softening and hair conditioning agent:** Example: Oleic ethanolamide
- **Foam boosters**

However, the ratio of detergent solution to the monoethanolamide must be 100:15 and above this ratio may be harmful to scalp and hair. Whereas ethanolamides are available as low melting point solids or even as simple liquids. They are used as powerful solubilizing agents. They solubilize the shampoo ingredients rapidly and more efficiently compared to mono ethanolamides. The shampoos containing high soap content and free ethanolamides must be used with precautions.

iii) Amine Oxides

Amine oxides are obtained by the oxidation of tertiary aliphatic amine with hydrogen peroxide. These compounds possess strong polar linkage between nitrogen and oxygen hence they are also called as polar non-ionic surfactants. They constitute a major group of synthetic surfactants. They are water soluble and compatible with various surfactants. They are added as secondary surfactants because of their conditioning, damboosting and anti static property. Coconut and dodecyl dimethyl amine oxides are most commonly used for this purpose.

C) Cationic Surfactants

Surfactants that contain positive charge are called cationic surfactants. They are used as both principal and secondary surfactants. These surfactants are used in low concentrations because they are toxic to the eye. Hence, they are considered as secondary surfactants. Apart from the above toxic effect, they also have good foaming and partly cleaning properties. Hence, they are also used as principle surfactants in conditioner shampoos.

Examples of cationic surfactants:

i) Alkylamines

They constitute a major group of cationic surfactants. They are used in combination with hydrophilic surfactants in order to provide conditioning and anti-static property to the shampoo. However they precipitate when combined with anionic surfactants. Usually they are used in the form of water soluble salts.

ii)Ethoxylated amines

These are nitrogen containing surfactants which are obtained by ethoxylation of long chain alkylamine. They are waxy in nature with low melting point. Because of their waxy nature. They are also used as viscosity inducers. However their main function is emulsification and hair conditioning. Sometimes they are also used as foam boosters. Due to their emulsifying property, complete dispersion of various ingredients is achieved.

iii) Alkyl-Betaines

These classes of cationic surfactants are obtained from N Dimethylglycine. They are readily compatible with majority of surfactants and have following properties

- Enhance the efficiency of foam. Example: foam booster.
- Contain conditioning and anti-static property Have viscosity inducing property
- Possess good stability Non irritant to skin and eye.

Based on the above properties alkyl betaines are considered as secondary surfactants. They Are also used as principal surfactants in baby shampoo and are often used in combination with ionic surfactants. Apart from the above various other cationic surfactants like imidazolines and morpholine derivatives, tetra alkyl ammonium salts are also used.

D) Amphoteric Surfactants

The surfactants which possess both cationic and anionic charges with respect to acidic and basic media are called amphoteric solvents. They form zwitterions when the pH of media is neutral These agents produce a mild action and show compatibility with surfactants. They have excellent hair conditioning properties and hence used as secondary surfactants.

Examples of amphoteric surfactants are:

i) Dialkyl Ethylene Diamines

These surfactants are soluble in water and compatible with surfactants. They are used as detergents and to a lesser extent as emulsifiers. They are usually prepared as aqueous solution or paste into which remaining shampoo ingredients are added. These agents are combined with anionic surfactants in order to minimize the irritation caused by them. These agents either enhance or inhibit the foaming property of the principle surfactant.

They are most widely used as an anti-irritating agent when anionic compounds are used as principal surfactants as anionic surfactants are irritant to the eye. These agents also possess conditioner and anti-static properties as a result of which the hair becomes smooth and soft.However, the pH of the shampoo prepared by using these surfactants must be neutral (65 to 7.5).

i) N-alkyl Amino Acids

The important compounds of this class are derived from aminoacids and asparagine. It exhibits good foaming property, possesses slightly alkaline pH by changing the pH to acidic range and the manageability of hair is improved.

The derivatives of asparagine are well compatible with both anionic and cationic surfactants. It also possesses properties like foaming, cleaning and conditioning.

Depending upon the pH, these compounds change their nature Le., they become zwitterions at pH 6 and at neutral pH, they become amine. Solubility of N-alkyl amino acids is greater than they are in the form of sodium salts, whereas the solubility decreases with zwitter ionic form. The foaming property of these agents decreases with decrease in pH. This is because at low plAte beconvecarionated (cationic form), These agents are highly stable and sometimes also employed as emulsifiers.

APPLICATIONS OF SURFACTANTS

1. Detergency

One of the most common applications of surfactants in cosmetics is for cleansing formulations. When skin and hair get dirty there are really two types of dirt, solid particulates and oily deposits. The oily deposits come from natural sebum which is produced in the hair follicles. Solid particulates are just naturally picked up from the environment. They remain on hair and skin via Van der Waals forces. Although running the surface with water can remove some of the dirt, oily deposits will tend to adhere to the more lipophilic surfaces of hair and skin.

Surfactants in detergent help get rid of these olly deposits. The lipophilic ends of the molecules are attracted to and align with the lipids on the surface of hair and skin. Meanwhile, the hydrophilic ends of the molecules align toward the surface of these deposits, thereby increasing the hydrophilicity. That allows the lipid deposits to lift off the surface of skin or hair where the rinse water washes them away

2 Wetting

Surfactants also act as wetting agents and this property allows surfactants to spread more easily on the surface and inject themselves between the oily deposit and the skin or hair surface. This lifts up the oil and allows it to be removed. Wetting also makes the product easier to spread and prevents it from balling up on the surface. This is useful in cosmetic creams and lotions.

3. Foam

Foam is an important characteristic of cleansing cosmetics. It is formed when air is dispersed in a continuous liquid medium. The air bubbles are surrounded by thin layers of liquid and the surfactants help stabilize the bubbles that are formed creating foam. It's important to note that foarn doesn't really contribute much to the removal of dirt but consumers like it, so it's very important for a cleansing product to foam Surfactants also have a slightly different role in a mouthrinse in that they are necessary to solubilize the flavour oils and give stability to the mouthrinse. They also provide some foaming for the product.

4. Thickening

In a water/surfactant solution in which water is the major ingredient surfactants align themselves in structures called micelles. These are tiny spherical structures in which the lipophilic tails orient inwards and the polar heads orient outwards toward the water. Micelles are important for the creation of emulsions and for thickening. The thickness of a surfactant solution depends on how closely the micelles pack together. Since cleaning products are typically made from charged surfactants, the outer surfaces of the micelles have the micelles, the thinner the solution. When the surface charge density is lowered by adding salt, for example the particles pack together more closely, and the solution thickens. For this reason salt is frequently added to adjust the viscosity of detergent systems.

5. Emulsification

Another major application of surfactants to cosmetics is in the creation of semi stable mixtures of oil and water, or emulsions Emulsions are the creams and lotions that deliver beneficial lipid materials to the surface of skin and hair. They can be simple oil-in-water or water-in-oil emulsions or more complex multiple emulsions. Each type has benefits that make it ideal for certain cosmetic applications. Nearly all creams and lotions are created using surfactants.

1.9.2 Rheology modifier

The development of personal care formulations will necessarily include the consideration of the required product rheology and the correct rheology modifier to provide these effects. Whilst the efficacy of the finished product will depend on the choice and level of active ingredients and excipients, the aesthetics and even the penetration of these actives into the stratum corneum will be affected by the product rheology. Rheology can be defined as "the science or study of how things flow".

A skin cream should appear highly viscous in the jar but should be capable of being picked up and rubbed into the skin. Nail polish should be sufficiently viscous to suspend the high volume of suspended pigment, not drip from the brush but thin sufficiently on the nails to provide an even coverage without any obvious brush strokes.

Rheology modifiers are often referred to as **thickeners,** and polymeric rheology modifiers can be added to formulations to control the rheology and the required effect can be achieved with low concentrations of the polymer. This will then affect the way that the product appears in the bottle, how easy it is to pour or scoop from the packaging, how easy it is to rub into the skin or along the hair shaft, and how easy it is to rinse and remove the product after use. It will also be essential to choose the correct rheological characteristics to ensure the stability of the finished formulation. To achieve such varied effects, a number of different types of rheology modifier are available to the formulator.

The choice of thickeners, to a large extent, depends upon the **compatibility** of the thickener with the rest of the ingredients in the formulation, the **pH** of the formulation

and the **desired feel** that is trying to be achieved. The predominant thickeners used in O/W emulsions are acrylic-based polymers. The most popular materials are c**arbomers and its derivatives**.
Carbomers are a cross-linked polyacrylate polymer and their derivatives which are high molecular weight homopolymer and copolymers of acrylic acid cross-linked with a poly alkyl polyether. These polymeric thickeners are very effective in stabilizing emulsions at elevated temperatures.

Classification

Water soluble polymers are classified as follows,

A. Organic

1. Natural polymer

- **Vegetables (mucopolysaccharides)**: Guar gum, locust bean gum, quince seed gum, carrageenan, galactan, gum Arabic, tragacanth gum, pectin, starch.
- **Microbial (mucopolysaccharides):** Xanthan gum, dextran, hyaluronic acid.
- **Animal (protein):** Gelatin, casein, albumin, collagen i Celluloses: Methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxy.

2 Semi synthetic polymer

- **Celluloses:** methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, carboxymethyl cellulose, methyl hydroxypropyl cellulose
- **Starches:** Soluble starches, carboxymethyl starch, methyl starch
- **Alginates:** Propylene glycol ester alginates,
- Other mucopolysaccharide derivatives

3. Synthetic polymer

- **Vinyls:** Polyvinyl alcohol, polyvinyl pyrrolidone, polyvinyl methyl ether, carboxyvinyl polymer, sodium polyacrylate
-
- **Others:** Polyethylene oxide, ethylene oxide-propylene oxide copolymers B. Inorganic Bentonite, laponite, silicate powders, colloidal alumina

Applications

Thickening agents are often regulated as food additives and as cosmetics and personal

hygiene product ingredients.Some thickening agents are **gelling agents** (gellants), forming a gel, dissolving in the liquid phase as a colloid mixture that forms a weakly cohesive internal structure. Others act as mechanical thixotropic additives with discrete particles adhering or interlocking to resist strain.

Thickening agents can also be used when a medical condition such as dysphagia causes difficulty in swallowing. Thickened liquids play a vital role in reducing risk of aspiration for dysphagia patients.
Some thickening agents may also function as stabilizers when they are used to maintain the stability of an emulsion Some emollient, such as petroleum jelly and various waxes may also function as thickening agents in an emulsion.

Thickeners are mainly used in the paint and printing industries, which depend heavily on rheology modifiers, to prevent pigment settling to the bottom of the can, yielding inconsistent results. Thickening agents increase the viscosity of the formulations. Pigments have to be uniformly suspended in the emulsion and should not sediment over time.and thickener contribute to this.

Thickeners provide the necessary rheological properties for the systems. Ashampoo with a viscosity similar to that of water would not be favorable as it would run off the hands and not stay on the scalp, but run into the eyes instead. Thickeners increase viscosity and influence the product feel.

Thickening agents used in cosmetics or personal hygiene products include viscous liquids such as polyethylene glycol, synthetic polymers such as carbomer (a trade name for polyacrylic acid) and vegetable gums.

Different thickeners may be more or less suitable in a given application, due to differences in taste, clarity, and their responses to chemical and physical conditions.

For example, **for acidic foods, arrowroot is a better choice than cornstarch**, which loses thickening potency in acidic mixtures. At (acidic) pH levels below 4.5, guar gum has sharply reduced aqueous solubility, thus also reducing its thickening capability. If the food is to be frozen, tapioca or arrowroot is preferable over cornstarch, which becomes spongy when frozen.

Thickening agents, otherwise known as texturizing agents, play an important role in the skin feel of emulsions. They contribute to the stability as well as appropriate rheological property of the formulations.

Examples for thickeners commonly used in skin moisturizing products include hydrophilic ingredients, such as **gums (e.g. xanthan gum), cellulose derivatives (e.g. hydroxyethyl cellulose), and acrylic polymers, among others, as well as liposoluble ingredients, such as waxes (eg. cetyl alcohol)**; many emollients used may also have additional thickening properties. Certain nonionic emulsifiers may also have additional thickening effects. Even in W/O creams thickeners are used for viscosity

control. The viscosity of a cream is primarily determined by the thickener used and the viscosity of the external phase.

1.9.3 HUMECTANTS

A humectant is a hygroscopic substance used to keep things moist; it is the opposite of a desiccant because it is wet. Chemically all humectants have something in common that is hydroxyl groups. These groups allow them to make hydrogen binding in other words they attract water. In Latin humectare means Moisten Humectants are water loving agents often referred to as hydrophilic ingredients in cosmetics. Humectants are usually molecules with one or more hydrophilic groups attached to them.
These hydrophilic groups can be
Amines (-NH3) like urea or amino acids.
Carboxyl groups (-COOH) like fatty acids or AHA
Hydroxyl groups (-OH) like glycerin, sorbitol, etc.

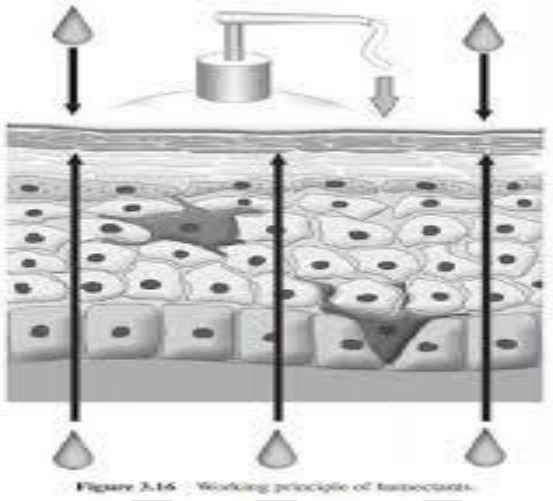


Figure 1.2: Working principle of humectants

- The humectant plays such an important role that it serves as a modifier staining agent of the products and the skin Humectants are ingredients and in lotions and deamers that hydrate the skin by attracting water molecules like a magnet Chemically speaking humectants are hygroscopic substances that form hydrogen bonds with water molecules.This bonding helps moisturize the skin by drawing water from the lower call Layers Humectants work by pulling water from the dermis (the second layer of skin to the epidermis (the top layer of skin.
-
- This process increases the level of more in the stratum corneum, the layer of dead cells that comprise the outermost enat of the epidermis. By doing so, the skin will look less flaky and be less prone to cracking and chafing.
-

- Humectants also encourage the shedding of dead cells called desquamation by breaking down the proteins that hold the cells together. If the humidity is over 70 percent, humectants can even draw water vapor from the air to help moisturize skin.
-
- The amount of humectant in any formula obviously has to be adjusted depending upon the other constituents of the formula (especially abrasive nature), but generally the total humectant loading is in the range 10-30% by weight. A humectant such as glycerol, sorbitol or propylene glycol is usually included at 10-15% to minimize drying out of the cream and to make the cream slightly softer. A list of humectant which finds use in cosmetic are given below,

- Ethylene glycol
- Diethylene glycol Triethylene glycol
- Polyethylene glycols
- Propylene glycol
- Di propylene glycol
- Glycerin
- Polyoxyethylene glycerin
- Alpha methyl glycerin
- Xylitol
- Mannitol
- Sorbitol Sorbitan
- Sorbide
- Polyoxyethylene glucoside
- Triethanolamine
- Sodium lactate
- Triethanolamine lactate
- Urea

TYPES OF HUMECTANTS

Humectants are used in many cosmetic and personal care products including

- hair conditioner,
- body cleanser,
- facial creams,
- eye lotions,
- after-sun lotion,
- frizz serums,
- lip balms, and
- some soap.

Humectants can either be man-made or derived from nature. Each works differently and may have properties that make them suitable for certain applications One such example is a type of humectant called a nanolipid gel which is used in many foot and heel balms because of its antifungal properties.

A) Synthetic Humectants

Synthetic humectants are widely used in personal care products because they are inexpensive to produce and have an inherently long shelf life. While synthetic humectants are able to lock in moisture to a certain degree, they don't provide any nutrients or noteworthy benefits to the skin. In some cases, they can interfere with the body's own moisturizing mechanism and end up drying the skin over the long term.
Some of the more popular synthetic humectants include:

- Butylene glycol
- Urea
- Glycerin
- Tremella extract
- Sorbitol
- Dicyanamide
- Sodium PCA
- Sodium lactate

B) Natural Humectants

Natural humectants serve a dual purpose: drawing moisture to the surface of the skin while enhancing the skin's own hydrating ability. They do so with substances that stimulate moisture production in the dermis while encouraging the growth of new cells in the epidermis.

Some of the more popular natural humectants include:

- **Hyaluronic acid,** a chemical produced by the body that promotes skin repair and the growth of basal keratinocytes.
- **Aloe vera,** a plant derivative which has anti-inflammatory and anti-acne properties. **Alpha hydroxy acid**, a natural compound found in fruit, milk, and sugar cane that encourages exfoliation and desquamation.Honey, a non-oily additive that also contains alpha hydroxy acid.
- **Seaweed**, a marine plant extract which contains hydrocolloids that aid in healing.

C) Occlusives

If the weather is especially dry (particularly during the winter months), humectants can actually draw too much water from the dermis and cause premature drying. This is especially true with synthetic humectants like glycerin. To counteract this, some moisturizers will add an occlusive agent that prevents moisture loss by creating an oil or lipid barrier on the skin. Occlusives are generally rich and oily and include such ingredients as

- Mineral oil
- Petrolatum
- Lanolin
- Dimethicone
- Shea butter

While there are a number of two-in-one products that contain both a humectant and an occlusive agent, some people prefer to mix-and-match moisturizers as part of their daily skincare routine. Read the product label carefully when choosing and always apply the occlusive moisturizer after the humectant moisturizer for the best results.

APPLICATIONS OF HUMECTANT

- Humectants are frequently used in cosmetics as a way of **increasing and maintaining moisture in the skin and hair,** in products including **shampoo, conditioner, frizz serum, lotions, creams, lip treatments, deansers, after-sun lotion, and some soaps or body lotions**. Humectants used in cosmetics include triethylene glycol, tripropylene glycol and propylene glycol.

- Other popular humectants in cosmetics include **glycerin, sorbitol (sugar alcohol), hexylene and butylene glycol, urea, and collagen**.
- A category of humectants called nanolipid girls allow skin to retain moisture, but also possess antifungal properties.

- Humectants have been added to skin moisturizing products to treat xerosis. Some moisturizers tend to weaken the skin barrier function, but studies on xerosis have proven that moisturizers containing humectants increase desired moisturizing effects on the affected area without damage to the skin barrier function

- **Butylene glycol** is claimed to be most resistant to high humidity and it is often used in hair sprays and setting lotions. The alcohol also retards loss of aromas and preserves cosmetics against spoilage by microorganisms.

- **Glycerin** is by far the most popular of all humectants used in personal care products. Concentrated solution of glycerin is also used to soften ear wax. Suppositories with glycerin (1-3 g) can also promote fecal evacuation. It is an

effective moisturizer, accelerates the maturation of corneocytes, reduces dryness, and enhances the cohesiveness of intercellular lipids.

- Overall, when combined with occlusive agents, glycerin has the ability to produce significant moisturizing effects in the skin.

- Most mouth rinses contain five basic ingredients: **alcohol, flavours, humectants, surfactants, fluoride** and other active ingredients, with **water** and minor ingredients making up the remainder of the product. In a mouth rinse they increase the viscosity of the liquid, and result in a good mouth feel after product usage.

- Products without humectants have a harsh chemical like taste/feel.Obviously humectants also impart some sweetness to the product. Levels of humectant in mouthrinses can vary between 5% and 20%.

- **Propylene glycol** is widely used in cosmetic and pharmaceutical manufacturing as a

- solvent and vehicle especially for substances unstable or insoluble in water.
- It is also often used in foods as antifreeze and emulsifier.
- Propylene glycol is also used as an inhibitor of fermentation and mold growth.
- Propylene glycol has been tried in the treatment of a number of skin disorders, including ichthyosis, tinea versicolor and seborrheic dermatitis because of its humectant, keratolytic, antibacterial and antifungal properties.

- Some common humectants used in food are honey and glucose syrup both for their water absorption and sweet flavor. Glucose syrup also helps to retain the shape of the product better than other alternatives for a longer period of time.

- In addition, some humectants are recognized in different countries as good food additives because of the increase in nutritional value that they provide, such as sodium hexametaphosphate.

- A main advantage of humectant food additives is that, since they are non-ionic, they are not expected to influence any variation of the pH aqueous systems.

- Humectants are used to stabilize the moisture content of foodstuffs and are incorporated food additives. A number of food items always need to be moist.

- The use of humectants reduces the available thus reducing bacterial activity.

- They are used for safety issues, for quality, and to have a longer shelf-life in food products.An example of where humectants are used to keep food moist is in products like toothpaste as well as certain kinds of cookies. Regional kinds of cookies often use humectants as a binding agent in order to keep moisture locked into the center of the cookie rather than have it evaporate out.

- Humectants are favored in food products because of their ability to keep consumable goods moist and increase shelf-life.Humectants are used in the manufacturing of some tobacco products. They are used to control and maintain the moisture content of the cut tobacco filler and add flavor. Humectants are vital to the creation of cigarettes.

1.9.4 EMOLLIENTS

Emollients are substances that replace the natural oils and help keep water in our skin to prevent it becoming dry, cracked, rough, scaly and itchy.Emollients are also described as refatting additives or fatteners in the case of bath products. The word refattener refers to substances improving the lipid content of the upper layers of the skin; they prevent defatting and drying out of the skin.

Emollients are available as moisturising creams, ointments, lotions and sprays, bath oils and shower products and soap substitutes. They provide a protective film.
Emollients are found in many skin and beauty applications, such as lipsticks, lotions, and a wide range of cosmetic products. People who use moisturizers and emollients for eczema or psoriasis should avoid perfumed products. Several emollients showing strong lipophilic character are identified as occlusive ingredients, they are fatty/oily materials that remain on the skin surface and reduce transepidermal water loss.

Applying emollients to your skin regularly is worthwhile as it can prevent eczema and other dry skin conditions from becoming worse.

Examples for emollients used in cosmetics products include

- **vegetable oils,**
- **seed and nut oils,**
- **fruit butters,**
- **lanolin,**
- **synthetic esters of fatty alcohols and**
- **fatty acids such as isopropyl palmitate and**
- **glyceryl stearate,**
- **polymers such as polyquaternium,**

- **hydrocarbons such as mineral oil and paraffin**
- **siloxanes such as dimethicone and cyclopentasiloxane and many others.**

sheabutter

olive oil

Mango butter

liquid paraffin

mineral oil

There is a wide range of emollients available and they all work to keep water in the skin. Emollients can be **creams and ointments**. You may need to try more than one emollient before you find the one that suits best.

Emollients soothe, smooth and hydrate the skin and are indicated for all dry or scaling disorders. Their effects are short lived and they should be applied frequently even after improvement occurs. They are useful in dry and eczematous disorders. The choice of an appropriate emollient will depend on the severity of the condition, patient preference and the site of application.

Advantages :

An emollient is a **humectant, a lubricant, and an occluder**. Emollient creams are less greasy than emollient ointments.

- They are easy to spread, absorb easily into the skin and are good for use during the daytime.
- They can also be used on weeping eczema.
- Emollient ointments are most suitable for very dry, thick skin and are not suitable for use on weeping eczema.
- Emollients can reduce symptoms of cracked and dry skin.
- Emollients offer an occlusive barrier and they smooth flaky skin cells, to make the skin look smoother.
- Some spread more easily than others.
- Esters and oils can be used.

Disadvantages :

- Emollients also vary according to the ratio of oil or lipid, to water. Emollients with high lipid contents are greasier and stickier. They also make the skin shirtler.
- Prescription emollients tend to be non-perfumed. However some creams contain preservatives, fragrances and other additives.
- Some people become sensitised (allergic to ingredient. This can make the skin inflammation worse rather than better.
- While applying emollients wash the hands and apply the emollient thinly, gently and quickly in smooth downward strokes in the direction of hair growth. Apply as often as needed to keep the skin supple and moist usually at least 3-4 times a day but some people may need to increase this to up to every hour if the skin is very dry.

Precautions to be taken:

- ointments need to be applied less often than creams or lotions for the same effect. Apply emollients after washing to trap moisture in the skin.Avoid massaging creams or ointments in or applying too thickly as this can block hair follicles, trap heat and cause itching.
- Don't stop using your emollient if your skin looks better. Skin can flare up again quickly, avoid bubble baths and soaps as they can be irritating and dry the skin Bathe regularly in tepid (luke warm water only.
- Regular bathing cleans and helps prevent infection by removing scales, crusts, dried blood and dirt. Use an emollient as a soap substitute (most emollients can be used in this way).

- Apply the emollient prior to washing and directly afterwards onto damp skin Alternatively you could use a bath or shower emollients designed specifically for washing with, and then apply your usual leave-on emollient afterwards.
- The quantity of leave-on emollient required will vary depending on the size of the person, the severity of the skin condition, and whether the emollient is also being used as a soap substitute.
- As a general guide, if you needed to treat the whole body, the recommended quantities used are 600g per week for an adult and 250-500g per week for a child under 12.

TYPES OF EMOLLIENTS

There are many different types of emollients and they can be classified according to how they are used and how greasy they are as follows,

A) Emollient type according to use

1. Soap substitutes

Soap is very drying for the skin and should be avoided in people with dry skin conditions. Any emollient (except white soft paraffin alone) can be used with water to cleanse the skin as they do not remove the natural oils in the skin.

2. Leave on emollient

These emollients are applied directly onto the skin and left on to soak in. They are not washed off the skin (as with soap substitutes).

B) Emollient type according to greasiness

1. Ointments

These are greasy in nature. They are usually made of white soft paraffin or liquid paraffin and are ideal for very dry or thickened skin and night time application. They do not usually contain preservatives and are therefore less likely to cause skin reactions.

2 Creams

These contain a mixture of oil and water and are less greasy and therefore easier on the skin than ointments. They must be used frequently and applied liberally to prevent the skin from drying out. Creams usually come in a container with a pump dispenser and are good for day time application. 3. Lotions spread

These contain the least oil and most water so are the least effective in moisturising the skin. They normally contain preservatives so may cause skin irritation. Lotions are useful for hairy areas such as scalps and areas of weepy skin.

APPLICATIONS OF EMOLLIENTS

1. Emollients, such as dimethicone and small amounts of natural oils are beneficial for skin lubricity and soothing. They improve the sensory properties of the emulsions. Addition of an emollient results in better spreading when the emulsion is applied to the skin. Examples: Isopropyl myristate, silicon oils.

2. Shaving foams are a unique example of emulsion mousses in that they contain avery low

level of nonvolatile components, yet possess remarkable stability and lubricating properties. The lubricity of the foam can be enhanced by the addition of emollient oils, polymers and humectants. In some instances, these can also improve the stability of the foam structure.

3. Modern soaps are actually very mild because they are buffered to neutral or slightly

acidicpH and contain lipids such as emollients and humectants.
Superfatted soaps contain more oil than required for a stoichiometric reaction.The excess oil may serve as a moisturizer and an emollient and improves the mildness of the product.

4 The advent of emollients in body cleansing liquids occurred with the emergence in the early 1990s of the body washes referring as 2 in 1 foaming emulsions, before the development of this new product niche, cationic polymeric materials were the most used skin conditioning agents.Propoxylated lanolin alcohols are lipophilic emollients used in soap bars and in other cleansers based on synthetic surfactants.

Liquid cleaning products offer an improved skin feel and more convenient and hygienic dispensing than wash bars. In addition, most liquid body wash includes more emollients and therefore can benefit the skin in more ways than just cleaning it. It has been clearly demonstrated that incorporation of high levels of emollients into liquid cleansers improves the mildness and moisturization of these cleansers.

5. Body washes with high emollient content have been shown to be beneficial for very dry skin users and for those whose only source of topical moisturization is their body cleanser

6. Bath oils and essences represent a unique category of bathing preparations today. These are oily products containing a high amount of emollients often combined with fragrances.
They are intended to be used in the bathtub to moisturize the skin. Bath oils and essences are typically non-foaming formulations. The main ingredients of such formulations are the emollients. Newer emollients used in bath oils include isopropyl myristate, isopropyl palmitate and other isopropyl esters; polypropylene glycol (PPG)

ethers, natural oils such as grape seed oil, olive oil, sweet cherry oil, and tea tree oil, as well as vegetable oil

7. Skin conditioning agents include various types of emollients and humectants to provide the hands with a soft and smooth feeling Foaming hand sanitizers are usually supplied as liquid soaps and the foam is generated by a special disperser. Liquid soaps are either simple solutions or/W emulsions if emollients are added.

8. Facial cleansing wipes are very efficient in removing makeup and debris from the skin.In addition to the chemical cleansing provided by the various ingredients deposited on the clothes they also provide physical cleansing through the rubbing action. They may deposit emollients on the skin surface which is beneficial for users with dry skin

9. Sticks are available as lipsticks and lip balms as well as sticks for babies. They Are suitable for smaller surfaces areas only such as the face and lips and for babies. The choice of waxes determines the melting point of the stick and its performance on the skin Melting point can be reduced by the level and type of the emollients used although firmness must

be maintained in hot weather conditions.

10. The latest sunscreen formulations are the wipes, which are similar to wet facial wipes These are pre-moistened by the manufacturer. The formulatorscan place emollients and other moisturizers onto the cloth wipes, which may, therefore, provide additional benefits

11. Antiperspirant sticks are usually anhydrous suspensions containing the suspended antiperspirant actives in a silicone based vehicle. In addition, sticks usually contain various waxy and liquid emollients for a soft skin feel and glide ability.

12. Antiperspirant aerosols are also anhydrous formulations similar to deodorant aerosols.This System contains emollients such as dimethicone and isopropyl palmitate, fragrances and preservatives.

13. Eyeliners are designed to help draw a precise line at the base of the eyelashes to contour the eyes. They give the illusion of a larger or smaller eye, bringing out the contrast between the iris and the white of the eye. Eyeliners are typically made as emulsions consisting of water, texturizers, pigments, emollients, and emulsifiers.

14. Basic ingredients for cake mascara include soaps such as glyceryl monostearate and triethanolamine stearate, emollients such as isopropyl myristate and lanolin, waxes such as carnauba wax and beeswax, pigments and antioxidants. Examples for emollients used in mascara include jojoba oil, palm oil, castor oil, provitamin B5, and panthenol.

15. Examples for emollients used in liquid and semisolid facial makeup products dude

waxes such as beeswax, vegetable oils, hydrocarbons such as mineral oil and isoeicosane,synthetic esters of fatty alcohols and fatty acids muchas isopropyl palmitate and glyceryl stearate and silicones such as cyclomethicone, cyclopentasiloxane, and dimethicone.

16. Nail moisturiser usually comes in cream or lotion form. They contain various moisturizing ingredients including occlusives, emollients, humectants and proteins may also be added. The nail polish removers typically contain emollients to counter the dehydration and brittleness effects of solvents and condition the skin.

17. Emollient based hair styling products are either anhydrous formulations or emulsions. They are often used for thicker, curly, or kinky hair i.e. hard to handle and can be very dry.

18. Pre-shave products are used primarily for dry (electric) shaving, however products for razor shaving are also available. Emollients such as diisopropyl adipate or isopropyl palmitate, silicone oils, and lubricating polymers may also be used in small amounts to help reduce the friction between the skin and the blade.

19. Disposable baby wipes represent one of the fastest growing sectors of the baby products

market. They have become very popular alternative liquid cleansing products particularly for the diaper area. Baby wipes usually consist of a nonwoven disposable cloth soaked with an aqueous surfactant solution or an O/W emulsion enriched with emollients.

20. Simple moisturizing lotions and creams for babies are emulsions generally light 0/W formulations that are easy to spread and quick to absorb. The oil phase generally consists of various emollients and also occlusive ingredients.

1.9.5 PRESERVATIVES

Cosmetic and personal care products that contain water and require **protection against the growth of microorganisms to ensure product safety**. Preservatives are **natural or synthetic ingredients** added to products to **prevent spoilage, microbial growth, undesirable chemical changes or to extend the product's shelf life.** The use of preservatives in personal care products is important because **not only do** they prevent product **damage caused by microorganisms** but they also help protect the **product from inadvertent contamination** by the consumer during use.

Without The addition of preservatives the product may become **contaminated,** which can lead to **product degradation** and in the case of cosmetic foundations, ultimately increase the **risk of irritation or even infection**. Preservatives are added to personal care products at **relatively low levels** to ensure products remain **safe and perform as**

intended over their lifetime. The determination of preservatives in these products is important for quality control to prevent allergic reactions and other health issues.

The optimal preservative should have the following attributes:

• Broad spectrum activity (bacteria and fungi)

Be effective over the anticipated shelf life • Be preferably liquid and water soluble

• Be effective over a wide pH range

• Not be deactivated by other ingredients

• Be odorless, colourless and safe
Besides a gray-green layer of mold on the surface of a product there are several other factors indicating that a cosmetic product is severely contaminated with microbes:

Loss of Effect of Preservatives

Loss of viscosity (product becomes thinner) Emulsion break (separation of water and oil

Cloudiness of previously clear products

Loss or change of color Drop in pH (product becomes more acid)

Classification

A) Classification based on mechanism of action

1) Antioxidants

The agent which prevents oxidation of active pharmaceutical ingredients which otherwise undergo degradation due to oxidation as they are sensitive to oxygen. Examples: Vitamin E, Vitamin C, butylated hydroxyanisole (BHA), butylated hydroxytoluene

(BHT)

2) Antimicrobial agents

The agent which is active against gram positive and gram negative microorganism which causes degradation of pharmaceutical preparation which are active in small inclusion levels. Examples: Benzoates, sodium benzoate, sorbates,

3) Chelating agents

These agents form the complex with pharmaceutical ingredients and prevent the degradation of pharmaceutical formulation.

Examples: Disodium ethylenediamine tetraacetic acid (EDTA),

B) Classification based on source

1) Natural Preservatives

polyphosphates, citric acid
These drugs are obtained by natural sources that are plant, mineral sources, animal etc.

Examples: Neem oil, salt (sodium chloride), lemon, honey

2) Artificial Preservatives

These preservatives are made by chemical synthesis and active against various hee

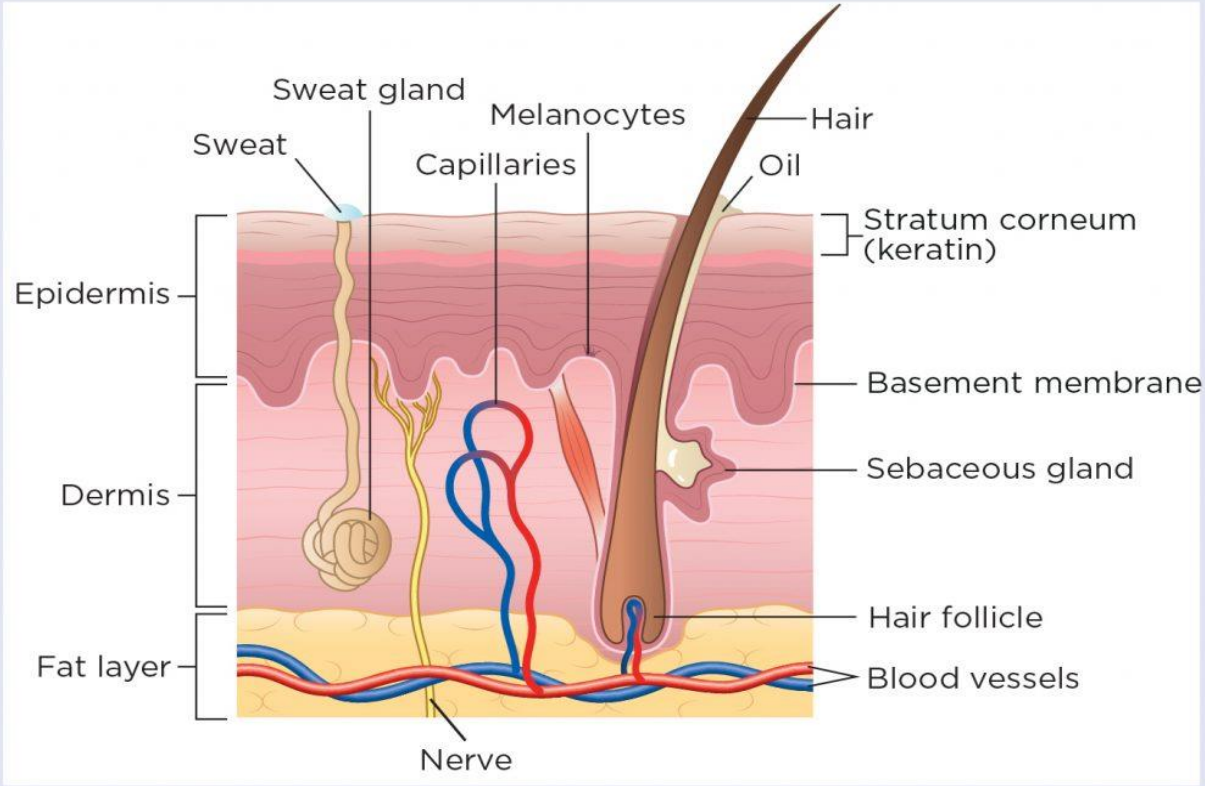
organisms in small concentrations.

Examples: Sodium benzoate, sorbates, propionets, nitrites Some commonly used preservatives in pharmaceutical preparations with their concentration are as follows.

Structure and function of the skin

The skin is divided into several layers, The epidermis is composed mainly of keratinocytes. Beneath the epidermis is the basement membrane (also known as the dermo-epidermal junction). The layer below the dermis, the hypodermis, consists largely of fat. These structures are described below

Fig 1. **Cross-section through the skin**



Epidermis

The epidermis is the outer layer of the skin, defined as a stratified squamous epithelium, primarily comprising keratinocytes in progressive stages of differentiation .Keratinocytes produce the protein keratin and are the major building blocks of the epidermis. As the epidermis is avascular it is entirely dependent on the underlying dermis for nutrient delivery and waste disposal through the basement membrane.

Functions

act as a physical and biological barrier to the external environment, preventing penetration by irritants and allergens.
it prevents the loss of water and maintains internal homeostasis.
The epidermis is composed of layers:

- Stratum corneum (horny layer);
- Stratum lucidum (only found in thick skin – that is, the palms of the hands, the soles of the feet and the digits);
- Stratum granulosum (granular layer);
- Stratum spinosum (prickle cell layer);
- Stratum basale (germinative layer).

Basement membrane zone

(dermo-epidermal junction)

This is a narrow, undulating, multi-layered structure lying between the epidermis and dermis, which supplies cohesion between the two layers (Amirlak and Shahabi, 2017; Graham-Brown and Bourke, 2006). It is composed of two layers:

- Lamina lucida;
- Lamina densa.

The lamina lucida is the thinner layer and lies directly beneath the stratum basale. The thicker lamina densa is in direct contact with the underlying dermis. It undulates between the dermis and epidermis and is connected via rete ridges called dermal papillae, which contain capillary loops supplying the epidermis with nutrients and oxygen.

This highly irregular junction greatly increases the surface area over which the exchange of oxygen, nutrients and waste products occurs between the dermis and the epidermis (Amirlak and Shahabi, 2017).

Dermis

The dermis forms the inner layer of the skin and is much thicker than the epidermis (1-5mm) (White and Butcher, 2005). Situated between the basement membrane zone and the subcutaneous layer, the primary role of the dermis is to sustain and support the epidermis. The main functions of the dermis are:

- Protection;
- Cushioning the deeper structures from mechanical injury;
- Providing nourishment to the epidermis;
- Playing an important role in wound healing.

The network of interlacing connective tissue, which is its major component, is made up of collagen, in the main, with some elastin. Scattered within the dermis are several specialised cells (mast cells and fibroblasts) and structures (blood vessels, lymphatics, sweat glands and nerves).

The epidermal appendages also lie within the dermis or subcutaneous layers, but connect with the surface of the skin (Graham-Brown and Bourke, 2006).

Layers of dermis. The dermis is made up of two layers:

- The more superficial papillary dermis;
- The deeper reticular dermis.

The papillary dermis is the thinner layer, consisting of loose connective tissue containing capillaries, elastic fibres and some collagen. The reticular dermis consists of a thicker layer of dense connective tissue containing larger blood vessels, closely interlaced elastic fibres and thicker bundles of collagen . It also contains fibroblasts, mast cells, nerve endings, lymphatics and epidermal appendages. Surrounding these structures is a viscous gel that:

- Allows nutrients, hormones and waste products to pass through the dermis;
- Provides lubrication between the collagen and elastic fibre networks;
- Gives bulk, allowing the dermis to act as a shock absorber .

Specialised dermal cells and structures.

The fibroblast is the major cell type of the dermis and its main function is to synthesise collagen, elastin and the viscous gel within the dermis.

Collagen – which gives the skin its toughness and strength – makes up 70% of the dermis and is continually broken down and replaced; elastin fibres give the skin its elasticity. However both are affected by increasing age and exposure to UV radiation, which results in sagging and stretching of the skin as the person gets older and/or is exposed to greater amounts of UV radiation.

Mast cells contain granules of vasoactive chemicals. They are involved in moderating immune and inflammatory responses in the skin.

Blood vessels in the dermis form a complex network and play an important part in thermoregulation.
The lymphatic drainage of the skin is important, the main function being to conserve plasma proteins and scavenge foreign material, antigenic substances and bacteria.
About 1 million nerve fibres serve the skin – sensory perception serves a critically important protective and social/sexual function. Free sensory nerve endings are found in the dermis as well as the epidermis (Merkel cells) and detect pain, itch and temperature. There are also specialised receptors – Pacinian corpuscles – that detect pressure and vibration; and Meissner's corpuscles, which are touch-sensitive.
The autonomic nerves supply the blood vessels and sweat glands and arrector pili muscles (attached to the hair).

Hypodermis

The hypodermis is the subcutaneous layer lying below the dermis; it consists largely of fat. It provides the main structural support for the skin, as well as insulating the body from cold and aiding shock absorption. It is interlaced with blood vessels and nerves.
Functions of the skin
The skin has three main functions:

- Protection;
- Thermoregulation;
- Sensation.

Within this, it performs several important and vital physiological functions, as outlined below (Graham-Brown and Bourke, 2006).

Protection

The skin acts as a protective barrier from:

- Mechanical, thermal and other physical injury;
- Harmful agents;
- Excessive loss of moisture and protein;
- Harmful effects of UV radiation.

Thermoregulation

One of the skin's important functions is to protect the body from cold or heat, and maintain a constant core temperature. This is achieved by alterations to the blood flow through the cutaneous vascular bed. During warm periods, the vessels dilate, the skin reddens and beads of sweat form on the surface (vasodilatation = more blood flow = greater direct heat loss). In cold periods, the blood vessels constrict, preventing heat from escaping (vasoconstriction = less blood flow = reduced heat loss). The secretion and evaporation of sweat from the surface of the skin also helps to cool the body.

Sensation

Skin is the 'sense-of-touch' organ that triggers a response if we touch or feel something, including things that may cause pain. This is important for patients with a skin condition, as pain and itching can be extreme for many and cause great distress. Also touch is important for many patients who feel isolated by their skin as a result of colour, disease or the perceptions of others as many experience the fact that they are seen as dirty or contagious and should not be touched.

Immunological surveillance

The skin is an important immunological organ, made up of key structures and cells. Depending on the immunological response, a variety of cells and chemical messengers (cytokines) are involved. These specialised cells and their functions will be covered later.

Biochemical functions

The skin is involved in several biochemical processes. In the presence of sunlight, a form of vitamin D called cholecalciferol is synthesised from a derivative of the steroid cholesterol in the skin. The liver converts cholecalciferol to calcidiol, which is then converted to calcitriol (the active chemical form of the vitamin) in the kidneys. Vitamin D is essential for the normal absorption of calcium and phosphorus, which are required for healthy bones (Biga et al, 2019). The skin also contains receptors for other steroid hormones (oestrogens, progestogens and glucocorticoids) and for vitamin A.

Social and sexual function

How an individual is perceived by others is important. People make judgements based on what they see and may form their first impression of someone based on how that person looks. Throughout history, people have been judged because of their skin, for example, due to its colour or the presence of a skin condition or scarring. Skin conditions are visible – in this skin-, beauty- and image-conscious society, the way patients are accepted by other people is an important consideration for nurses.

8. Absorption and excretion

Sebaceous glands are outgrowths of hair follicles in the dermis. They secrete a lipid, sebum, to make the skin water resistant. Sebum is bactericidal but if the glands become blocked, this results in a boil. Very small amounts of carbon dioxide are excreted through the skin. In addition to water, sweat excretes a number of waste products

including sodium chloride and urea. Although the skin is normally water resistant it is a useful absorbent medium for some medicines, including hormones and glyceryl trinitrate (used to treat angina). It is also useful for the application of topical medications for a range of skin diseases. Because of the problem of penetrating the barrier of intact skin, medications may need to be massaged into the skin and/or covered with an occlusive dressing to prolong contact time.

9. Nutrient and water storage

Water stored in the skin cells can be accessed in emergency situations when blood volume falls, for example when a patient haemorrhages. The skin also contains a potential energy source in the form of triglycerides (fatty acids and glycerol) stored in the adipose tissue.Exposure to UV radiation not only encourages the production of melanin but also initiates vitamin D production from a cholesterol compound (7-dihydroxycholecalciferol) in

the dermis.

10. Communication

Nurses can gain a lot of information about patients' health and well-being simply by examining patients' skin. Physiological changes in the skin are common-when we are hot, the skin reddens and sweat breaks out; when we are in pain, it tends to be pale; patients experiencing a heart attack often look grey, a yellow tinge to the skin may be a sign of jaundice; blue (cyanosis), a sign of oxygen deficiency.

Physiological health is indicated not only by the colour of the skin but by its appearance, elasticity and sensitivity.

HAIR

111.1 BASIC STRUCTURE OF HAIR

In humans, hair has an aesthetic function influencing our appearance. Today, it has social,

psychological, and sexual significance. Any change in the pattern of the hair, such as hair loss, hair overgrowth, or color change may negatively affect the self-esteem of individuals and has emotional consequences. Hair is a flexible thin keratin thread with great strength and elasticity. It is present on almost all surfaces of the human skin, except for the palms, soles,vermilion zone of the lips, and certain genital parts. Each hair consists of a root embedded in the dermis and a hair shaft protruding above the surface of the skin. The hair root is surrounded by a tube like sheath made of epithelial cells that form a downward extension of the epidermis into the dermis, This is called the hair follicle. The base of the root and hair follicle is slightly larger than the rest of the met this onion shaped structure is called

the hair bulb. The hair bulb receives a cluster of blood vessels from the dermis which push into the bulb to form the hair papilla(otherwise known as the dermal papilla).

Oxygen and nutrients via the blood vessels supply the actively growing cells in the ha follicle around the hair bulb known as the hair matrix. These cells are the only source of new hair. The hair shaft itself arises from the bulb region of the root and is produced by rapid multiplying matrix keratinocytes. The growth of hair is similar to that of skin cells, as cells divide and grow, they push older cells upward away from the blood supply, resulting in gradual cell death and keratinization About midway to the surface, all cells forming the hair root die and complete the process of keratinization. The shaft is, therefore, made up entirely of dead cells composed mainly of keratin. These cells remain attached to each other by an intercellular cement-like substance. Hair follicles are part of the pilosebaceous unit, which also includes one or more sebaceous glands and a small muscle. Sebaceous glands, which produce sebum that coats the hair and skin, open into the hair follicle. An arrector pili muscle is attached to the hair follicle; when this muscle contracts, it causes the hair to stand up

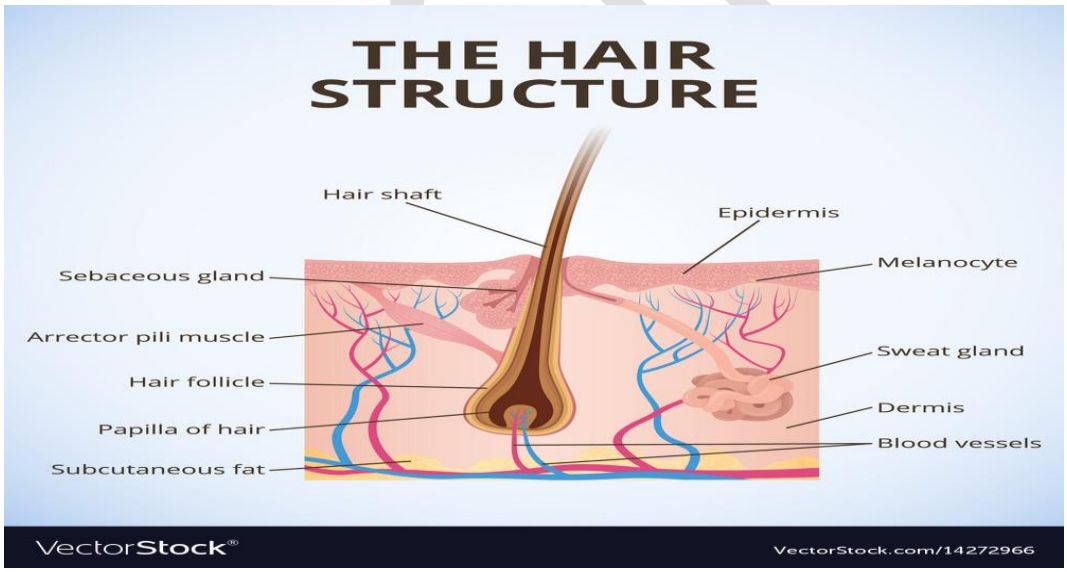


Figure1.6:Structure of the human hair

The cross section of a hair shaft has three major components, from the outside to the inside the **cuticle, cortex, and medulla.**

The outermost structure is the **cuticle.** It is composed of multiple layers of keratinized flattened cells (scales), which overlap in a roof-tile formation with an intercellular cement

to bind them together. It is translucent, allowing light to penetrate the cortex pigment and is composed primarily of keratin.

The **cortex** is the major component of the hair shaft. It lies below the cuticle and contributes to the mechanical properties of the hair fiber, including strength, elasticity and curliness.

The **medulla** (often referred to as the 'core') is composed of flattened, cornified cells. It appears as a continuous discontinuous, or absent structure under microscopic examination of human hair fibers. It is viewed as a framework of keratin supporting thin shells of amorphous material bonding air spaces of variable size

HAIR GROWTH CYCLE

Hair growth is a unique and complex process that involves continuous cycles of growth and **regeneration (anagen phase), transition (catagen phase), and resting(telogen phase)**. The cyclic activity continues throughout life: but the phases of the cycle change with age.

Figure1.7:Hair growth cycle

anagen

During this phase, new hair is produced in the lower part of the hair follicle. Normally, most of the scalp hairs (approximately 85-90%) are in the anagen phase at any time, while the remaining 10% is in the telogen or catagen phase.

On the scalp, the anagen phase can last 2-6 years11; however, in some cases, it may be longer (even 8 years). The longer the anagen phase, the longer the hair is able to grow. The difference in individual's hair length can be related to the varying length of the anagen phase. Scalp hair grows at a normal rate of about Imm every 3 days.

The hair on the arms, legs, eyelashes, and eyebrows have a much shorter anagen phase and a slower growth rate, explaining why it is much shorter than the scalp hair (the general length is in the range of 1-3 cm).

Catagen phase

It is a brief transition phase between the growth and the resting phases, which marks the end of the growth phase. On the scalp, the catagen phase usually lasts between 2 and 3 weeks During This phase, cell division stops, the follicle tube shrinks and detaches from the dermal papilla, and the base of the follicle moves upward toward the surface of the skin. Melanin production stops in this phase, leading to a non-pigmented lower end in the hair(which is under the scalp until it falls off).

Telogen phase

This is the final phase and lasts until the fully grown hair is shed. Although the telogen phase is called the resting phase, many activities occur during this phase, which allows the hair shaft to be shed and stimulates the conditions essential for regrowth The hair either shed during the telogen phase remains in place until the next anagen phase, when the new hair growing in pushes it out.

On the scalp, the telogen phase usually lasts for approximately 2-3 months. As soon as the telogen phase ends, the hair returns to the first phase and the entire cycle begins again. New Hair appears from the same follicle Removal of telogen hairs is easy and painless; these are the hair follicles that came out during shampooing or combing the hair

COMMON PROBLEMS ASSOCIATED WITH TEETH AND GUMS

There are many oral and dental diseases that may result from poor dentalHygiene which could be prevented with regular use of dental and oral care products.

1. Plaque

Plaque is a sticky, colorless film of bacteria and sugars that constantly forms on our teeth. It is

the main cause of cavities and gum disease and can hardens into tartar if not removed daily

2 Dental caries

Dental caries is one of the most well known dental diseases, which damages the teeth structure Dental caries is also known as tooth cavities and tooth decay. If the dental caries are untreated, it may cause tooth pain, tooth decay, and tooth loss.
When you eat, pieces of food remain between your teeth, and around your gums. These pieces of food mix with your saliva and bacteria forming plaque, which is a sticky substance attaching to your teeth The dental caries is caused by the acids produced by bacteria digesting sugars in the plaque. The acids produced by the bacteria dissolve the enamel of the teeth causing tooth decay

Dental caries is usually discovered during regular dental checkups. In the early stage of caries there might not be any pain, but the tooth surface is usually softened. The damaged part of the tooth cannot be regenerated.

The caries are treated by removing the damaged part of the tooth by drilling and then filling the hole with restorative materials like gold, dental amalgam or composite resin. If caries is treated in its early stages, there will be less pain and the treatment won't be expensive usually. As with most dental problems, caries can be avoided by maintaining good oral hygiene brushing and flossing your teeth regularly

3. Tartar

Tartar, otherwise known as dental calculus, is a plaque that is hardened (calcified on the teeth. It can also form beneath the gums and can irritate the gum tissues. It gives plaque more surface area to grow and can be a causative factor in other dental diseases. In the long term, it causes a yellowish-brownish discoloration to the teeth. As tartar is hardened on the teeth, it cannot be removed by simple brushing it has to be mechanically removed by dental professionals

Gum disease

Gum disease, otherwise known as periodontal disease, is an infection of the gums that can

progress to affect the bone that surrounds and supports the teeth. Itis the major cause of teeth loss among adults. This disease is caused by plaque formation. Plaque can be removed by regular brushing and flossing: however if not removed, it can eventually lead to infection and inflammation.

The early stage of periodontal disease is called gingivitis (Le., inflammation of the gums). It often results in gums that are red and swollen and may bleed easily. This Stage, however, is usually reversible since the connective tissue and the boneare not

yet affected. If left untreated, it can advance to periodontitis (which means inflammation around the teeth).

At this stage, the gums pull away from the teeth and form small pockets below the gumline. These pockets can trap food and plaque and eventually lead to more severe infection and inflammation. If Not treated, the bones, gums, and tissue that support the teeth are destroyed. Asa result, the teeth can become loose and may eventually fall out.

5. Tooth sensitivity

Tooth sensitivity is a common dental condition, it has been reported that up to57% of the adult population suffers from this condition. Patients experience brief episodes of sharp well localized pain when subjected to various stimuli, such as cold and hot drinks and food, brushing, and air currents.

The teeth can become sensitive for various reasons, including worn tooth enamel, worn fillings, gum recession, tooth decay, a cracked tooth, tooth roots that are exposed as a result of aggressive brushing gum disease, or even dental procedures can lead to temporary sensitivity. Depending on the cause, tooth sensitivity can be treated in several ways. A self-treatment option is the use of anti-sensitivity toothpaste.

6. Dental stains

Dental stains, or tooth discoloration, are spots or small areas on the teeth contrasting with the rest of the teeth color. They may be caused by multiple local and systemic conditions, which are typically classified as being either intrinsic or extrinsic. Intrinsic discoloration means that the enamel and/or dentin in the tooth darken, and therefore, the teeth get a yellow tint.

Discolorationmay be caused by dental materials, caries, trauma, infections, medications (such as tetracyclines),20 and even excessive fluoride intake while the teeth are still developing. Extrinsic stains are caused by certain molecules and metal ions found in our diet. Such ingredients include coffee, tea, wine, and tobacco. If Tooth discoloration is not treated, it can affect the appearance of a person's smile causing temporary, as well as permanent social and psychological problems,

7. Bad Breath

Bad Breath also known as Halitosis, is a common dental condition caused in most cases by the degradation of proteins by bacteria in the mouth. Having a bad breath can negatively affect your quality of life. That's why it is important to understand what causes bad breath, and how to prevent bad breath.

When you eat, small pieces of food get stuck between your teeth, on your tongue and around your gums. If you don't clean up your teeth regularly (both brushing and flossing

required)the food that has remained in your mouth begins to disintegrate producing unpleasant odor.

Consuming certain foods, like garlic, some cheeses and various exotic foods, can cause bad breath as well. However, in this case the bad breath is not caused by rotting food, but by the food itself. Smoking and drinking alcohol also contribute to bad breath. Another Possible cause for bad breath might be caused by a health problem not related to the mouth.
Examples of health problems that might contribute to bad breath are respiratory infections,gastrointestinal problems, sinusitis, diabetes, and kidney or liver problems. Keep in mind that most of the bad breath cases are directly related to the mouth.

8. Dry Mouth

Dry Mouth is a dental condition in which the level of saliva in the mouth is reduced The Saliva has several important functions to moisten your mouth, to help cleaning small food pieces after eating, to help digestion, to control bacteria and keep the moth healthy Almosteverybody has experienced dry mouth at one time or another.

There are many possible causes of dry mouth, which include but are not limited to stress, dehydration, or taking certain medications, having certain diseases, and smoking. If the glands in the mouth that produce saliva are not working properly, you can experience dry mouth.

Having dry Cosmetic and Cosmeceutical Products mouth can be really uncomfortable and you can experience thirst, dry feeling in the mouth and the throat, trouble swallowing, dry lips, sores, and dry tongue. Dry mouth can increase the risk of gum disease and dental caries.