Cosmetics represent a highly diversified field involving many subsections of science and "art." Indeed, in these days of high technology, "art" and intuition continue to play an important part in the development of formulations, their evaluation and the selection of raw materials. There is a move toward more sophisticated scientific methodologies in the field of cosmetic formulation design, safety, formulation evaluation with a better understanding of the properties of application sites i.e. skin, nails, eyes and hair etc.

Today a new hot topic in the cosmetic industry is 'active cosmeceuticals', which is the fastest growing segment of the natural personal care industry. Cosmeceuticals are topical cosmetic-pharmaceutical hybrids intended to enhance the beauty through ingredients that provide additional health-related function or benefit via cosmetic formulations through topical effects.

These cosmeceuticals serving as a bridge between personal care products and pharmaceuticals, which are developing specifically for their medicinal and cosmetic benefits.

1.1 Chronology of Cosmetics

India has enormous resources of medicinal and herbal plants. The pre-historic knowledge of Ayurveda and its applications to cure illnesses effectively hasn't been explored fully by India. If this happens successfully, India could gain a very significant competitive edge in the global market, especially in the beauty care, and healthcare segments. Since this traditional knowledge of Ayurveda is
not available to other countries, India could be leader in this sector. Thirty thousand year ago, early men used color in cave paintings, mostly of bulls and calves, apparently to attract the animals they wished to hunt. They survived by hunting and fighting and in both cases colored their skin and adorned their body for protection, either as camouflage or to provoke fear in an enemy, whether man or animal.

Some are born beautiful and others are "made" beautiful; for both type of persons, cosmetics are vital tool. The first group of beautiful people is required to maintain their natural beauty and to safe guard from environmental hazards which may effects beauty adversely. For the second type of people, cosmetics are must to make them attractive.

Cosmetics are used by all ages with economic and social strata for beautification and protective purposes since ancient time. In facts, the concept of beauty and cosmetic is as old as mankind and civilization. It is as long as people use face paintings and eye shadows as mentioned in the old testament of Egypt, China, and India. Especially for females, the desire is to look beautiful, charming and young by using different beauty ways bring various herbs and things known by the world since centuries.

The famous depictions in the Ajanta and Ellora caves, Khajurao art proves that not only women but men also adorned themselves with jewelry, scents and cosmetics. Ancient scriptures like Abhijnana Shakuntalam and Meghadootam of Kalidasa and many mythological epics encompass the reference of cosmetic like; Tilak, Kajal, Agarw (Aqvilarie agulbeha) and Ubatan (wheat floor oat and turmeric paste) were used as body decorative and to create beauty spots on
the chin and cheeks in the era ruled by gods and their deities. Enscripted in history of the Aryan period also witnessed the use of turmeric-haridra (*Curcuma longa* Linn), saffron, alkanet, agaru chlorophyll green from nettle and plants and indigos for bodily-decorations apart from using raktachandan (*Pterocarpus santalinus* Linn), chandan (*Santalum album*), henna (*Lawsonia inermis*) for skin and hairs dying in different color and conditioning were practiced in the olden times. The origin of cosmetics as recorded the use of cosmetics is attributed to Egyptians, in 4000 BC. The ancient Sumerians, Babylontians, and Hebrews (Yahudiees) also applied cosmetics. The Neolithic age ended in Egypt in about 4000 BC, and copper working with the discovery of tin used to harden it, this led to the bronze age, evidenced by the implements found: combs, hair pins, tweezers and small clamp like instruments believed to be curling tongs, and beautifully made spoons and ladels. As early as ten thousand B.C., Egyptians men and women used scented oils and creams to clean, soften their skin and mask the body odor. Dyes and paints were used to color the skin and hairs. A plant that has been used in ancient Egypt much today it is known as henna. The pungent odour of the flowers was probably used to perfume oils and ointments. In modern times in the Eastern countries, the heena leaves are used to redder the nails, the palms of the hands and soles of the feet 3.

This seems to have the fashion in ancient Egypt as the mummies are similarly stained. In religious processions in ancient Egypt there was always a lavish use of perfumes and no any king was ever crowned without being anointed with fragrant oils by priests 4.
In earlier times the women painted the undersides of their eyes with green colour made from malachite, a copper carbonate ore, and the lids, lashes and eyebrows were painted black with khol. These powders were pulverized on stone or metal plates and the powder applied to the eyes by a finger dipped in water.

Indian women have rouged their faces, hands, palm, cheeks with clay and fingers, palm and hairs stain with henna paste. They painted their body parts with sign of sun, moon, flowers, stars and birds by using natural paints. The paste of henna is being applied several times by every strata of Indian population for the purposes of staining to improve the beauty on each festival and occasion.

There were plant oils from sesame seeds, croton, saffron, pumpkin seeds, linseeds and olives. Animal fats were obtained from cows, sheep and goats, were used to cure baldness and other skin disorders. Oil baths perfumed with sandal wood and floral extracts since times were considered to be a skin tonic, and physically and mentally refreshing. Stem baths were popular where the bather sits besides the tub of boiling water in to which neem leaves have been thrown, under an all-enveloping blanket.

India had a medical code since 1000 B.C., in the Ayurveda and used the native raw materials in medicines as well as domestic cosmetic preparations with religious rites for decorative as well as other body ailments benefit.

The ancient civilization in India, China, Greece and Egypt had rich knowledge of the utility of medicinal and cosmetically active plants. In modern times, the utility of medicinal and cosmetically active plants declined with the advent of...
synthetic substances, e.g. shampoos contain antibacterial and antidandruff components, coloring effects can be seen drastically by using the synthetic dying process, which effects can be seen directly by acute changing in the biological system. But now again time came to explore the natural flora as cosmetic ingredients with more and long-term effects with reduced side effects. Now each and every event of cosmetic application reflects real picture as pharmacological and physiological effects associated with plants and extractives.

In our routine life, we use many cosmetic preparations without accessing quality of product, but now in present scenario consumer demands quality, efficacy and safety of cosmetic products. Such requirements of cosmetic products are satisfied country wise, therefore every country obeys own definitions of cosmetics products.

1.2 Definitions

According USFDC 1938, a cosmetic is defined as an article intended to be rubbed, poured, sprinkled, or sprayed on, introduced in to, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance without effecting the structure and function. It is noteworthy that in this definition the cosmetic is not allowed to have any activity, means without effecting the structure and function.

This definition was reevaluated and described by the European council directive (2) and defined A "cosmetic product" shall mean any substance or preparation intended to be placed in contact with the various external part of human body epidermis, hair system, nail, lips and external genital organs or

CHAPTER 1
with the teeth and the mucous membrane of the oral cavity with a view exclusively or mainly to cleaning them, perfuming them, changing their appearance and/or correcting body odour and/or protecting them and keeping them in good condition.

European cosmetics directive (Article 7a) describe the product information requirement, it is stated that proof of effect should be included. In the United state, on the other hand, a product would be regarded as a drug if proof of effect is mentioned.

Pharmaceutical affairs law of Japan define cosmetic with slight difference from the definition of the Europe. Both definitions allow cosmetics to have mild activity. Japanese definition are as The term cosmetic means any article intended to be used by means of rubbing, sprinkling or by similar application to the human body for cleansing, beautifying, promoting attractiveness and altering appearance of the human body, and for keeping the skin and hair healthy, provided that the action of the article on the human body is mild.

A current definition of cosmeceuticals covers all formulations “that will achieve cosmetic results by mean of some degree of physiological action” and known as quasi drug.

The Food, Drug, and Cosmetic Act USA defines cosmetics by their intended use, as articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance. Among the products included in this definition are skin moisturizers, perfumes, lipsticks, fingernail polishes, eye, and facial makeup preparations, shampoos, permanent
waves, hair colors, toothpastes, and deodorants, as well as any material intended for use as a component of a cosmetic product. In the series of cosmetics the herbal cosmetics comes in the sequence of definitions according to Saudi Arabia, Ministry of health: "Herbal cosmetic preparations are as a product prepared for therapeutic and prophylactic use, the active ingredients of which are of plant origin." In India the definition of cosmetic was reevaluated and described by the Drug and Cosmetic act 1948. "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 cleansing, beautifying, promoting attractiveness, or altering the appearance and includes any article intended for use as a component of cosmetic" According to the official definitions given by different countries, it has been clear that all such cosmetic preparations can be broadly classified as two types:

- Synthetic cosmetics
- Natural cosmetics

Synthetic cosmetics are the products, which are made by use of synthetic ingredients including active materials. Synthetic colorants, treated pigments, synthetic softeners, sun screeners, whiteners, foamier etc. are widely used to make elegancy of formulations.

Natural cosmetics are designed by using natural ingredients as base or as natural active materials. Natural cosmetics are being used since ancient time in different forms or some time direct usable forms e.g. mucilaginous form of Aloe vera and ordinary extracts of Pterocarpus santalum, Curcuma longa, and
pastes made up of oat meal flour were widely used for smoothening, protection, cooling, rejuvenations for the cuts and burns of the skin. Oils and plant extractives are mostly used to maintain the viscoelastic properties of skin in different mode of applications like lepas, message oils etc.

1.3. Skin and Cosmetics

New insights about the function of the skin as well as the development of new formulations for skin care make it necessary to redefine the definitions of cosmetics and drugs. Skin structure and physiology has provided evidence that even small changes in environment (temperature, humidity, dusty air) can modify the functioning and activity of skin.

Cosmeceuticals being integral content of cosmetic preparations having medicinal or drug-like benefits are able to affect the biological functioning of skin as properties of functional ingredients. So many skin-care products that go beyond decorating the skin these improve the functioning texture of the skin via encouraging collagen growth by combating harmful effects of endogenous free radicals. Thus, maintaining keratin structure in good condition and making the skin healthier 13-15.

In the formulation design, initially ingredients knowledge is required because cosmetic ingredients influences the primarily quality and efficacy of any cosmetic formulation.

Fundamentally there may be two incompatibilities occur due to ingredients i.e., intolerance and toxic reactions. Toxic reactions are passive damage to organism caused by the action of some poison or toxic materials. When toxic materials applied to the skin are called caustic or primary irritant and the effects
called primary irritation. Such irritation reactions depend not only on chemical nature of components but also on its applied concentrations and duration of contact. These irritation reactions reflect the nature of skin, either allergic or nonallergic.

It is comparatively easy to avoid primary irritant effects of cosmetic ingredients because irritant substances are generally known. But in case of new substance, it irritant effects can be easily determined by using patch tests. It is never possible to guarantee that any formulation will be perfectly free from allergenous effects.

Even if a formulation has been made with nothing but basic materials of proved compatibility, it cannot necessarily be assumed quite safe formulation. Because there is always possibility that two ingredients, both of which are safe in alone concentration, can cause an irritation when combined. The skin reacts to external conditions such as heat, sunlight, smoke, dust, gases and other radiations. Skin secretes several different kinds of substances i.e. endogenous waste materials as toxins, secrete metabolic waste materials that is result of poor diet, poor digestion, infection, illness, and pharmaceutical drugs inform of sweat to maintain its texture. It also secretes sebum in order to protect the skin from dryness in hot environment. The sebum and sweat composition affect the quality and texture of our skin sometimes positively and sometimes negatively.

To maintain healthy nature of skin, cosmetic preparations play an important role via direct application to site of action.
Cosmetic preparations affects the moisture content of the corneal layer (upper layer), which directly influence the mechanical, electrical and optical properties of the skin.

1.3.1 Structure and Anatomy of skin

In adults, the skin covers an area of about two square meters and weights about four to five kilograms. It ranges in thickness from 0.5 – 4 mm. Cosmetically, the skin structure consists of two main parts. The superficial thinner portion, which is composed of epithelial tissues, is the epidermis. The deeper, thicker connective tissue part is the dermis.

The epidermis is the outermost layer of skin, which consists of five sub-layers, which are progressively more compressed and horny as they approach the surface, many small nerve endings and no blood vessels (Figure 1F-1 & 1F-2).

1.3.1.1 Epidermis

The epidermis is keratinized stratified squamous epithelium. It contains four standard types of cells that are more responsible compared to anatomy of skin for cosmetic formulations.

- Keratinocytes
- Melanocytes
- Langerhans
- Merkel

About 90% cells are keratinocytes, which are arranged in four layers and produced the protein keratin. Keratin is tough, fibrous protein that helps to protect the skin and underlying tissues from heat, microbes and chemicals.
Keratinocytes also produce lamellar granules that release a water repellent sealant.

About 8% of the epidermal cells are melanocytes that produce the pigment melanin. It is a brown black pigment that contributes to skin color and absorbs damaging ultraviolet light.

Langerhans cells arise from red bone marrow and migrate to the epidermis where they constitute a small fraction of the epidermal cells. They participate in immune responses mounted against microbes that invade the skin and are easily damaged by UV light.

Merkel cells are the least numerous of the epidermal cells. These are located in the deepest layer of the epidermis where they contact the flattened process of sensory neurons known as tactile. Merkel cells detect tactile aspects of different touch sensations.

The anatomy of skin accounts five sub layers of epidermis.

Stratum corneum

The upper layer called the stratum corneum is composed of twenty five to thirty layers of flattened dead keratinocytes. These cells are continuously shed and replaced by cells from the deeper strata. The interior of the cells contains mostly keratin. Between the cells are lipids from lamellar granules that help to make this layer an effective water repellent barrier. Constant exposure of skin to friction and UV light stimulates the formation of a callus, an abnormal thickening of the stratum corneum.
**Stratum Lucidum**

It is present only in the thick skin of the fingertips, palms and soles. It consists of three to five layers of flattened clear and dead keratinocytes that contain large amount of keratin and thickened plasma membrane.

**Stratum Granulosum**

It consists of three to five layers of flattened keratinocytes that are undergoing apoptosis (an orderly genetically programmed cell death in which the nucleus fragments before and cell die). A distinctive feature of these cells in this layer is the presence of darkly staining granules of a protein called keratohyalin which converts the tonofilaments into keratin. A membrane enclosed lamellar granules keratinocytes are also present which secrete lipid rich secretion. This secretion fills the spaces between cells of the stratum granulosum, stratum lucidum and stratum corneum. Lipid rich secretion acts as a water replent and retard loss of body fluid and entry of foreign materials.

**Stratum Spinosum**

Superficial to the stratum basale is the *stratum spinosum* where eight to ten layers of many sided keratinocytes fit closely together. Cells in the more superficial portion of this layer become flattened. This provides strength and flexibility to the skin. Langerhans and melanocytes also appeared in this stratum.

**Stratum Basale**

This is the deepest layer of the epidermis composed of a single row of cuboidal or columnar keratinocytes. Some cells in this layer are stem cells that undergo cell division to continually produce new keratinocytes.
1.3.1.2 Dermis

The dermis lies between the epidermis and subcutaneous fat, it is responsible for the thickness of the skin. It plays the key role in the cosmetic appearance. The thickness of the dermis varies over different parts of the body and doubles between the age of three and seven years and again at puberty (Leslie). With aging, this basic layer decreases in thickness and moisture. It is composed of the connective tissues containing collagens and elastic fibers. The few cells present in the dermis include fibroblast, macrophases, and some adipocytes. Blood vessels, nerves, sweat and sebaceous glands and hair follicles are embedded in dermal tissues. Collagen, one of the strongest and natural proteins yields the durability and resilience characteristics of the skin. The importance of the collagen is emphasized in the literature regarding many of the topical agents that claim to increase collagen synthesis such as glycolic acid, ascorbic acid. Type I collagen comprises 80-85% of the dermal matrix and is responsible for the tensile strength of the dermis. Elastin fibres are also found at the periphery of the collagen bundles and endow the skin with recoil properties. These fibres are assembled on bundles of microfibrils composed of fibrillin which is a form of a template on which elastin is deposited. The optimum level of sun exposure, elastin is degrade and seen as an amorphous substance in the dermis. This resultant elastosis is a hallmark of the photoaged skin.

It is responsible for the skin's pliability and mechanical properties and is involved in the regulation of the body temperature. The dermis supplies the nutrients to epidermis by means of its vascular network. It contains sense organs for touch, pressure, pain and temperature (Meissner's corpuscles,
Pacinian corpuscles, free nerve endings) as well as blood vessels, nerve fibres, sebaceous and sweat glands and hair follicles.

**Figure 1F-1: General structure of skin**

**Figure 1F-2: Cellular structure of skin**

**Blood vessels**

These are tiny pipes through which blood circulates. The blood vessels supply the skin with fresh blood, which contain nutrients and oxygen, and carry away waste products.
Meissner's corpuscle
These touch receptors are especially effective in detecting light touch and soft, fleeting movements.

Pacinian corpuscles
Pacinian corpuscles function as receptors for deep pressure and vibrations.

Free nerve endings
Free nerve endings are sensitive to pain, temperature changes and itchiness and they forwards the information's to counterbalance the reflex activities.

Sebaceous glands
Sebaceous or oil glands are small, sacculated organs that secrete sebum. This oily substance is a natural moisturizer, which conditions the hair and skin. Sebaceous glands are found all over the body, but they are more numerous in the scalp area and around the forehead, chin, cheeks and nose.

Sweat glands
These are sweat-producing structures consisting of a single tube, a coiled body and a superficial duct. They are involved in thermoregulation as they cool the skin by sweating.

Hair follicles
Hair follicles are downward growth into the dermis of epidermal tissue and produce hair. They are found all over the body except on the palms of the hands and soles of the feet as well as on the lips. When the body gets cold, the hair stands upright with the help of the arrector pili muscle, closing up the skin's pores and keeping the warmth in.
Arrector pili muscle

This small muscle is attached to the base of the follicle. When it is stimulated by cold or fright, it pulls the hair follicle up, causing it to stand upright.

Glands

Several kinds of exocrine glands are associated with the skin e.g. sebaceous (oil) gland, sudoriferous (sweat) gland and ceruminous glands. Sebaceous glands are especially abundant in the scalp and face, and on the face they are more abundant on the nose, cheeks, forehead and chin than other areas. These glands are small, sacculated, glandular organs, lodged in the substance of the dermis. Each gland has a single duct, which typically opens into a hair follicle, but also along the free margin of the lips. On the nose and face the glands are of large size and often become much enlarged from the accumulation of pent-up secretion. Sebum is produced in the sebaceous glands and secreted through the sebaceous ducts into the hair follicles, from which it ascends to the skin surface. The flows of sebum carry dead skin cells with it that flake off from the inside of the duct or follicle. The composition of sebum is given in Table 1T-1.

Table 1T-1: Composition of sebum

<table>
<thead>
<tr>
<th>Composition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramides</td>
<td>13</td>
</tr>
<tr>
<td>Fatty acids</td>
<td>47</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>7</td>
</tr>
<tr>
<td>Cholesterol esters</td>
<td>2</td>
</tr>
<tr>
<td>Squalene</td>
<td>11</td>
</tr>
<tr>
<td>Triacylglycerides</td>
<td>3</td>
</tr>
<tr>
<td>Wax esters</td>
<td>17</td>
</tr>
</tbody>
</table>
Sebum protects the skin by reducing the evaporation of water from the skin (dehydration) and blocking the penetration of excess water into the skin. Cholesterol, ceramides and triglycerides in sebum also aid in the healing of the skin tissue and prevent foreign organisms from infecting the skin. Environmental conditions, such as a cold, dry, wind and topical chemicals can reduce sebum's protectiveness.

Typically, sebaceous glands are more active in young condition. The lipid film present on the surface of the skin is composed of both sebum and the lipids of the epidermal cells. The composition of the epidermal lipids is briefed in Table 1T-2. Pores are the openings in the epidermis for the hair follicles. Pore size is related to sebaceous gland size. Pores enlarge to accommodate greater oil flow. Often acne clears up because the pores enlarge enough so that the sebum no longer gets stuck there.

Table 1T-2: Composition of epidermal lipids

<table>
<thead>
<tr>
<th>Composition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglycerides</td>
<td>47.8</td>
</tr>
<tr>
<td>Free fatty acids</td>
<td>3.0</td>
</tr>
<tr>
<td>Phospholipids</td>
<td>9.7</td>
</tr>
<tr>
<td>Waxes</td>
<td>4.0</td>
</tr>
<tr>
<td>Squalene</td>
<td>3.0</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>10.0</td>
</tr>
<tr>
<td>Free cholesterol</td>
<td>7.4</td>
</tr>
<tr>
<td>Fasting acting sterols</td>
<td>0.4</td>
</tr>
<tr>
<td>Cholesterol esters</td>
<td>3.0</td>
</tr>
<tr>
<td>Unidentified</td>
<td>11.7</td>
</tr>
</tbody>
</table>
1.3.1.3 Subcutaneous layer
The subcutaneous layer below the dermis consists of loose connective tissue and much fat. It acts as a protective cushion and helps to insulate the body by monitoring gain and loss of heat. Not all authors consider this layer a part of the skin, but it definitely has a strong impact on the way the skin looks.

1.3.2 Composition
The most characteristic features of stratum corneum lipid composition are its heterogeneity, dominant presence of saturated chemical species, extensive amounts of cholesterol and complexity in ceramides chemistry. Ceramides constitute 47%, cholesterol 24%, fatty acids 11% and cholesterol esters 18%.

Cholesterol has an important role to play in the lipid mixtures, as it can increases the chain mobility of lipids in the gel state and decrease their mobility in the liquid crystalline state, a property likely to be important for barrier function during processing of glucosylceramides to ceramides in the lower and upper regions of the stratum corneum. Cholesterol sulphate is another intercellular lipid that is believed to be hydrolysing in the surface layers of the stratum corneum. These types of compositional changes could therefore dramatically influence the conditions of the skin. The lipid packing states might not only influence the barrier properties of the skin but also its desquamation.

1.3.2.1 Sweat glands
There are three to four million sweat bearing glands. The cells of sweat glands release their secretion by exocytosis and empty them into hair follicles or onto the skin surface through pores. They are divided into two main types, eccrine and apocrine, based on their structure, location, and type of secretions.

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gland consists of a single tube, the lower part of which is coiled into a ball, and the upper part, or duct, which traverses the dermis and cuticle and opens onto the surface of the skin. Their primary function is to regulate body temperature, but they also eliminate toxic substances and waste products. The clear perspiration they continually secrete is mostly water with traces of salt, carbohydrates, protein and oil; it cools the body as it evaporates. Eccrine sweat usually does not have an odor problem. Apocrine sweat glands are concentrated in the underarm area, around the nipples, and in the genital area. They are stimulated by the same hormones that cause hair growth in the underarms and genital area. They secrete milky fluid which is rich in organic material. This subjected to bacterial decay and is the primary cause of body odor.\(^2\)

**Compositions of sweat**

Sweat mainly consists of secretions of the eccrine glands. It is the most dilute of all animals' fluids. The human sweat has specific gravity of about 1.001-1.006, pH 3.8-6.5 and the average compositions is as given in Table 1T-3. The only conspicuous constituents is NaCl, which varies between 0.2 - 0.5 percent.
Table 1T-3: Composition of sweat

<table>
<thead>
<tr>
<th>Content</th>
<th>g or mg. per 100mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>99.22 - 99.74 g</td>
</tr>
<tr>
<td>Solids</td>
<td>1.174 - 1.158 g</td>
</tr>
<tr>
<td>Ash</td>
<td>0.14 - 0.56 g</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.1 - 1.3mg</td>
</tr>
<tr>
<td>Urea</td>
<td>12 - 57 mg</td>
</tr>
<tr>
<td>Lactic acid</td>
<td>285 - 336 mg</td>
</tr>
<tr>
<td>Carboxylic acid</td>
<td>2 - 6 mg</td>
</tr>
<tr>
<td>Sugar as glucose</td>
<td>1 - 3 mg</td>
</tr>
<tr>
<td>Uric acid</td>
<td>0.07 - 0.25mg</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>0.07 - 0.1 mg</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>33.2 mg</td>
</tr>
<tr>
<td>Non protein nitrogen</td>
<td>27 - 64 mg</td>
</tr>
<tr>
<td>Amino acid</td>
<td>1.1 - 10.2mg</td>
</tr>
<tr>
<td>Ammonia</td>
<td>5 - 9 mg</td>
</tr>
<tr>
<td>Urea</td>
<td>5 - 38 mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>1 - 8 mg</td>
</tr>
<tr>
<td>Iodine</td>
<td>0.0005 - 0.0011mg</td>
</tr>
<tr>
<td>Iron</td>
<td>0.022 - 0.046 mg</td>
</tr>
<tr>
<td>Chloride, Sodium, Potassium,</td>
<td>0.7 - 38 mg</td>
</tr>
<tr>
<td>Sulphur, Copper</td>
<td></td>
</tr>
<tr>
<td>Total amino acids</td>
<td>43.52 mg</td>
</tr>
</tbody>
</table>

1.3.2.2 Tissues

In the skin, connective tissue is chiefly composed of collagen and elastin. Collagen, elastin and reticulin are dermal proteins; they are composed of protein fibers. These fibers are, at the macromolecular level, composed of fine cross-striated fibrils of mucopolysaccharides linked with protein. Collagen, elastin, and reticulin are composed of the 20 amino acids in differing proportions. Collagen alone comprises 33% of the total body protein and 70% of connective tissue. In the dermis it provides elasticity and strength.
Smooth, elastic skin contains mainly non-crosslinked, flexible, "soluble" collagen. Lined, wrinkled, inelastic skin is caused by crosslinked, insoluble collagen. Collagen is called soluble when it can absorb large quantities of water, which allows it to remain elastic. Cross linking occurs when the sulfur-containing amino acids in protein oxidize and form a disulfide bond. Cross linking also affects all the other components of connective tissue.

There is a close association between the skin and the nervous system; nervousness or anxiety can be reflected in the skin, especially as acne, psoriasis, and eczema.

1.3.3 Properties of skin

Skin has variety of properties that directly and indirectly influences the appearance of the skin. Color, pH, firmness, emmolliency, elasticity are the dominating properties of skin which are influenced by aging of skin either intrinsic or extrinsic.

1.3.3.1 Color

The skin color is not solely depends on the pigments, it is associated with other components and factors i.e. blood flow, micro and macro nutrients availability, oxygen availability, thickened skin, eleidin etc. The pigments are more especially distinct in the cells of the stratum basale (lowest level). As cells approach the surface and desiccate, the color becomes partially lost. The pigment (melanin) consists of dark brown or black granules of very small size, closely packed together within the cells, but not involving the nucleus. The color of skin is determined by a number of factors.

- The amount of melanin pigments in the epidermis.
• The amount of carotene in the epidermis, dermis and subcutaneous tissues.
• The proportion of reflected and scattered light.
• The amount of blood in the dermal and subcutaneous blood vessels.

In the normal skin the brown melanin granules are contained predominantly in a supranuclear cap in the basal cell (previously discussed) and to a lesser extent in other epidermal cells. The blood vessels contribute a role in skin color reflexation due to the superficial venous plexus, which runs parallel to the skin surface. The shade of skin also depends on the reddish or bluish appearance produced by oxidized or reduced hemoglobin in varying ratios in the skin vessels. The varying ratio of oxidized and reduced form depends in turn on the rate of blood flow through the skin. A bluish tint of skin indicates the lack of oxygen or shortage of cell respiration, mostly seen with aged cells. At more rapid flow rate, more of the oxidized hemoglobin from the arteries, which reaches to the augmentory system, thus appearance of skin is reflect reddish.

1.3.3.2 Acid mental

The acidity of skin seems to play a role in the defense against microorganisms either bacteria or fungal. The acid mental of the skin depends on pH values, which shows that the general body surface of the adult has a pH of 3.0-5.0. The alkaline area of body becomes more sensitive to infections and microbial attack like streptococci. The reconstitution of the acid pH after exposure to alkaline materials (soap materials) forms an important defense against chemicals or adverse pH to skin buffer. The skin physiology provides the natural buffer system to the skin, which maintained the skin pH in adverse conditions.
A temporary treatement of the skin with alkaline formula results in only slight shift of the pH values. The moment alkaline formula is removed from skin the normal pH of skin re-established. The overall mainmtainance (re-establishment of pH) of skin buffer is found as acid mental of skin. The pH values represent the presence of water-soluble components on the skin surface. Prolonged immersion of the skin in water results in the extraction of water soluble substances from the surface and from the loosely packed horny layer, so at this condition the the buffering capacity of the skin became greatly reduced.  

1.3.3.3 Breathing

The disposal of carbon dioxide also occurs mostly through the blood and only to a small degree into the surrounding atmosphere. The direct breathing of skin is restricted, even though certain amount of respiratory oxygen taken directly from the atmosphere.

1.3.3.4 Hydroregulatory balance

The skin has very limited water permeability. The barrier that controls the escape of moisture from and penetration in to body does not lie immediately on the skin surface, but below the corneal layer (Rein's barrier). When the corneal layer dries out, it becomes brittle and will not regain its elasticity through only fatty substance but only through the supply of water.

1.3.3.5 Emmolliency

Prevention of drying of skin is called emolliency or moisturizing skin. Moisturizers are expected to increase skin hydration and via modifying the physical and chemical nature of the skin surface provides the smoothness, softness and flexibility or pliability of the skin.
1.3.3.6 Luster

The surface character (luster) of the skin also plays important role in skin properties. This depends on site-to-site and availability of the gland secretory material and hairs availability, e.g. fore head, nose tends most shine as compared to upper and lower limbs.

1.3.3.7 Texture

Skin morphological characteristics can be sense by sensory and tactile means, texture may be smooth and rough. Healthy and nutritional skin texture is always smooth with good emolliency.

1.3.3.8 Firmness and Extensibility

Additional changes in skin behavior resulting from the aging process are losses of firmness and elasticity. Looseness in skin firmness is usually accompanied by loss of skin elasticity. Firmness is the skin ability to resist deformation and elasticity is the rate at which a specific deformation is resolved.34-35

1.3.3.9 Wrinkles and Folds

The loss of the elasticity into the skin's upper layer (corneum) appears as wrinkles and folds primarily. The constantly forming of folds leave traces on the skin and finally develop into deep lines and wrinkles. The fine lines do not present a cosmetic problem, but the skin pores are another matter, when these pores swell or distend and becomes visible to naked eyes.33 The skin not just only gives us our appearance and shape, it also serves other important functions as:
Protection
Stratum corneum, which is the outermost layer, is horny and formed by the keratinized stratified epithelial cells, resists the action of external agencies. Skin is a shield that protects from:
- Mechanical impact such as pressure and stroke.
- Thermic impact such as heat or cold.
- Environmental impact such as chemicals, UV-radiation and bacteria.

Regulation of body temperature
The skin regulates body temperature and the production of sweat, which evaporates on the skin surface, will cool down the temperature. The cutaneous vasoconstriction diverts the blood to the interior of the body and so diminishes heat loss. This is an important mechanism of protection against cold environment. Vasodilatation in the skin also helps in elimination of heat from the body and regulates the body temperature.

Sensation
Besides the senses of smell, taste, sight and hearing the sense of touch is one most important sense of body. The skin serves as the medium for receiving the general sensation. Touch, pain, temperature etc., are served by the respective nerve ending present in the skin. The hair roots are richly supplied with nerves. Various cells and nerve endings in the skin, which send impulses to our central nervous system, and made it sense possible.

Synthetic function
Vitamin D is synthesized by ultra-violet rays of the sun acting upon the ergosterol present in the skin and subcutaneous tissue.
Absorption

Lipids are easily permeable through the skin. Lipid soluble substances like vitamins are easily absorbed through the skin but hydrophilic substances are absorbed at some limit. Waxy layer hinders water absorption through the skin. But the skin is not completely waterproof and on prolonged exposure to water, there is water absorption causing swelling of the stratum corneum.

The skin absorbs different nutrients and other micromolecules out of them certain substances penetrate the epidermal and dermal layers and are subsequently absorbed into the systemic circulation: their path is through the hair follicles and the sebaceous glands. These substances provide the nutrition to the skin and maintained the normal physiology against the different kind of environmental hazards. Other substances seem to penetrate the interstitial spaces (the gaps between the cells of the skin). Some substances are effective carrying agents, which, when combined with other cosmetic ingredients, enable the latter to better penetrate the skin's surface and helpful to maintain the normal skin physiology $^{37}$.

All these functions of skin reflect properties of skin that helps a cosmetic scientist to formulate and evaluate a cosmetic product.

1.3.4 Types of Skin

Different geographical-racial groups of people can have different skin characteristics. These characteristics based on the variations in physiology of skin and alterations in the structural components of the skin. These variations are affected by the climatic conditions. For instance, the Mongols have thick
skin with fewer pores, sweat glands, and sebaceous glands, and the nerve endings are farther from the surface than the skin of caucasians.

1.3.4.1 General Classifications
The skin can be classified in different ways accordingly to the susceptibility of individual to environmental conditions. In broad skin could be considered as normal and abnormal.

The skin often describes as oily, normal, dry, combination, sensitive, acne-prone, and mature, but what it really is balanced (normal), unbalanced (oily, dry, combination, acne), and damaged (wrinkled, lined, etc.).

Normal skin is usually defined as skin that is neither oily nor dry. It produces enough oil to prevent dehydration but not enough to thickly coat the skin. It is the optimal condition for skin.

1.3.4.2 Physiologically based classification

Normal skin

Normal skin has an even tone, soft, a smooth texture, no visible pores or blemishes, and no greasy patches or flaky areas. This type of skin has a clear, fine-textured, supple and smooth surface, which is neither greasy nor dry. It glows with an inner health, which stems from good blood circulation and excellent health. There may be occasional pimples in women just before menstruation due to increased hormonal activity, which makes the sebaceous glands overactive. Acne is, however, not a problem for people with normal skin.
Oily skin

Oily skin is shiny, thick and dull colored. Often a chronically oily skin has coarse pores and pimples and other embarrassing blemishes. It is prone to blackheads. In this type of skin, the oil producing sebaceous glands are overactive and produce more oil than is needed. The oil oozes and gives the skin a greasy shine. The pores are enlarged and the skin has a coarse look.

Dry skin

Dry skin has a low level of sebum and can be prone to sensitivity. The skin has a parched look caused by its inability to retain moisture. It usually feels "tight" and uncomfortable after washing unless some type of moisturizer or skin cream is applied. Chapping and cracking are signs of extremely dry or dehydrated skin. Dryness is exacerbated by wind, extremes of temperature and air-conditioning, all of which cause the skin to flake, chap and feel tight. This type of skin is tightly drawn over bones. It looks dull, especially on the cheeks and around the eyes. There may be tiny expression lines on these spots and at the corners of the mouth.

Sensitive skin

A sensitive skin is a thin or a fine-textured skin. It reacts quickly to both heat and cold; therefore, it sunburns and windburns easily. It is commonly dry, delicate and prone to allergic reactions. Temperature changes, some detergents, cosmetics and alcohol (used on the skin) can all cause irritation, leaving the skin red and blotchy, with visible surface veins.
Combination skin

Combination skin is a combination of both oily and dry skin. There is a greasy center panel consisting of nose, forehead and chin and a dry panel consisting of cheeks, mouth and the areas around the eyes. This type of skin is very common, and it should be treated as if it were two different types of skin.

Acne-prone skin

Acne-prone skin is prone to one or more of the forms of acne. Acne-prone skin usually has at least one "spot", although it can experience brief intervals of no spots. It is usually also oily skin. Acne often begins when a person enters puberty; it is thought to be a response to the hormones that are activated at that time. It can extend into the late 40s and even beyond41.

1.3.4.3 Photosensitive classification

The photosensitive skin is classified into six categories e.g., always burn, easily burn, some time burn and moderately burn etc. The sensitivity to sun light (UV rays) and required sun protection factor (SPF) and detailed in table 1T-4.

Table 1T-4: Characteristics of photosensitive skin

<table>
<thead>
<tr>
<th>Type</th>
<th>Characteristics</th>
<th>Examples</th>
<th>Suggested SPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Always burn easily, never tans</td>
<td>Blue eyes, red hairs</td>
<td>15</td>
</tr>
<tr>
<td>II</td>
<td>Burn easily, tan slightly</td>
<td>Faded skinned</td>
<td>12 - 15</td>
</tr>
<tr>
<td>III</td>
<td>Some time burn, tan gradually</td>
<td>Most Caucasians (Pale color skinned)</td>
<td>8 - 10</td>
</tr>
<tr>
<td>IV</td>
<td>Burn minimally, Always tanned</td>
<td>Asians and Hispanics (Spanish)</td>
<td>6 - 8</td>
</tr>
<tr>
<td>V</td>
<td>Burn rarely, Tan deeply</td>
<td>Indians</td>
<td>6 - 8</td>
</tr>
<tr>
<td>VI</td>
<td>Almost never burn, deeply pigmented</td>
<td>Blacks</td>
<td>6 - 8</td>
</tr>
</tbody>
</table>
1.3.5 Ageing of Skin

Aging of skin is commonly associated with increased wrinkling, sagging and increased laxity. There are two main process of skin aging: intrinsic and extrinsic. Intrinsic aging reflects the genetic background of an individual and results from the passes of time. It is inevitable; thus, it is beyond voluntary control. Extrinsic aging is caused by external factors such as smoking, excessive use of alcohol, poor nutrition and sun exposure. This process then is not predictable and, by definition refers to pre mature skin aging. However, the vast majority of the skin's age related cosmetic problems are thought to be as a result of cumulative exposure to sunlight.

In ageing, the skin becomes fewer firms, dry and more wrinkled, because of the decrease level in the amount of mucopolysaccharides, collagens and elastin. As well as the level of enzymes like sodium dismutase (SOD), catalase, and vitamins like ascorbic acid and alpha tocopherol becomes declined. The mitochondrial theory of aging (MTA) was first proposed in 1972 by Denham Harman, which supported the normal aging process.

1.3.5.1 Natural and Intrinsic ageing

The process of intrinsic skin ageing is similar to that occurring in the most internal organs, involving slow deterioration in tissue function. The stratum corneum remains relatively unchanged, but the epidermis and dermis thins with a flattening of the dermo-epidermal junctions. In natural process of skin ageing, some changes occur abruptly in the physiology of sebaceous gland. Glands became less active solely as a result of the lower level of circulating
androgens, or male sex hormones. Sweat glands become less active with age, and the number of active eccrine glands is reduced.

Intrinsic ageing, also known as the natural aging process, is a continuous process that normally begins in mid-20Yrs, the skin collagen production became slows, and elastin, the substance that enables skin to snap back into place, which has a bit less spring. Dead skin cells do not shed as quickly and turnover of new skin cells may decrease slightly. While these changes usually begin in twenty year, the signs of intrinsic ageing are typically not visible for decades. The signs of intrinsic ageing are:

- Fine wrinkles
- Thin and transparent skin
- Loss of underlying fat, leading to hollowed cheeks and eye sockets as well as noticeable loss of firmness on the hands and neck
- Bones shrink away from the skin due to bone loss, which causes sagging skin
- Dry skin that may itch
- Inability to sweat sufficiently to cool the skin
- Graying hair that eventually turns white
- Hair loss
- Unwanted hair

1.3.5.2 Exagrated or Extrinsic ageing

A number of external factors act together with the normal aging process to prematurely age our skin. Cigarette smoke; some topical chemicals like mineral oil and coal tar dyes (common in makeup); allowing dead skin cells to pile up on
the skin; diet (caffeine beverages, alcohol, sweets, excessive red meat); genetics heredity. Premature aging is mostly caused by sun exposure over the years, results in frickles, age spots, spider veins on the face, rough and leathery skin fine wrinkles that disappear when stretched, loose skin, a blotchy and blemished complexion, actinic keratosis and skin cancers. Premature aging of the human skin is result of a number of extrinsic, or external, factors often act together with the normal aging process. Other external factors that prematurely age our skin are repetitive facial expressions, gravity, sleeping positions, and smoking.

- Sunburn and immune suppression occurs acutely in response to excessive exposure to the sun, where as skin cancer and photoaging results from accumulated damage caused by repeated exposure.

- Skin cancer is the most prevalent form of cancer in humans typically occurs in skin that is photoaged. Photoaged skin is characterized by wrinkles, toxicity, uneven pigmentation, brown spots and leathery appearance, and chronologically aged skin that have been protected from the sun.

*Photo aging*

Mild sunburn is a first-degree radiation burn, which produces reddening of the skin with accompanying pain. Generally, as the skin heals, redness may persist and the outer layers of the epidermis will peel within a week with accompanying itching. Prolonged exposure can result in a second-degree burn, which is characterized by blistering of the skin and more severe pain.

Ultraviolet rays are broadly divided into three sections according to their wavelengths. Ultraviolet light is artificially divided into three ranges.
UVA - Radiation in the 320-400 nm range.

UVB - Radiation in the 290-320 nm range.

UVC - Radiation in the 100-290 nm range.

UVC is totally blocked by the ozone layer in the upper atmosphere of the earth. The ozone layer blocks some of the UVB and the entire UVA pass through the ozone layer. Generally, UVB has been blamed for sunburn, but some studies indicate that UVA may also cause skin damage.

The abundant literature was found, which describes the harmful effects of UV radiations on the skin. The excessive exposure induces the extensive generation of reactive oxygen species (ROS) and its reaction to DNA, proteins, fatty acids and saccharides causing oxidative damage. Study suggests that such injuries result in a number of harmful effects: disturbed cell metabolism, morphological and ultrastructural changes, attack on the regulation pathways and, alterations in the differentiation, proliferation and apoptosis of skin cells49-50.

A) Effects of UVB radiations

Solar UV radiation is the most important environmental factor involved in the pathogenesis of skin cancers. These rays only have the strength to penetrate the epidermis. The epidermis is the very top layer of the body and the same thickness as a silk scarf. Melanocyte cells synthesize tyrosinase and the pigment melanin that is transferred to the keratinocytes or skin cells for color. UVB rays simulate the melanocyte cell to produce more melanin, which is more color known as a suntan or age spot33. UVB radiations are the primary cause of sunburn because
of its shorter wavelength and its effects on the outer skin layers. UVB appear to damage skin cells by directly bombarding the genetic materials, the DNA inside the skin cells. The well-known genotoxic properties of UVB radiation (290-320 nm) mostly involve bipyrimidine DNA photoproducts on UVB irradiation\textsuperscript{52}. The bipyrimidine photoproducts are generated in the DNA of human skin upon UVB irradiation. The formation of photoproducts was found linear with respect to the applied UVB dose (0-0.2 J/cm\textsuperscript{2})\textsuperscript{53}. The chronic effects of UV-B radiation were found to be induced the biochemical changes in the skin of mice with insufficient collagen fibers to support the increasing mass of the tissue\textsuperscript{54}.

B) Effects of UVA radiations

An UVA effect is initially seen through the epidermis then disperses in the dermis. The dermis is dominantly affected by UVA radiations, and slow down the normal renewing process itself in the middle age. Skin after this age is considered "mature skin" and damages incurred are not repairable.

UVA radiation is composed of longer wavelengths. These penetrate more deeply and efficiently into the inner skin layers and are responsible for tanning and allergic reactions to sunlight.

UVA radiation provokes the generation of reactive oxygen species (ROS), which induce oxidative stress in the exposed cells leading to extensive cellular damage and cell death either by apoptosis or necrosis\textsuperscript{55}. 
Occurrence of skin cancers, which mostly arise from exposure to solar UV radiation, has constantly increased in the recent years due to changes in life habits. Harmful effects of UV radiation are mostly associated with both direct and indirect photoinduced damage to DNA (Cadet et al. 2005) that can lead to the induction of mutations. The chemical nature and the formation efficiency of the DNA lesions greatly depend on the wavelength of the incident photons. UVB radiation (290–320 nm), the most energetic mutagenic and carcinogenic component of solar radiation, is directly absorbed by DNA, giving rise to dimeric photoproducts between adjacent pyrimidine bases. Two types of these bulky modifications are produced, namely cyclobutane pyrimidine dimers (CPDs) and pyrimidine (6-4 hydroxyl linkage) pyrimidone photoproducts. Evidence for the involvement of these lesions in photocarcinogenesis is provided by the high proportion of p53 mutations (TC to TT or CC to TT transitions) detected at bipyrimidine sites in skin tumors.

UVA radiation of the range 320–400 nm is mutagenic in cultured cells and induces skin tumors in mice. In addition, UVA has been shown to be involved in immunosuppression and is suspected to play a major role in the induction of melanoma, the most severe type of skin cancers. Consequently, the carcinogenic properties of UVA have become a matter of concern.
Histopathological alterations

The immediate after exposure to a large influence of UV radiation, significantly decreased the enzymic and non enzymic antioxidant capacity of the skin\textsuperscript{62}. So many studies showed the histologically alterations in collagen due to different intensity of different wave length on skin exposure which become appeared as wrinkling of skin\textsuperscript{63}. The high UVA exposure produced greater skin atrophy and fine wrinkles than the 1 MED solar stimulated UV treatment. These finding revealed that damage to the dermal components is responsible for the clinical manifestation of sagging and wrinkles\textsuperscript{64}.

The effects of repetitive UV-A and UV-B irradiation on human showed marked pigmentation and thickening of the epidermis and inflammation, elastosis in the dermis\textsuperscript{65}.

The biochemical mechanisms responsible for the connective tissue changes are seen in actinically sun damaged skin. Diminution and ultrastructural alterations of collagen fibrils and deposition of elastotic material in the papillary dermis characterize the actinic skin histologically. Such study suggests that direct stimulation of collagenase synthesis by human skin fibroblasts by UVA radiation may contribute to the connective tissue damage induced by ultraviolet radiation leading to photoaging\textsuperscript{65}.

The acute effects of a single exposure to near (UVA) above $>320$ nm on various skin antioxidants were examined in hairless mice immediately after irradiation. Impairment of cutaneous catalase and glutathione reductase activity was observed. Superoxide dismutase and glutathione peroxidase were not significantly influenced, but found that inhibition of catalase may render skin
more susceptible to the damaging effects of hydrogen peroxide and its reactions product such as the hydroxyl radical\textsuperscript{62}. There was tangential (non significant) decrease in cutaneous tocopherol ascorbic acid level, indicates direct photo-oxidative stress.

The main damaging effects of UVA appear to be the promotions of the release of oxidants (oxygen free radicals). These unstable particles are the results of many chemical processes in the body\textsuperscript{66}. Figure 1F-3 showed molecular damaging mechanism of sunlight and natural healing pathway.

Ageing Mechanism

Skin tissues composed of proteins and are therefore major target for photo oxidation with in cell. The direct photo oxidation arises from the absorption of UV radiation by the proteins. There by generating excited state species (singlet or triplet) or radicals (as a result of photo ionization). The indirect photo oxidation of proteins arises from the formation and subsequent reactions of singlet oxygen generated by the transfer of energy to ground state (triplet) molecular oxygen by either protein bound or chromophores.

Small amount of ultraviolet radiations trigger the negative effects on the skin and damages the collagen fibers, which are the major structural proteins in the skin and causes accumulation of abnormal elastic (this is the protein that causes tissues to stretch). This accumulation leads to production of large amounts of enzymes called metalloproteinases\textsuperscript{67}.

These metalloproteinases degrades the collagen in extracellular matrix of the dermis. Normal functions of these enzymes are generally positive to remodel the sun-injured tissues by manufacturing and reforming collagen process.
The reforming collagen process causes an uneven formation (skin matrix) of disorganized collagen fibers called solar scars and than this process recycled. The sign of skin aging reflects the condition of the skin matrix disarrangement. The weaker and less regular the matrix, the more wrinkles, rung fries and sag occur in skin.

The reactive oxygen species (ROS) can react with cellular components like cell walls, lipid membranes, mitochondria and DNA, leading to skin damage and increasing the visible signs of aging. Direct oxidation of amino acid, peptides and proteins by ultraviolet light is only a significant process, if the structural protein absorbs the incident light.

In the whole process of skin ageing, the enzymes, which are critical moieties to protect the skin from oxidation or oxidative stress the level of these enzymes like sodium dismutase (SOD), catalase, glutathione, peroxidase etc. become less. Therefore as people get older, they age faster and the body's ability to protect itself is reduced. As the persons ages help can be given to supplement natural defense systems by helping to protect the skin from the ravages of time and environmental attack by formulating cosmetics containing safe protective supplements.

Damage of skin cells results from photochemical reactions leads to the stimulation of inflammatory pathways. UVB irradiations are considered the major cause of typical sunburn, which starts to develop within a few hours.

So many studies suggest that such extrinsic damages results in a number of harmful effects: disturbed cell metabolism, morphological and ultrastructural changes, attack on the regulation pathways and, alterations in the...
differentiation, proliferation and apoptosis of skin cells. The extensive generation of reactive oxygen species (ROS) and its reaction to DNA, proteins, fatty acids and saccharides is one of the causes of oxidative damage. These damages can be minimized using naturally occurring herbal ingredients such as phenolic acids, flavonoids, and high molecular weight polyphenols, which could be use to gained considerable attention as beneficial protective agents in skin formulations.\(^7\)

The acute effects of near UV and visible light on the cutaneous antioxidant defense system were examined. After single exposure to near (UV-A) above >320 nm on various skin antioxidants studied in hairless mice immediately after irradiation. Impairment of cutaneous catalase and glutathione reductase activity was observed. Superoxide dismutase and glutathione peroxidase were not significantly influenced, but found that inhibition of catalase may render skin more susceptible to the damaging effects of hydrogen peroxide and its reactions product such as the hydroxyl radical. There was tangential (non significant) decrease in cutaneous tocopherol ascorbic acid level, indicates direct photo-oxidative stress.\(^6\)

There is increasing evidence that the incidence of the three main types of skin cancers (Basal cell carcinoma, Gnamons cell carcinoma and malignant melanoma) is linked to sun exposure, individual sun sensitivity and to some extent to the history of sunburn.

1.4 Hair and cosmetics

Ebling and Johnson have shown how each hair follicle originates from an interaction between epidermal and dermal layers of the skin. The hair follicle is
a sheath of epidermal cells and connective tissue that encloses the root of the hair.

Specific cells from the superficial dermis increase in number and grow forward to form a "peg or hook". Beneath this are specialized fibroblasts which will become the dermal papilla. Epidermal cells adjacent to the dermal papilla multiply and push a column of keratinizing cells towards the scalp surface, and these keratinizing cells become the hair shaft. The hair peg migrates downwards to form the follicle with swellings appearing as the column elongates. These are the sites of the erector pili muscles and sebaceous glands. The hair follicle has one of the highest rates of cell division in the human body and makes considerable demands on energy to sustain such growth.

1.4.1 Structure

It is the nature of the hair shaft which is of primary interest. The outermost structure is the cuticle which surrounds the cortex. It is composed of flat cells which overlap in a roof tile formation with an intercellular cement to bind them together. Each cell has an outer membrane and contained within the membrane are three distinct layers, the A layer, the exocuticle and the endocuticle.

The hair is formed by the shaft and the piliferos bulb, the visible part of the hair is the shaft has the diameter ranging between from 40-120 microns; it is made-up of dead cells and completely keratinized. Three concentric layers form a cross sectional section of hair:

- The cuticle (External part)
- Marrow (Core part)
- The Cortex (Actual structure)

The cuticle is the outermost layer made-up of flattened cells that overlap in the forms of tiles and are 45 micron long with thickness 0.5-1.0 microns. The medulla is the core of the hair and it is made-up of overlapping cells with a low cellular density. It has a relative importance in comparison to two other parts of the hairs, as it contributes in little way to its chemical and physical behaviors. The medulla forms only a small proportion of the total fibre mass and contributes very little to the mechanical and chemical properties of the hair. It comprises a series of vacuoles or air spaces formed due to dehydration of the loosely packed cells during the keratinization process.

The cortex comprises the majority of the fiber mass, consisting of elongated keratinized cells bound together with intercellular material. The cortex is formed by the cells, which are 1-6 micron thick and 100 micron in length. The cortex made-up for about 90% of total weight of hair fiber. The fiber is formed by long twisted proteins chain, which gave its elasticity; the color pigments are tucked among these proteins strands and protected against external agents like sunlight, dust, humidity.

Melanins (natural color pigments) occur within the cortex. These are derived from an aminoacid, tyrosine and are of two types, eumelanin and pheomelanin. These pigments are formed by melanocytes situated in the pigmented part of the hair bulb and the outer sheath of the hair follicle. The eumelanin gives brown to black coloration and the pheomelanin gives an auburn tone.

An outer hair cell is a self-supporting cylinder that is attached to adjacent epithelial cells only at the extreme base and apex\textsuperscript{72-74}. Cell shape is maintained...
by cortical structures, particularly by the cortical lattice, a two dimensional cytoskeleton that lies beneath the lateral plasma membrane. One interpretation of the structure of this lattice is that it is an anisotropic network composed of long, circumferential filaments, 6-7 nm thick, which are cross-linked by filaments 3-4 nm thick and 40-50 nm long. Neither of these filaments has been identified although immunofluorescence labeling suggests that they may be composed of actin and spectrin. Another interpretation is that the cortical lattice is based primarily upon the thin filaments linked together by short fragments of actin, thus resembling the spectrin skeleton in erythrocytes.

The cortex of outer hair cells is further specialised by a system of concentric endoplasmic membranes that lies immediately beneath the cytoskeletal lattice.

1.4.2 Chemistry of hair

Hair fibres are composed of approximately 85% of the complex protein keratin, with some 7% of associated water. The other principal constituents are lipids 3%, and pigment 2%. The pigments are melanin, derived in biosynthesis from the aminoacid tyrosine. The most important material is keratin which has been formed biochemically from the condensation of some 18 types of amino acids. Chemically it is composed of hairs:

Carbon (50%), Oxygen (25%), (Hydrogen6.5%), (Nitrogen 7.0%) and Sulphur (4.5%). Trace amounts of many metals such as aluminium (Al), chromium (Cr), calcium (Ca), copper (Cu), iron (Fe), manganese (Mn), magnesium (Mg) and zinc. Phosphorous compounds are also abundant (80mg/100gm hair), mainly derived from degraded nuclei of the cortex cells.
1.4.3 Hair growth biology

Hair grows from primary follicles. Actively growing hair follicles penetrate the entire epidermis and dermis. There are approximately 5 million total body hair follicles, of which 100,000 to 150,000 are scalp follicles. In adults, 90% of the hair follicles are in the growing (anagen) stage and the remainder is in the resting stage (telogen) stage. Follicular density decreases with age (1135/cm² at birth to 485/cm² at age of 30 years and till 80 years decreases to 435/cm²).

Scalp hair grows at a rate of 0.37 to 0.44 mm/day and normal scalp hair loss or shedding in adults ranges from 50 to 100 hairs per day.

The growth of hair in human is controlled by complicated mechanisms that can differ among various body locations. Morphologically, there are three types of hair; vellus, terminal, and intermediate. Vellus hair are short, fine (<0.3mm in diameter), soft and usually nonpigmented and unmedullated. Terminal hairs are large (>0.3mm in diameter), dark pigmented and medullated. Ninety percent of the hairs on the chest, trunk, shoulders, legs and arms of men are terminal hairs, whereas only 45 percent of hairs in the same regions on women's are terminal. Intermediate hairs occur on the scalp and they demonstrate morphology between those of terminal and vellus hairs. Intermediate hairs are medullated and contain a moderate amount of pigment i.e. less than that found in terminal hairs.

1.4.4 Hair disorders

Alopecia

Androgenetic alopecia is the most common type of hair loss in human. Its prevalence in any population has been accurately studied, but it occurs much
more often in Caucasians than other races. Androgenetic alopecia affects approximately 50% of men over 40 years of age and may also affect just as many women.

Stretching strength
The environmental factors like temperature, humidity and major are the sunlight, which decreases the strength of hairs and hair becomes loose and dwelling. The Sunlight produces the deleterious effects on hairs also. The photooxidation of hair elements, such as melanin and cuticle proteins, occurred.

In the hair fiber, the lipids and protein bound in the epicuticle, belying that this is indeed a filament of cellular origins, not a man made fiber. The keratin of hair gives rise to its final physical form and structure properties. This primary component consists of a hard, keratinized protein, with a high level of sulfydryl amino acid and virtually none of the marker aminoacid, hydroxyl praline, found in fibrillar connective tissue, such as collagen.

The layer of the cuticle, the cystine content can be as high as 35%. Other UV absorbing aminoacids present in the hair includes the aromatics, tyrosine and to a lesser extent tryptophan. All three of these protein monomers in the pure state and insitu are photo labile and give rise to active oxygen species, chain reaction propagating free radicals, such as singlet oxygen, when hairs exposed in sun light.

Loss of hair properties
Hair is the recipient of a constant series of environmental assaults termed as weathering. Such potentially damaging influences as rain, air pollutants, wind, sea water, chemicals contributes to the environmental process known to cause
structural and chemical degradation to hairs. Most damaging of all environmental factors is ultraviolet radiations exposed from sun light. Most damaging portion of hair is cuticle, the condition of a cuticle covering hair that has been exposed to UV radiation and with other elements also.

The cuticle is considered to play a key role in determining the overall physical properties in relation to keratin fibers. The cuticle dictates the frictional properties of the hair fibers and also largely responsible for the integrity of the interior portion of hairs, which ultimately decides the appearance of hairs.

In normal hair, cuticle cells are smooth rounded and tightly packed on to the cortex, while long term exposure to sun light and other environmental damages, results in breakdown of cuticle cells that coat exposed hair surface.

The scientific data shows that photochemical reaction occurs in hair after exposure to ultraviolet radiations. Discoloration is the most obvious chemical alteration caused by the high intense ultraviolet exposure. Other subtler changes also occur due to environmental factors like changes in sorption characteristics and the urea and bisulfite solubility of hair have been detected after weathering exposure.

**Mechanism**

A free radical mechanism has been proposed that may account for many of the photochemical changes occurring in weathered hair.

UV radiations is absorbed by inert hair amino acids like cystine, tyrosine, phenylalanine and other amino acids as well as possibly some peptide bonds, which results in the formation of free radicals and due to this hemolytic scission of disulfide bonds, occur in hair. In the presence of such free radicals carriers
as water present as humidity in the atmosphere, a sequence of radical transfer reactions, involving hydroxyl radicals can take place. This causes random displacement along the protein backbone that leads to an assortment of degradation and ultimately tensile strength of hair became decreased. Although pronounced tensile alteration is due to primarily to photochemical effects on disulfide linkage, deamination or decarboxylation of amino acids, disorientation of hydrogen bonds and the chemical alteration of the aromatic nuclei in tyrosine and phenylalanine so contribute to a chemical reduction in tensile strength of hair.

Protection of Hair
Such hair damages can be control and minimize by using conditioning ingredients as well as photo protective types of substances, which can impart role in ultraviolet radiations absorption at the surface level.

1.5 Cosmetic strategies
In modern skin care the cosmetic sunscreen formulations used widely for more benefit than simple moisturizing and cosmetics, demands of users are good fed factor. Formulation contains substances like antioxidants components, which have cellular protective nature or maintain biochemistry of skin. Sun protective, free radical scavengers, anti-inflammatory and anti-microbial substances provides all the benefits, which are able to improve skin protection and delay the onset of visible ageing and such benefits are confirmed by natural materials. Many plants and their products are being used as medicine since ancient time. Several studies are still going on the properties and mechanism of these plants extracts in skin care.
1.5.1 General skin care

The aging process can be delayed by using daily balanced diet in food and properly utilization of micronutrients as a topical formulation application.

General skin care requires balance nutritional diet orally and topically.

The micronutrients like vitamins, enzymes, proteins and antioxidants are capable of directly scavenging lipophilic and hydrophilic pro-oxidants through or the topical delivery serve as an antioxidant.

Flavonoids, polyphenol and vitamins contribute to antioxidant defense mechanism, may also contribute to retard endogeneous aging process.

Vitamin-C regenerates tocopherol from the tocopheroyl radical and transfer the radical load to the aqueous compartment where it is finally eliminated by antioxidant enzymes.\(^9^3\)

Now a day, peptide technology also is proving its ability against natural aging via penetrating the skin without redness or irritation to improve the skin morphometric parameters. The use of specific active peptides able to target and regulate cell function, maximize collagen production by stimulating the growth of collagen cells, results in reduction of fine lines, increasing skin firmness and tone. Polyphenols are also found as efficient antioxidants obtained from fruit and plant extracts.\(^9^4\). These extracts are utilized as cosmetics ingredients, having the effects on skin and hairs.

1.5.2 UV Care

Care from UV rays through the natural substances is undoughtily possible.

Substances containing variety of vitamins, proteins, peptides, flavonoids,
pigments and sterols can play a protective role via different ways against the skin aging.

1.5.2.1 Photoprotectants

These are the substances, which screen on or filter out the complete ultraviolet radiations range from 290-400 nm. Photoprotective products containing ultraviolet radiation absorbing or scattering ingredients provides varying degree of protection from sunlight, thus minimizing the deleterious effect on the skin. When skin is exposed to sunlight, ultraviolet radiations is absorbed by skin molecules that then can generate harmful compounds, called reactive oxygen species (ROS) which are highly reactive molecules that can cause oxidative damages. ROS can react with cellular components like cell wall; lipid membranes, mitochondria and DNA, leading to skin damage and increase the visible sign of aging. UV filter contained in the sunscreen cut down the amount of UV radiation that can penetrate the skin UV radiation.

Natural

Human skin is protected against UV radiation by melanin, an endogenous pigment that scatters and absorbs UV light. The use of sun screening agents for topical protection is promoted against skin aging process and skin cancer. UV absorbing compounds and inorganic pigments like titanium dioxide, zinc oxide are combined in many sunscreen formulations. Thus, protection can be mediated via absorption, reflection and light scattering or ultraviolet rays. Natural protectants like minerals e.g. bentonite, china clay, soft stone, titanium dioxide and oils e.g. tea tree, cinnamon, jojoba, bergamut oil and plant juices and extracts like tulsi, cinnamoun, callendula, orange peel brahmi, rose are
being used since last so many time. Chlorophyll pigments, henna powder, oil layers were used as a thick barrier system. All these natural ingredients were used as such in paste and as an extracts lapas form. These natural photoprotectants contained variety of substances, which plays different role in the mechanism of the photo protection.

The naturally occurring herbal compounds such as phenolic acids, flavonoids, and high molecular weight polyphenols have could be use to gained considerable attention as beneficial protective agents

The potential effects of aloe gel revealed that significant protection on (Glutathion, oxidative glutathion by decreasing in level and significant increment in MDA (Melanodialdehyde) level and controlled the second-degree burns in controlled manner was controlled by aloe gel topical administration.

Synthetic

Sunscreens were introduced in 1928, in the United States. An emulsion containing two-sun screening chemicals i.e. Benzyl salicylate and Benzyl Cinnamate was commercially introduced in early 1930. Australia introduces a cosmetic sunscreen formulation containing phenyl salicylate. In 1936, In France a chemist E. Schueller introduce first commercial sunscreen formulation.

The varieties of synthetic sunscreen agents are given in Table 1T-5.

Sunscreen formulations contain special molecules - called UV filters, which cut down the amount of UV radiation that can penetrate the skin. Over time, though, these filters penetrate into the skin below the surface of the epidermis. The additional ROS are generated only when the UV filters have penetrated
into the skin and, at the same time, sunscreen has not been reapplied to prevent ultraviolet.

Hansen et al. report that three UV filters (Octyl methoxy cinnamate, Benzophenone-3, and octocrylene), widely used in sunscreen, generate ROS in skin themselves when exposed to UV radiations. Many studies indicate that the additional ROS are generated only when the UV filters have penetrated into the skin and can become harmful to the skin99.

In the United States lotions containing quinine oleate and quinine bisulphate appeared in 1935, but cause of photoallergic reactions, skin rashes were found. Para-amino benzoic acid (PABA) was first patented in 1943, leading the way for the several PABA derivatives in sunscreen formulations. The growing public awareness to the photosensitization reactions of PABA and its derivatives has encouraged the use of PABA free products100. The production of another sunscreen, containing 4-isopropyl dibenzoyl methane was ceased in 1993 due to the high number of photoallergy incidents.

Moreover, some of the cases of adverse reactions to sunscreen active ingredients related to the adverse reactions with cross reactivity of several sunscreen ingredients like cinnamate derivatives (Ibid). In addition, several studies have demonstrated the photoinduced DNA damage and phototoxicity of sunscreen agents, including padimate, and phenylbenzimidazole sulfonic acid101. Physical sunscreens agents such as titanium dioxide are known to be photocatalysts capable of rupturing covalent bonds and have been shown to produce reactive oxygen species under illumination102-103.
### Table 1T-5: Synthetic Sunscreens agents

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Approved Concentration %</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxybenzone</td>
<td>2-6</td>
<td>UV-A Absorber</td>
</tr>
<tr>
<td>Sulisobenzone</td>
<td>5-10</td>
<td>UV-A Absorber</td>
</tr>
<tr>
<td>Diclofenacate</td>
<td>3</td>
<td>UV-A Absorber</td>
</tr>
<tr>
<td>Avobenzone</td>
<td>3</td>
<td>UV-A Absorber</td>
</tr>
<tr>
<td>Methyl anthralinate</td>
<td>3-5</td>
<td>UV-A Absorber</td>
</tr>
<tr>
<td>Amino benzoic acid</td>
<td>1-5</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Amyl dimethyl PABA</td>
<td>5-15</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Dioctylamine p- methoxycinnamate</td>
<td>8-10</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>2-Ethoxyethyl p- methoxycinnamate</td>
<td>1-3</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Benzophenone</td>
<td>1-10</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Butyl methoxy dibenzoyl methane</td>
<td>1-8</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Digaloyl trioleate</td>
<td>2-5</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Ethyl 4-bis hydroxy propyl amino benzoate</td>
<td>1-5</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>2-ethyl hexyl-2-cyano-3,3 diphenyl acrylate</td>
<td>7-10</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Ethyl hexyl p- methoxycinnamate</td>
<td>2-7.5</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>2- ethyl hexyl salicylate</td>
<td>3-5</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Glycerol amino benzoate</td>
<td>2-3</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Homomenthyl salicylate</td>
<td>4-25</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Lawsone dihydroxy acetate</td>
<td>0.25-3</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Octyl dimethyl PABA</td>
<td>2-8</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>2- Phenyl benzimidazole- 5- sulphonic acid</td>
<td>1.5</td>
<td>UV-B Absorber</td>
</tr>
<tr>
<td>Ethanolamine salicylate</td>
<td>5-12</td>
<td>UV-B Absorber</td>
</tr>
</tbody>
</table>

**Mechanism of photo protection**

Structural requirements for suitable photoprotecting agent depend on the mechanism of action of photoprotection:

(i) Increasing the barrier for UV light (UV absorbing compounds)
(ii) Protecting through molecules which act as scavengers e.g. antioxidants.

(iii) Repairing UV induced damage by induction of repair system.

(iv) Suppression cellular responses e.g. anti-inflammatory agents.

The active sun protecting agent's affects in different ways either by absorbing, reflecting, or scattering some or all of the sun rays. Most of the sunscreen products contain combinations of ingredients. Possible mechanism of sun protections via natural substances includes free radical acceptance, blocking of catalytic effect of UV, anti-inflammatory effects and in long term inhibition of UV induced cellular stress. General Photoprotecting follow the mechanism are:

- Agents that attenuate the level of actinic insult (e.g. by absorbing or acting as barrier to UV rays) in case of topical protectants

- Agents that compete with the target molecules for the damaging product of the aberrant agent

- Agents that provide restoration action (repair of the damaged target molecules) and prevent UV suppression and contact hypersensitivity

- Agents that suppress various stages of the inflammatory responses and mask certain manifestations of UV damages.

UV filter contained in the sunscreen cut down the amount of UV radiation that can penetrate the skin UV radiation. Hansen et al. report that three UV filters (Octyl methoxy cinnamate, Benzophenone-3, and octocrylene), widely used in sunscreen, generate ROS in skin themselves when exposed to UV radiations.
They observed that the additional ROS are generated only when the UV filters have penetrated into the skin.

The synthetic Oxybenzone, are absorbed and subsequently excreted in human urine with low acute toxicity in animal studies; its chronic toxicity and disposition after topical application in people were found. Study concluded that sunscreen in the product (i.e. greater than 10%) over the period of application showed critical condition of skin. That's why sunscreens should not be the sole method of sun protection.

Side effects and toxicity

The synthetic sunscreen compounds like butyl methoxy dibenzoyl methane (BMDBM) and bezophenone are the most efficient and frequently used UV filters. These agents generate carbon centered free radicals, when illuminated with simulated sunlight and causes in vitro strand breaks in DNA and oxidative modification. Many studies on photoinduced allergic reactions were carried out. The photoallergic reactions of sunscreen were noticed from study of 355 consecutive patients with suspected photosensitivity test with different UV filters. Schauder et al. (1998) showed the sunscreen allergy and photoallergy reactions in 402 patients with suspected clinical photosensitivity via patch and photo patch testing with the commercial sunscreens and facial cosmetics containing chemical UV absorbers, fragrance materials, preservatives, and emollients. The study found that such allergies are due to the real frequency of sunscreens exposure.

The intolerance of sunscreen agents with suspected photodermatosis and positive reactions was noted in sixty one positive photopatch for photocontact
allergy to sunscreens contains-oxybenzone and to para-aminobenzoic acid and its derivatives.

More than one third photoallergies had due to a moisturizer contained oxybenzone. The butyl methoxy dibenzoylmethane, methoxycinnamate and benzophenone were found to be major cause of photoallergic contact dermatitis\textsuperscript{113-114}.

Topically applied sunscreens penetrated into human viable epidermis to put the local keratinocyte causing risk of toxicity (e.g. avobenzone, octinoxate, octocrylene, oxybenzone and padimate) showed by keratinocyte culture response curves (changes in cell morphology and proliferation)\textsuperscript{115-116}. The fetus malformations was observed after use of widely suncreening agent (2,3',5'-Di-tert-butyl-2'-hydroxyphenyl)-5- chlorobenzotriazole\textsuperscript{117}.

1.5.2.1 Photoprotection via antioxidants

From the earlier, it appeared that natural antioxidants are photoprotective. Pauling coded first time that diet rich in ascorbic acid was beneficial in reducing UV-B induced neoplasma in animals\textsuperscript{118}. Diet rich in antioxidants mixtures was found to be reduced UV induced carcinogenesis\textsuperscript{119}. Vitamin E alone decreases lipid peroxidation reaction generated due to sunlight. Ascorbic acid is one of the most effective antioxidant in vivo, and found to be logical candidate as topical photoprotectant to control sunburn cell formation and tumor formation\textsuperscript{63}. Besides the vitamin C and E, another natural antioxidants has been studied for their photoprotective efficiency i.e. polyphenolic components, carotene and enzymes like SOD which are found to be regenerative of vitamin E, vitamin C and glutathione. More with these compounds ability, to alter the physical and
mechanical properties of the skin, thereby inhibiting penetration of UV wavelengths and counter act the oxidative stress in skin.\textsuperscript{98}

Like most antioxidants, idebenone is primarily preventive and another super antioxidant, plant-derived ferulic acid, fern extract and green tea has been shown to strengthen the natural photoprotective effects of topically applied vitamin C and E.

An extract obtained from buckwheat herb and compared with rutin, which is the main constituent of the extract, regarding their antioxidant and radical scavenging activity with, the photoprotective properties. These extract were compared to those of a commercial UV absorber, indicates the extract prevents the UV-induced peroxidation of linolic acid effectively than rutin and the commercial UV absorber. The use of the extract from buckwheat herb seems to be more beneficial than the use of pure rutin. This could be referred due to the presence of minor phenolic compounds in the extract. The results indicate that it is advisable to use antioxidants rather than only UV absorber to obtain a maximum of photo protection.\textsuperscript{120}

The methanol extracts of \textit{Eucommia ulmoides} (52%), \textit{Evodia officinalis} (45%), and \textit{Pleurotus multiflorus} (41%) was used to get potent inhibitory effect on the matrix metalloproteinase-1 (MMP-1) production in ultraviolet B (UV-B) irradiated human fibroblasts.\textsuperscript{87}

From the abovementioned studies, it can be appreciated that the overwhelming evidence of natural suggests that phytochemical, antioxidants are effective at inhibiting UV damages to skin and could be used as a potential agent in preventing photoaging.
1.5.2.2 Photoprotection via enzymes

The herbs as biological additives in form of extracts are utilizing since long period of time in the cosmetic formulation and scientific evidences proven that many plant extracts showed their photo protective activity and shows significant improvement in enzymes like superoxidizedismutase, catalase, and total protein and ascorbic acid level\textsuperscript{121-122}. Many plants, citrus fruits and leafy vegetables as source of ascorbic acid, vitamin C and phenolics compounds containing enzyme extracts of different varieties possess the ability to reduce the oxidative damage. These oxidative damages ultimately reduce the protective enzyme level and maintain the level of total protein and ascorbic acid in cells.

Klingman L.H. (1986) studied on histological examination of skin samples that had been irradiated with daily dose of UV-A light for a week, results revealed that a strong degradation of dermal collagen could be preserved or minimized after treatment with palmitoyl-Gly-His-Lys\textsuperscript{123}.

The potential roles of herbal enzymes were studied several times. The aqueous extract of fennel (Foeniculum vulgare) contains its peroxidase enzymes in the form of peroxisomes delivery with excellent cosmetic properties\textsuperscript{124}. The treatment with such herbal extracts containing creams could be utilized for the protection of photo induced intrinsic oxidative stress as well as structural alteration in skin.

Proteolytic enzymes like bromelaine, papain etc. has been used\textsuperscript{125} for skin peeling and smoothing. the review provide condensed studies regarding topically applied DNA repair enzymes to prevent UVB radiation – induced skin damage and the protective mechanism of superoxide dismutase and
peroxidase which were extracted from yeast are utilized as efficient tool to reduce UV-induced erythema, which can also be thought of as free radical scavenging ability\textsuperscript{126}. Recent studies indicated that endogeneous SOD activity is important in the severity and treatment of a wide range of inflammatory skin disease\textsuperscript{128-129}. Superoxide dismutase (SOD) plays a prominent role in regulating cellular superoxide anion level, and does so by dismutation to hydrogen peroxide (\(H_2O_2\)). A hyaluronidase derived protein, SOD are effective in treatment of a wide range of inflammatory responses. Lipid peroxidation has been suspected of being a source of sunlight induced cellular damage and initiated by free radical attack\textsuperscript{128-129}. The SOD activity in those patients with severe disease who were highly recalcitrant to therapy was found to be slightly elevated and marked decrease. These studies have opened up new avenues to photoprotection reaction occurring within the cell. Several non-enzymatic (ascorbic acid, vanillin, propyl gallate) superoxide anion and scavenging antioxidants also have a photoprotective and anti aging effects on repeated UV induced cutaneous damage\textsuperscript{118-119}.

1.5.2.3 Photo protection via Vitamins

There are different strategies for protection of skin against the UV radiations damages, which are closely associated with skin aging. It has been speculated that an increased topical protection against UV light might affect endogenous vitamin D synthesis in the skin and may causes disorders related to vitamin D deficiency. Even, like reduce bone strength at present use of vitamin D in sunscreen and in cosmetics are controversially. Vitamin C does slowdown the skin-damaging free radical activity\textsuperscript{118}. It is also required for collagen synthesis,
which declines markedly in aging skin. As humans age, they suffer diminished microcapillary circulation within the skin, thereby depriving skin cells of the supply of vitamin C it needs for youthful collagen synthesis. The topical application of vitamin C in a skin-penetrating medium can enhance the availability of vitamin C for collagen production. Vitamin C helps to regenerates vitamin E in the skin and can only suppress a limited number of free radicals before it runs out of electrons to donate. Vitamin C regenerates vitamin E and enables vitamin E to provide sustained antioxidant protection in the skin’s elastin fibers. Vitamin C also plays a vital role in skin repair. When skin is injured, its vitamin C content is used up rapidly in the scavenging of free radicals, and in synthesizing collagen to speed healing. The protective effects of vitamin C (ascorbic acid) containing formulation proved that the ascorbic acid levels of the skin was severely depleted after UV irradiation, which would lower skins innate protective mechanism as well as reduces the risk of impaired healing after photoinduced damage. These damages can be minimize using topical application of vitamin C, which can enhance the collagen production.

1.5.2.4 Photo protection via Extracts

Botanicals are playing an increasingly important role in the activity and safety of cosmetics, they allow for renewal of the source of active ingredients. Cosmetic formulas contain plant extracts, were tested and conventionally grouped into four major classes.

1. Primary antioxidants (Considered as free radical acceptors).

2. Secondary antioxidants (Acts synergistically with primary antioxidants).

3. UV absorbers (Blocks the catalytic effect of UV and visible light).
4. A miscellaneous group that comprises largely reducing agents with free H-groups including some radioprotectors that are not considered as antioxidants.

Topical application of polyphenols to human skin inhibited the UV-B induced erythema response and decreased the formation of cyclobutane pyrimidine dimer in skin found both in epidermis and dermis. There are numerous mechanisms by which a cell may deal with electronically activated species and some mention is warranted of naturals, endogenous free radical defense mechanism. Flavonoids recently been shown to have one of the highest 'active-oxygen' scavenging abilities of different plant extracts tested. Such extracts are more powerful anti-oxidants than vitamin E, and also exhibit potent cell-protective effects, which are linked to the well-known anti-ageing properties of anti-oxidants.

1.6 Cosmetic Classifications

All the cosmetic formulations can be classified on the basis of -

1. Site of application
2. Dosage forms
3. Pharmacological and Physiological
4. Consumers

1.6.1 Site of application: According to site, cosmetics are classified as-

(i) Skin cosmetic: These are directly and indirectly used to adorn the skin via improving luster and glow of skin. e.g. bath products, deodorants, antiperspirant, powders, rouges, perfume, oils, colorants, face packs.
(ii) **Eye cosmetics:** These are directly or indirectly used to improve the appearance of eyes. e.g., eye pigment, shadow, linear lashes, wax carbon.

(iii) **Hair cosmetics:** Strengthening, antidandruff and antioxidants agents are used in many hair formulations like shampoos, coloring materials, detangling hair care, hair grooming and cream and gels.

(iv) **Nails:** Nail formulations like nail liquor and polishes contains hydrating agents, coloring pigments and reflectors.

1.6.2 **Dosage Form**

**Solid**

(a) **Powders:** For scenting, washing, coloring, dyeing and pigmentation (Insoluble in liquids).

(b) **Pearls:** Drugs are encapsulated within layers of protein and calcium carbonate. These layers reflect sunrays and act as sunscreen.

**Semisolids**

Creams, lotions, ointment, gels, sticks, eyeliners, cheek shave, shampoos.

**Liquid**

Hair oils, after shave lotions, shampoos, color dyes, bath oil and body oils.

**Novel cosmetics:** Lioposomal, microspherical beads, nanosomes, multiple and micro emulsion

**Aerosols:** Air brushing, mist color foundations
1.6.3 Pharmacological and Physiological

Antiaging: Creams and lotions

Antiperspirants and deodorants: Sticks, powder and sprinkles via different physiological mechanism.

Antidandruff: Shampoos and creams.

Antiwrinkles-Antiaging: Antioxidant creams, herbal extracts and anticellulite skin toners.

Antiseptic: Creams and lotions.

Photoprotective: Creams, lotions and oils.

Aromatic: Oils and creams.

Skin whiteners: Creams, solutions and lotions (Chemical like antityrosinase properties)

1.6.4 Consumer classification

1.6.4.1 Face and skin preparation

i. Powders: Compact powders, face powders, talcum powders, face mask, face packs, triple mild talc powder, luminizing powders and concealer powder.

ii. Cosmetic Creams: Barrier creams, antiwrinkles, antiseptic, sun protectives, cold creams, cleansing creams, emollient, massage creams, bleaching creams, lubricating or night creams, skin protective and hand creams, vanishing creams, foundation creams, liquid creams and miscellaneous creams.

iii. Sticks: Anti perspirants, deodorants, lipsticks and colorants.
iv. **Lotions**: Moisturizers, photoprotectives, hand lotions, skin toning lotions, skin fresheners, astringent lotions, bleaching and freckle lotions, medicated lotions, after shaving lotions.

v. **Shaving preparation**: Lather shaving stick, lather shaving creams, shaving foam, shaving gels, after shave lotions.

1.6.4.2 **Hair Preparations**

Hair shampoos (Clear liquid, aerosol egg shampoo, bath foams) hair tonics, hair conditioners, hair lotions, hair waiving, hair strengthens, rinses, oily scalp hair tonics, hair dressings, fixatives, bleaches.

1.6.4.3 **Dental preparations**

Tooth powders, toothpastes, dentifrices, anti caries liquid solutions, mouth washes, cosmetics for teeth and mouth washes

1.6.4.4 **Foot preparation**

Foot powders, foot sprays, foot creams and lotions for sportsmen are available.

1.6.4.5 **Manicure preparations**

Nail polish, nail liquor and bleaches.

1.6.4.6 **Eye preparations**

Shadows, liners, erasers, flesh toned crayon, Mascara, Lashes, Brows putty.

1.6.4.7 **Lip preparations**

Nondrying lipsticks, color coordinate lip liners, lip glows, dual pencil sharpeners.
1.6.4.8 Color makeup

Lipsticks, rouges, mascaras, eye make-up, eyeliner, eyebrow pencils, liquid foundation, stick foundation.

1.7 Herbal cosmetics

Cosmetics are used almost regularly and universally in different forms according to the body needs. The purpose of developing a cosmetic, such as one for reducing wrinkles, fighting acne, or for oil control and for more any types of (skin protective, hair protective) formulations are designed using varieties of materials either natural or synthetic with the aim of quality standard. The development process for cosmetic formulation needs maintenance of quality standard as per the requirement. The qualities of a formulation should satisfy the consumer's need in terms of its performance. Recently herbal cosmetics (lipsticks, shampoos, toothpaste, body and hair oil, soaps, sun blocking cream or gel, moisturizer, facial scrub etc.) products have gained much recognition and became very popular in Indian consumers as well as abroad. These formulations claims to have no side effects commonly seen with synthetic products. The herbs used in preparation of these cosmetic products also have varieties of properties like antioxidant, anti-inflammatory, antiseptic and antibacterial. Popularity of herbal cosmetic in society and technological advances in manufacturing process has resulted in flooding of market with herbal formulations in India. So in the present study we explore the scientific data of traditionally used herbs in skin and hair preparations and tried to develop herbal cosmetic preparations.
1.7.1 Traditional system

India is a land of sandalwood, cinnamon and precious spices, of exotic flowers like gardenia, rose, lavender and hibiscus and oils of exotic roses, lemon grass, and sensuous jasmine. Indian system of cosmetic is rich in history and well tested in the use of plants, through the practices of Ayurveda, Unani and Siddha systems of medicine.

The medicinal herb mentioned in Ayurveda by experienced sage basically state about function of Ayurvedic herbs in to blood and eliminates doshas (vata, pitta kapha) from the body, as they are mainly responsible for any type of body ailments.

Among the written information in Ayurveda also, like is Charak sahita, the sage charakh stated numerous medicinal plants in Varnya kashaya. The herbs like chandan, halid, khus, nagkhashara, marjistha, yastimadhu, are use to obtained glowing complexion and arusa, amala, bavchi, guduchi, chakmard, are mentioned as kustaharan.

There are certain herbs which are mentioned in Kushthagna Mahakashiya like amalaki, haridra, abhaya, khadira, vidyanga, jati, saptaparna, karavira of various potential for effective curative skin disorder.

Charak and other sages Sushruti stated in the literature that the Eladi Gana containing ela, tagar, kusstha, jatamani, tvak, dhmamaka, potra harenuka, shutki, stouneyaka, choraka, guggol sarjarasa, agaru, devdaru and padmakesher could be use to eliminate toxins from the body and clear the complexion that leads to glow on the skin and protect from kushtha and boils.
Among the naturals, plant extracts are gaining popularity as ingredients in cosmetic formulations, primarily because of "the poor image that animal-derived extracts have acquired during the past few years." Historically, plants were the main source of cosmetic ingredients, until methods for synthesizing substances with similar properties were discovered. Although natural molecules derived from plant extracts are currently the constituents of many commercial cosmetic products and offer "a particularly exciting avenue for further research". The stability, color, odor, and transparency of many extracts are limiting factors. Additionally, plant extracts may be perceived as more dilute than are purified synthetic agents.

1.7.2 Present status

The global market for cosmetics and toiletries reached nearly $150 billion in 2004, up by more than 4 per cent from 2003, according to a new study that also highlights major growth in key developing markets.

The herbal market has been boosted by increasing demand for natural alternative medicines. World demand for herbal products has been growing at a rate of 10% -15% per annum. The medicinal plants related trade in India alone is approximately Rs. 5.5 billion. Disappointment with conventional medicines is growing and customer perceptions of the health benefits of herbals and botanicals are under going major change. W.H.O. (World Health Organisation) has forecasted that the global market for herbal products would be worth $5 trillion by the year 2050. Global sales of herbal products are expected to reach $26.2 billion dollars in 2007. Europe and the United States are the two major
herbal products markets in the world, with a market share of 41 percent and 20 percent respectively.

According to the World Bank, the global market for medicinal plants and products includes the potential sectors of pharmaceuticals, nutraceuticals, and cosmeceuticals to be estimated of worth US$ 62 billion, offers a plethora of opportunities for the Indian pharma and cosmetic companies (Figures as quoted by Asia-Pacific Traditional Medicine and Herbal Technology Network (APTMNET). India's current share in the global herbal market is just $1 billion and a huge opportunity awaits the indigenous Indian cosmeceuticals.

1.7.3 Natural extractives

Natural extracts, whether from animal (Enzymes, Proteins, peptides vitamins etc.), botanical, and mineral origin (bentonites, titanium dioxides and different forms of clays and mud), have been used as active cosmetic ingredients or cosmetics for as long as human history can go.

Herbal extracts have been used for centuries and are present in today's cosmetic formulations either for their own properties or as substitutes of synthetic materials that may have to be removed from formulations because toxic and unwanted post used effects.

The botanical extract is active cosmetic ingredient, it may contain hundreds of chemical structures and it has a proven activity. These botanical cosmetic ingredients can be separated out from drug, because the drug needs to know the chemical structure of the active ingredient within the extract, required purifying it or synthesizing it.
These natural extractives can be utilized in different forms like:

I. Total extracts
II. Selective extracts
III. Biotechnology extracts

From these natural extractives, total extracts are the most common in the cosmetic formulations. They are generally known from traditional usages, which have a long history. Their activities are often empirical and their active ingredients are not always identified, but their benefits are, very often, without possible doubt. Their mode of preparation is also adopted from traditional systems of different countries like China, India, Africa, Europe America or from traditional practitioners.

The contents of such total extracts are very much a function of the type of solvent, the temperature, plant solvent ratio, the time of contact, the part of plant use, their species and seasonal collection.

Here is need to clarify the ambiguity of such cosmetic extracts from the drug extractive materials. In the drug industry, especially, the extract must be concentrated and isolated by selective techniques like chromatographic, UV spectrophotometric, and electrophoresis.

The solvent used for herbal extracts is again matter of selection criteria, solvent selection is not only considered for extraction of materials, but also for their compatibility with the final formulation and harmlessness.

Historically, many herbals have been used for the treatment of various skin and hair conditions. Traditional uses and scientific studies of these natural extractive demonstrate the potential functional actions (anti-inflammatory, antioxidants,
antimicrobial, antihyaluronidase, antityrosinase and antimelanogenesis) in cosmetics

1.7.3.1 Cosmeceuticals

In ancient Greece and Rome, countless ointments and tonics were recommended for the beautification of the hair, as well as remedies for the treatment of scalp diseases. Henry de Mondeville was the first to make a distinction between medicinal therapies intended to treat diseases and cosmetic agents for the purpose of beautification\textsuperscript{137}. But today's delineation of cosmetics from pharmaceuticals has become more complex through the development of cosmetics with physiologically active ingredients, i.e. cosmeceuticals.

Cosmeceuticals are topical cosmetic-pharmaceutical hybrids intended to enhance the beauty through ingredient that provide additional health related function or benefits. They are applied topically as cosmetics, but contain ingredients that influenced the skin's biological function\textsuperscript{138}. These cosmeceuticals, serving as a bridge between personal care products, pharmaceutical and phytomaterial, have been developed specially for their medicinal and cosmetic benefits.

Cosmeceutically active ingredients are now constantly being used by big and small corporations engaged in cosmetics, pharmaceuticals, biotechnology, natural products, and cosmetics. The advances in the field of cosmetics and knowledge of skin biology and pharmacology have facilitated the cosmetic formulations\textsuperscript{139}. The development of novel active and natural compounds is being rapidly used as cosmeceuticals. The desirable features of cosmeceutical
agents are efficacy, safety, formulation stability, novelty, and easy metabolism within skin and inexpensive, which became essentiality of cosmetics\textsuperscript{140}.

Natural extracts from plant, animal, mineral origin, have been used as active ingredients of cosmetics for as long as human history can go. Oil, butter, honey, beeswax, lead and lemon juice and aloe gel etc. were common ingredients of the beauty recipes.

Natural functional actives play an important role in alteration of skin physiology and cosmetic science. With the great advances in research, now it is possible to think of a single substance that can alter the skin function and tactile sense of skin or hair. The most convincing example is water, which is considered innocuous or safe. On the other hand, when cotton pad moistened with water is sealed to human skin for two days, pro inflammatory substances such as interleukins are released from the dead stratum corneum. These provoke a series of cytotoxic changes in the viable epidermis\textsuperscript{141}. In another few days, an inflammatory reaction is provoked in the dermis. This the basis for the adverse clinical events associated with prolonged exposure to water.

Another traditional substance considered inert is petrolatum. However, various studies show that petrolatum promotes healing of wounds and prevent ultraviolet induced tumors, even though it is not a sunscreen\textsuperscript{141}.

These are clearly medicinal effects that affect the structure and function of skin. From these and any other examples, it is apparent that nearly all cosmetic articles would have to be reclassified as drugs, if a strict interpretation of the "Structure and function" proviso of the FDC act of 1938\textsuperscript{a} A cosmetic is defined as an article intended to be rubbed, poured, sprinkled, or sprayed on,
introduced into, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting structure or function. It is noteworthy that in this definition the cosmetic is not allowed to have any activity (i.e. without affecting structure or function).

In India the definition of cosmetic was reevaluated and described by the Drug and Cosmetic act 1940. "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 cleansing, beautifying, promoting attractiveness, or altering the appearance and includes any article intended for use as a component of cosmetic"

Antioxidant

Natural antioxidants includes minor lipids are of increasing interest for cosmetic and skin care formulations. They also offer extended shelf-life to vegetable oil based formulations as well as protection of skin cell constituents such as proteins, lipids and DNA.

Many common natural oils such as rapeseed oil, sunflower oil and soybean oil are rich in polyunsaturated fatty acids, mainly linoleic (18:2n-6) and linolenic (18:3n-3) acids. These natural oils are of significant nutritional importance and are also desirable emollients for skin care applications. However, the drawback of the unsaturated oils is their high sensitivity to oxidation and many of them present limited shelf-life during storage as well as in application. Natural oils like bergamot, levender, rose, majoram, chamomile also proves cosmetic values via different activities like antityrosinase, antielsatage and antioxidant.
In addition, natural oils are good sources for tocopherols and phytosterols, components offering both antioxidant activity and bioactivity for skin care applications. By careful processing of these minor lipids can be retained and even enriched during the purification of vegetable oils.\textsuperscript{143}

Mechanism

The changes in skin contour are always symptoms of aging process of skin, either by external or internal oxidative stress. Besides external inducers of oxidative attack, the skin has to cope with endogenous generation of reactive oxygen species (ROS) and other free radicals, which are continuously produced during physiological cellular metabolism. To counteract the harmful effects of reactive oxygen species, the skin is equipped with antioxidant systems, which an equilibrium between prooxidants and antioxidants.

In the recommendation of skin advancement, a variety of primary (preventive, vitamin C) and secondary (interceptive, vitamin E) antioxidant mechanism have been developed, which form an antioxidative network of closely interlinked components.

Antioxidants intervene at different levels of oxidative process\textsuperscript{144-145}

i. Scavenging free radical.

ii. Scavenging lipid peroxyl radicals.

iii. Binding with metal ion.

iv. Removing oxidatively damaged biomolecules.

However, the antioxidant defense in cutaneous tissues can be overwhelmed either by an increased exposure to exogenous (e.g., UV exposure) or endogenous (e.g., inflammatory disorders) sources of reactive oxygen species.
or by primarily depleted antioxidant defense (e.g. malnutrition) facing a normal level or prooxidative challenge.

The imbalance of the prooxidant or antioxidant may results in oxidative damage of biomolecules, such as lipids, proteins and DNA, and has been termed as oxidative stress\textsuperscript{146-147}.

**Vitamins**

Dietary ascorbate is absorbed and distributed throughout the body with in a few hours. The biochemical importance of Vit.C in cosmetic is primarily based on its reducing potential, as is required in a number of hydroxylation reactions. Several hydroxylases involved in collagen synthesis require ascorbate as a reductant\textsuperscript{93}.

In human skin, which is dependent on dietary vitamin C, the epidermis apparently contains approximately five foild higher levels than the dermis\textsuperscript{99}.

The major lipophilic antioxidant are vitamin E, which is collectively refers to eight naturally occurring molecules (four tocopherols and four tocotrienols), which exhibit antioxidant activity. In human skin $\alpha$-tocopherol is the most abundant vitamin E homologue, followed by $\gamma$-tocopherol.

Vitamin E is act as an antioxidant by scavenging free radicals, which can either directly or indirectly, initiate (HO*, and O*$_2$) or propogate (lipid peroxyl radical) lipid chain reactions\textsuperscript{147-148}.

Tocopherols are important antioxidants frequently used in both food and skin care applications. In vegetable oils their main function is to protect polyunsaturated fatty acids against oxidation, properties of importance also for
the shelf-life of the oil during storage. In the human skin they are part of the natural defence system with tocopherol being the predominant lipid-soluble antioxidant in human stratum corneum. The tocopherols protect cellular components such as DNA, proteins and lipids against free radicals and reactive oxygen species caused by UV radiation, pro-oxidative environments and air pollutants\(^{149}\).

Dietary vitamin A is available in the form of provitamin A compounds (e.g., α-β-carotene, and cryptoxanthin)\(^{142}\). Vitamin A generically encompasses retinol, retinal and retinoic acid. The main focus of retinoid usage in cosmeceuticals has been its role as the mythical “fountain of youth” (i.e. reversal of photoaging). Retinol is necessary dietary nutrient, required for growth and bone development, and skin keratosis.

Besides the Vitmin E, C and A, several other compounds with antioxidative potential have been found to skin care, when applied topically. Application of different plant extracts, particularly flavonoids, were found to diminish acute and chronic skin damages Flavonoids (e.g., apigenin, catechin, epicatechin, α-glycosylrutin and silymarin) are polyphenolic compound that occur in plants and due to their free phenolic groups, exhibit antioxidative capacity.

**1.7.3.2 Skin effectiveness**

Protecting and preserving the skin is essential to good health. Environmental elements, air pollution, exposure to solar radiation as well as normal aging process cause cumulative damage to building blocks of skin – DNA, collagen, and cell membranes. Use of simple cosmetics or beauty products will not cause
the skin to change or heal. These products are just meant to cover and beautify, while natural cosmeceuticals provides over all protection to body. Cosmeceuticals being cosmetic products having medicinal benefits and able to affect the biological functioning of skin owing to type of functional ingredients they contain. There are skin-care products that go beyond coloring and adorning the skin. These products improve the functioning/texture of the skin by encouraging collagen growth by combating harmful effects of free radicals, thus maintaining keratin structure in good condition and making the skin healthier. Kuno and Matsumoto had patented an external agent for the skin comprising an extract prepared from olive plants as a skin-beautifying component, in particular, as an anti-aging component for the skin and/or a whitening component. Dry emollient preparation containing monounsaturated Jojoba esters was used for cosmeceutical purpose. Martin utilized plant extract of genus Chrysanthemum in a cosmetic composition for stimulating skin and/or hair pigmentation. Novel cosmetic creams or gels with active ingredients and water-soluble barrier disruption agents such as vitamin A palmitate have been developed to improve the deteriorated or aged skin.

Moisturizers are used to smooth out the age lines, help brighten, and tone the delicate skin. Moisturizers usually consist of emollients to smoothen the skin surface by working their way into the nonliving outer layers of the skin, filling spaces between the layers and humectants to help skin cells to absorb and retain moisture in these layers. Healthy balancing lotion has been created for menopausal women, which diminish the appearance of fine lines, and wrinkles.
uplift the neck area and moisturize the dry sagging skin. Some of those ingredients include black cohosh, soy extract, and natural oils.

Augmenting the skin's natural moisture balance are a nourishing complex containing hyaluronic acid and a revival complex containing green tea leaf extract, and glutathione$^{153}$.

**Skin lightening**

A variety of herbal skin lightening formulations is available in the world market. Such formulations contain natural extracts, which directly or indirectly influence the melanization process in the skin. The first and rate-limiting step of melanin formation is mediated by tyrosinase. This enzyme catalyses the hydroxylation of tyrosine into 3, 4- dihydroxyphenylalanine (DOPA) and the subsequent oxidation of DOPA into DOPA quinone. The pharmacological inhibitors of tyrosinase or other melanogenesis pathway targets may serve as topical inhibitors of melanogenesis resulting in skin lightening properties.

A variety of skin lightening formulations is commercially available. They contain one or several different combination of natural extractives like Arbutin (Uvae ursifolium), Azelaic acid (Malassezia), Kjolic acid (Aspergillus spp), α- and β - hydroxyacids from citrus fruits, Resveratrol (Morus alba) and Liquorice (G. glabra)$^{154}$. The synergistic action of these extracts with each other or separately in formulations could be used as an additive in skin whitening cosmetic formulations.

**Skin pigmenting**

Certain plant extracts have been used as traditional herbal cosmetics for the utilization in vitiligo. These extracts now known to contain furcoumarins, which
was first characterized with the isolation of beregapten (5-methoxy psoralen) from oil of bergamot \(^{155}\). *Psoralea coriifolia* and *Ammi majus* have been tested to treat depigmented areas of the skin in India and Egypt respectively.

### 1.7.3.3 Hair effectiveness

The appearance of the hair is a feature of the body over which humans, unlike all other mammals, has direct control. One can modify the length, color and style of hair according to wish to appear. Hair care, color, and style play an important role in person’s physical appearance and self-perception. Among the earliest forms of hair cosmetic procedures in ancient Egypt were hair setting by the use of mud and hair coloring with henna.

Shampooing is by far the most frequent form of cosmetic hair treatment. While shampoos have primarily been products aimed at cleaning the hair and scalp. Current formulations are adapted to the variations associated with hair quality, hair care habit, and specific problems such as treatment of oily hairs \(^{156}\), dandruff \(^{157}\) and for androgenic alopecia related to the superficial condition of the scalp \(^{158}\).

Cosmetics for the treatment of hair are applied topically to the scalp and hair while they can never be used for therapeutic purposes; they must not be harmful to the skin and scalp, hair and to the mucous membranes and should be nontoxic. A patented shampoo composition is reported to clean the hair and scalp without causing any damage to the fragile biological equilibrium of the scalp and hair \(^{159}\). A haircare cosmetic composition comprising synthetic ingredients with a nonallergenic dry extract of yarrow (*Achillea millefolium*) has been patented, prepared from oxidation of a water–alcohol solution extract of
flower tops of yarrow. The extract contains less than 0.5% by weight of polyphenolic derivatives and is used for the treatment of hair, particularly in oily hairs.  

The other functional ingredients include butcher’s broom, chamomile, vitamin E, antioxidants – vitamins A, C and E, green tea (*Marticaria chamomilla*), tiare flower, *Ginkgo biloba*, cucumber, calendula and α-bisabolol (an active constituent of chamomile) to calm irritated skin. A key ingredient in the eye lifting moisture cream, that treats puffiness, irritation, and also protects against future skin damage is yeast which helps to plump up the wrinkles. The eye wrinkle cream helps forestall the signs of aging and generally contains wheat germ and corn oil, squalene and carrot extract. Eye firming fluid has aosain, an algae extract from seaweed that helps the skin to maintain elasticity.  

1.7.4 Need  

As discussed previously that India is the birthplace of renewed system of indigenous medicine such as Siddha, Ayurveda and Unani and enriched with flora and therefore plants have been used since ancient times for the simple remedies and became popular. The physician of the traditional medicines in different parts of India and local believer (base on traditional used) always tried to utilize the local plants as cosmetics for the maintenance of skin appearances as well as to maintain their beauty.  

- Selection can be done easily based on recognized natural system of cosmetic by referring to well recognized, validated and well accepted books on natural system of medicines as well as cosmetics, where the safety and effects are time tested.
• Selection of plants in present study is based on new claim and
discoveries mentioned in the research review.

Following criteria for the selection of herbal cosmetics –

- 80% of the world populations still depend on natural products.
- It is in line with nature without hazardous reactions.
- Many of these having some scientific as well as traditional evidences
  that are based on experiment data on animals and ethno botanical
  survey.

1.7.5 Benefits

- It helps to cleanse and purify the body without the side effects.
- It normalizes the body functions.
- It is extremely nutritional, high contents in vitamins and minerals.
- It raises the energy level of the body.
- It stimulates the body immune system.
- It works synergistically with the body and without disturbing inherent
  physiology of the body.
- Variety of phytoconstituents could be used.

1.7.6 Limitations

- At present poor scientific justification.
- More susceptible to microbial and inorganic contamination.
- Poor stability.
- Poor organoleptic properties.
- Low efficacy.
- Substantial identity of herbs.
- Multi phytoconstituents evaluation is hard-hitting.
- Staining at the site of applications may occur.
- High dose is required.
- Limited incorporation of naturals.

1.7.7 Advantages

However, in developing countries, the use of easily accessible, low cost herbal products are still continued, along with modern agents in the form of biotechnologically produced extracts and isolated effective components. Lately there has been a revival of interest in the use of herbal cosmetics because of observed and proven efficacy of natural oil like almond, sesame, mustered and many herbs like Aloe vera, Curcuma longa, Melaleuca alternifolia, Sesamum indicum, Santalum album, Lavandula angustifolia, Embellica officinalis, Pomegranatum as paste or face mask. Because of the fact that herbal cosmetics are free from serious toxic effect associated with synthetic agents e.g. Butyl methoxy dibenzoyl methane (BMDBM), bezophenone, phenylbenzimidazole and sulfonic acid, which are found to be allergic and free radical generator and may be natural cause of aging.

The synthetic cosmetic ingredients protect the skin from extrinsic aging process, but they may produce other kinds of damage. A number of studies suggest that the use of sunscreens may actually increase their risk of melanoma because they spend too much time in the sun. Serious side effects
like interference with normal sexual development, ooze, rashes, burning and pus in hair follicles etc. observed with synthetic sunscreen\textsuperscript{162-163}.

The profile of various plant extracts and oils\textsuperscript{164-161} used in cosmetics and toiletry preparations as, hair care\textsuperscript{162-207} and skin care\textsuperscript{208-232} as antiaging ingredients as cosmeceutical are shown in Table 1T-6-1T-8.

Table 1T-6: Profile of cosmetically active plant extracts and oils

<table>
<thead>
<tr>
<th>Extracts</th>
<th>Application</th>
<th>Efficacy</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green tea</td>
<td>Skin tumor</td>
<td>Protective</td>
<td>164</td>
</tr>
<tr>
<td>Polypodium leucotomos</td>
<td>Erythemal skin phototoxicity</td>
<td>Protective against UV induced damages</td>
<td>165-166</td>
</tr>
<tr>
<td>Epigallocatechin</td>
<td>Skin tumor</td>
<td>Protective</td>
<td>167</td>
</tr>
<tr>
<td>Silymarin (Thistle herb)</td>
<td>Edema sunburn</td>
<td>Protective</td>
<td>168</td>
</tr>
<tr>
<td>Cysteine derivative</td>
<td>UV induced binding of epidermal biomacromolecules</td>
<td>Protective</td>
<td>169</td>
</tr>
<tr>
<td>Melatonin</td>
<td>Erythemal skin</td>
<td>Protective</td>
<td>169-170</td>
</tr>
<tr>
<td>Superoxida dismutase Bifidus extract</td>
<td>Skin wrinkle, erythemal skin</td>
<td>Protective</td>
<td>171-172</td>
</tr>
<tr>
<td>Wheat germ oil</td>
<td>Aged skin</td>
<td>Antioxidant and antiaging</td>
<td>173</td>
</tr>
<tr>
<td>Rosa canina</td>
<td>Erythemal and aged skin</td>
<td>Antioxidant as source of ascorbic acid</td>
<td>174</td>
</tr>
<tr>
<td>C. asiatica</td>
<td>Aged and photoirradiated skin</td>
<td>Antioxidant Elastin and collagenase inhibitor</td>
<td>175</td>
</tr>
<tr>
<td>Malphigia punicifolia</td>
<td>Erythemal skin</td>
<td>Antioxidant and skin protective</td>
<td>176</td>
</tr>
<tr>
<td>Fagopyrum</td>
<td>Loose skin</td>
<td>Antifree radical and histamine inhibitor</td>
<td>177</td>
</tr>
<tr>
<td>Eucalyptus sambucus</td>
<td>Erythemal skin</td>
<td>Antifree radical</td>
<td>178</td>
</tr>
<tr>
<td>Sophora japonica</td>
<td>Erythemal skin</td>
<td>Antifree radical</td>
<td>179</td>
</tr>
<tr>
<td>Syzygium aromaticum</td>
<td>Erythemal skin and aged Skin</td>
<td>Protect collagenase activity</td>
<td>180</td>
</tr>
<tr>
<td>Germanium thumbergii</td>
<td>Erythemal skin and aged Skin</td>
<td>Protect collagenase activity</td>
<td>180</td>
</tr>
<tr>
<td>Chamaemelum nobil</td>
<td>Topical</td>
<td>Antinflammatory and antihyaluronidase</td>
<td>181</td>
</tr>
<tr>
<td>Plant</td>
<td>Source</td>
<td>Plant part</td>
<td>Activity</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------</td>
<td>------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Aloe</td>
<td>A. vera</td>
<td>Leaf</td>
<td>Moisturizing</td>
</tr>
<tr>
<td>Amalika</td>
<td>Emblica officinalis</td>
<td>Fruits</td>
<td>Prevents greyness and Anti stress</td>
</tr>
<tr>
<td>Bhringraj</td>
<td>Eclipta alba</td>
<td>Entire herb</td>
<td>Promoting hair growth</td>
</tr>
<tr>
<td>Brahmi</td>
<td>B. monnieri</td>
<td>Entire herb</td>
<td>Hair strengthening and antioxidant</td>
</tr>
<tr>
<td>China rose</td>
<td>Hibiscus rosasinensis</td>
<td>Flower</td>
<td>Improves hair</td>
</tr>
<tr>
<td>Gotukola</td>
<td>C. asiatica</td>
<td>Entire herb</td>
<td>Hair strengthening and antioxidant</td>
</tr>
<tr>
<td>Lemon peel</td>
<td>Citrus limon</td>
<td>Peel</td>
<td>Conditioning</td>
</tr>
<tr>
<td>Neem</td>
<td>A. indica</td>
<td>Leaf</td>
<td>Ant fatigue</td>
</tr>
<tr>
<td>Orange</td>
<td>Citrus aurantium</td>
<td>Peel</td>
<td>Soaps,</td>
</tr>
<tr>
<td>Shikakai</td>
<td>A. concina</td>
<td>Pod</td>
<td>Detergency, Antidandruff</td>
</tr>
<tr>
<td>Baheda</td>
<td>Terminalia belerica</td>
<td>Fruit</td>
<td>Hair tanning</td>
</tr>
<tr>
<td>Benjamin</td>
<td>Moringa oleifera</td>
<td>Seed</td>
<td>Scalp strengthen</td>
</tr>
<tr>
<td>Chamomile</td>
<td>Matricaria chamomilla</td>
<td>Flower</td>
<td>Antioxidant</td>
</tr>
<tr>
<td>Fenugreek</td>
<td>T. graccum</td>
<td>Seed</td>
<td>Improves hair, Conditioning</td>
</tr>
<tr>
<td>Henna</td>
<td>Lawsonia alba</td>
<td>Leaf</td>
<td>Hair growth</td>
</tr>
<tr>
<td>Soap wort</td>
<td>Sapindus trifoliatus</td>
<td>Fruit</td>
<td>Natural detergent</td>
</tr>
<tr>
<td>Til</td>
<td>Sesamum indicum</td>
<td>Seed</td>
<td>Hair tonic</td>
</tr>
<tr>
<td>Wheat germ</td>
<td>Triticum sativum</td>
<td>Germ</td>
<td>Vt-E</td>
</tr>
</tbody>
</table>
Table 1T-8: Modern plants widely used in skin care cosmetics

<table>
<thead>
<tr>
<th>Plant</th>
<th>Source</th>
<th>Plant part</th>
<th>Activity</th>
<th>Use</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aloe</td>
<td>Aloe vera</td>
<td>Leaf</td>
<td>Moisturizer, Emollient and antioxidant</td>
<td>Protective, Sunscreen</td>
<td>208-210</td>
</tr>
<tr>
<td>Beetle nut</td>
<td>A. catechu</td>
<td>Seed</td>
<td>Anthyluronidase antielastase</td>
<td>Antiaging and firming agent</td>
<td>211-213</td>
</tr>
<tr>
<td>Bavkali</td>
<td>Passiflora</td>
<td>Seed</td>
<td>Antigranulating, Keratinocyte inhibitor</td>
<td>Pigmenting agent and melanin spot formation</td>
<td>214-217</td>
</tr>
<tr>
<td>Carrot</td>
<td>Daucus carota</td>
<td>Seed</td>
<td>Antioxidant</td>
<td>Natural source of Vit A Protective</td>
<td>218</td>
</tr>
<tr>
<td>Chakramard</td>
<td>Cassia tara</td>
<td>Seed</td>
<td>Antifungal and antioxidant</td>
<td>Nourishing and moisturizer</td>
<td>219-225</td>
</tr>
<tr>
<td>Chamomile</td>
<td>Matricaria</td>
<td>Flower</td>
<td>Antioxidant</td>
<td>Skin cleanser</td>
<td>226</td>
</tr>
<tr>
<td>Cobras safron</td>
<td>Mesua ferrea</td>
<td>Flower</td>
<td>Astringent</td>
<td>Coloring agent</td>
<td>227</td>
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<tr>
<td>Cotukola</td>
<td>C. asindica</td>
<td>Entire herb</td>
<td>Antioxidant, anti-proliferative</td>
<td>Antiaging and firming agent and red</td>
<td>228-231</td>
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<td>Garlic</td>
<td>Allium sativum</td>
<td>Bulb</td>
<td>Antibacterial</td>
<td>Promotes skin healing</td>
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</tr>
<tr>
<td>Green tea</td>
<td>Thea viridis</td>
<td>Leaves</td>
<td>Antioxidant</td>
<td>Rejuvenator</td>
<td>233-235</td>
</tr>
<tr>
<td>Harda</td>
<td>Terminalia</td>
<td>Fruit</td>
<td>Astringent</td>
<td>Skin toner</td>
<td>235-236</td>
</tr>
<tr>
<td>Karanj</td>
<td>Pongamia glabra</td>
<td>Seed</td>
<td>Antibacterial and antifungal</td>
<td>Externally for skin disorders and UV protective</td>
<td>237-238</td>
</tr>
<tr>
<td>Liquonce</td>
<td>Glycyrrhiza</td>
<td>Root</td>
<td>Anti-inflammatory and antioxidant</td>
<td>Decrease pigmentation and cooling effects</td>
<td>239-240</td>
</tr>
<tr>
<td>Manjistha</td>
<td>Rubia cordifolia</td>
<td>Root</td>
<td>Wound healing</td>
<td>Lighten pigment</td>
<td>241</td>
</tr>
<tr>
<td>Mangold</td>
<td>Calendula</td>
<td>Flower</td>
<td>Anti-inflammatory, Antiseptic</td>
<td>Skin care</td>
<td>242-244</td>
</tr>
<tr>
<td>Nagamotha</td>
<td>Cyperus rotundus</td>
<td>Roots</td>
<td>Suntan, Astringent</td>
<td>Skin care</td>
<td>245</td>
</tr>
<tr>
<td>Neem</td>
<td>Azadirachta</td>
<td>Leaf</td>
<td>Antiseptic and Antibacterial</td>
<td>Reduce dark spots</td>
<td>246-248</td>
</tr>
</tbody>
</table>
1.8 Objective

Many of the world’s popular cosmetics brands entered the Indian market in the 1990s as the Indian market opened up to foreign companies. The cosmetics and personal care industry has been growing at an average rate of 15-20 percent for the last few years. Growth has come mainly from the low and medium-priced categories, which account for 90 percent of the cosmetics market in terms of volume. Even though mass-market products still constitute the major portion of the India cosmetics and toiletries market, increased disposable income has led to growth in demand for premium products.

The urban population in particular, with its rising purchasing power, is the main force that drives the demand for various cosmetic products in India. The
reasons for the growing demand for cosmetic products in India also include
greater product choice and availability.

Even with double-digit growth rates, the market penetration of cosmetics and
toiletries products in India is very low. Current per capita expenditure on
cosmetics is approximately $0.68 cents, as compared to $36.65 in other Asian
countries. This low market penetration for cosmetics and personal care
products in India can be viewed as an opportunity for more significant growth
down the road in this country of more then 1 billion people.

The current size of India's cosmetic and toiletries market is about $950 million.
The global market for natural personal care product only for skin and hair is
around 2.8 billion $ and total Indian cosmetic market is about one thousand cr.
Around three billions people realizes blindly on herbal cosmetics because of the
non-polluting, renewable resources and hope for sustainable supplies of
cheaper products for world growing population. Approximately 80% of the
cosmetic product in the market are illegal, risk to consumer and fooled by
substantial claims. The herbal cosmetics have own way of caring but it needs
quality assurance.

These utility products are used extensively throughout the world for maintaining
and improving general appearance of body. Cosmetics alone are not sufficient
to take care of skin and body parts, it require association of active substances
so the herbal cosmetics are now emerged as the appropriate solution for such
formulations. The use of herbs in cosmetic formulation also serves the care of
body apart from cosmetic effects because the botanical ingredients also
influence biological function of skin.
India has a great wealth of traditional knowledge and wisdom and richest in terms of mineral resources and having naturally occurring varieties of herbs with ingredients of proven cosmetic value. To benefit from the present global advancement and regulatory guidelines of developed country in the field of herbal technology regarding safety, purity, identity and efficacy of cosmetic products will play a key role in the development and study of quality control parameters for creating wealth to make country for globally competitive in an increasingly technologically sophisticated world.

The objective of research was based on the utilization of scientific technology for the development and evaluation of herbal formulation free from serious toxic effect associated with synthetic agents for safety and quality control parameters in the area of cosmetics. The selected herbs *Cassia tora*, *Glycyrriza glabra*, *Centella asiatica*, *Aloe vera*, *Punica granatum*, *Psoralea corylifolia*, *Areca catechu* and *Curcuma longa* have proven their effectiveness for the cosmetic purposes like antiaging, sunprotective, moisturizing, cleanse, disinfectant, soothe, heal, lubricate, stimulate and refine the skin. Ethanolic extracts of these herbs were used as such or in combination with other natural ingredients to perform all the functions of cosmetics as similar to commercial marketed cosmetics with inherent benefits of the natural agents as gentler and more effective then modern day cosmetic with chemicals.

This research work provided vast information about potentiality of herbal cosmetic and enhances the utilization of popular herbs in national and international market.
1.9 PLAN OF WORK

1. Literature Review

2. Selection of herbs
   - Procurement and collection of herbs
   - Identification of herbs
   - Preparation of the Extracts
   - Evaluation of the Extracts

3. Selection of formulation
   - Cream
   - Lotion
   - Shampoo

4. Preparation and selection of bases
   - Natural base
   - Alternative base

5. Formulation preparation

6. Evaluation of formulations
   - Physicochemical, Microbiological and psychometric parameters
   - In-vitro
   - Physiological evaluation
   - In-vivo studies
     - Biochemical
     - Histological

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