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Advances in cosmetic evaluation: Instrumental and sensory methods

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ABSTRACT

The evaluation of cosmetic products has evolved significantly in recent years, driven by the growing demand for safe, effective, and consumer-friendly formulations. Traditional sensory analysis, which relies on human perception of attributes such as texture, fragrance, spreadability, and overall acceptability, continues to play a crucial role in understanding consumer preferences. However, the limitations of subjectivity and variability have encouraged the integration of advanced instrumental techniques. Modern instrumental methods—including rheology, texture analysis, colorimetry, spectroscopy, chromatography, and imaging technologies—provide objective, quantifiable, and reproducible data that complement sensory evaluations. Together, these approaches enable a more comprehensive assessment of cosmetic performance, stability, and consumer satisfaction. This synergistic use of sensory and instrumental methods not only enhances product development and quality control but also supports regulatory compliance and innovation in the cosmetics industry. The paper highlights recent advances, methodological improvements, and the importance of combining instrumental precision with sensory insights for holistic cosmetic evaluation.

Keywords: Cosmetic evaluation, Instrumental analysis, Sensory analysis, Consumer perception, Rheology, Texture analysis, Colorimetry, Spectroscopy, Chromatography, Imaging techniques, Product stability, Quality control, Skin bioengineering methods, Consumer acceptability, Innovation in cosmetics.

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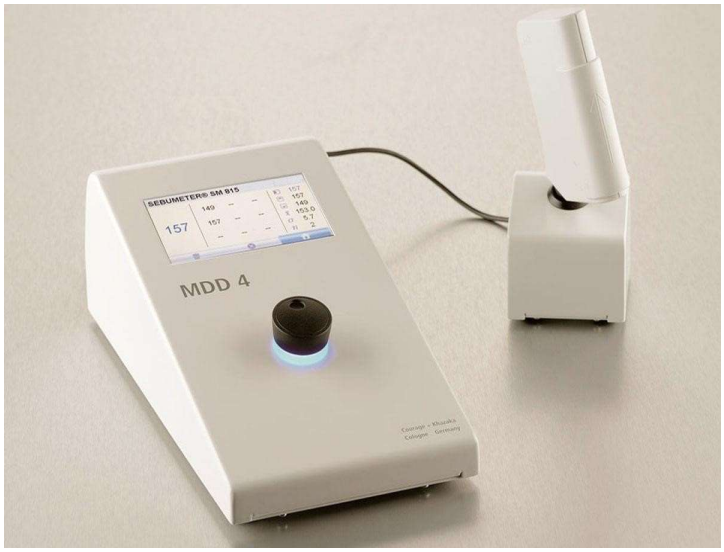
INTRODUCTION

Cosmetic ingredients are mostly chemicals and often mixtures of chemicals of synthetic origin or extracts. The careful selection of ingredients is the key issue for ensuring the safety of the finished product. Based on the state of knowledge, possible interactions between ingredients with potential safety relevance have to be considered. Influence on skin penetration may also be of importance, especially for sensitization and cosmetic risks. Studies must be relevant and comprised of methods which are reliable and reproducible. The studies should follow a well-designed and scientifically valid methodology according to good practices. The criteria used for evaluation of product performances should be defined with accuracy and chosen in compliance with the aim of the test. The test laboratories must have standardized operating procedures. The equipment must be the subject of documented maintenance adapted to it's use.[1]. Cosmetics are formulations designed to enhance appearance, promote hygiene, and improve skin and hair health. Their widespread use in daily life makes it essential to ensure their safety, quality, and efficacy. Evaluation of cosmetics is a systematic process that involves physical, chemical, microbiological, and performance-based testing to confirm that products meet regulatory standards and consumer expectations.

The evaluation process not only helps in determining the stability, compatibility, and effectiveness of cosmetic formulations but also ensures that they are free from harmful effects such as skin irritation, allergic reactions, or microbial contamination. Modern cosmetic evaluation integrates traditional testing methods with advanced analytical techniques and consumer acceptability studies, providing a holistic assessment of product quality.[1].

SEBUMETER

Excess oiliness or excess dryness affects cosmetic appearance of the correct regimen to achieve cosmesis. Besides, sebum affects the permeability of skin and absorptivity of water, protects against bacteria and fungi, limits evaporation and affects permeation of pharmaceutical preparations and other active or non-active substances. Hence measurement of natural presence of sebum on human skin particularly facial skin is a matter of current interest amongst dermatologists and pharmaceutical and cosmetic manufacturers. Heterogenous components of sebum are produced from secretion of sebaceous glands, fat of keratinous layer and remnants of perspiration. Sebum is a complex and variable mixture of lipids like glycerides, free fatty acids, wax esters, sqalene, cholesterol esters, and cholesterol. Different types of apparatus exist for measuring the amount of



sebum. They are based on the principle that when sebum is deposited on a translucent element, such as a frosted glass or plastic plate or strip, the element becomes increasingly transparent. Light passing through this sebum covered translucent element is then measured using photoelectric receiver. [2].

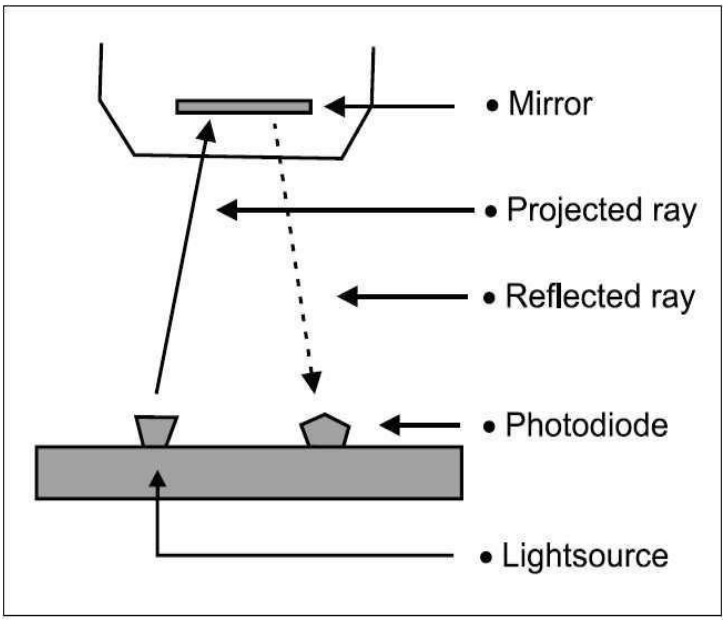


Figure 1: Optical diagram of sebumeter

Mechanism of sebum measurement by SEBUMETER:

The measurement is based on the principle of grease-spot photometry. The measuring head of the cassette with the transparency is measured by a light source passing through the tape. A photocell measures the transparency. A microprocessor calculates the result, which is shown on the display in mg sebum/cm2 of the skin. [2].

Sebumeter probe (cassette):

The sebumeter cassette contains a mat synthetic tape, mm thick. The measuring head of the cassette exposes a 64mm2 section of the tape, which is transported forward by a trigger at the side of the cassette for the next measurement. The measuring time of 30 seconds is controlled by a clock set in the device. Sebum is then determined as explained in the measurement principle above. The instrument has an accuracy of 5%.[3]. The reading of sebum may be displayed as a number or as type of skin i.e. ; dry/normal; normal; normal/oily; oily.

Uses of sebumeter:

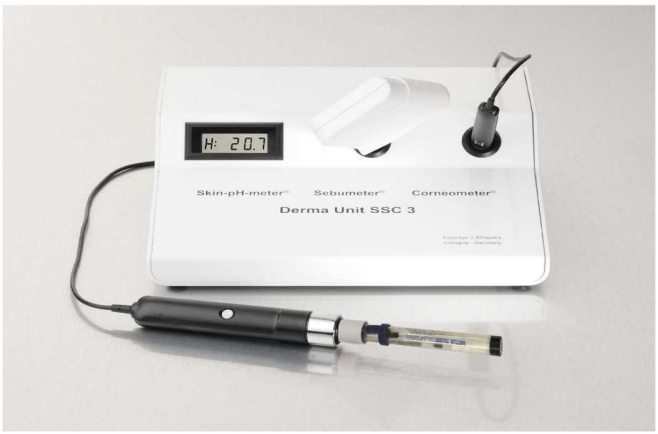
- To classify skin type as dry, normal and oily in an objective manner.
- To prescribe pharmaceutical/cosmetics suitable to the patient's skin type to increase efficacy and minimize side effects.
- Pre-placement examination for correct analysis of skin type in the field of occupational medicine e.g. person of dry skin type may not suitable to work in chemical industry involving use of acid and alkaline.
- To make early diagnosis of senile asteotosis.
- To measure skin cleaning effects of soaps.
- To do preliminary screening and follow up of patients with hyper-androgenic states.
- To study the endocrine control of sebaceous follicle in women for assessing hormonal ageing.
- To study the correlation between bad hair days, sebum secretion, and menstrual cycle.
- To study sebo-suppressive effects of certain anti-acne medications like retonic acid in treatment of acne vulgaris.
- To study the sebaceous gland activity in diabetes, in whom the activity of the glands is decreased.

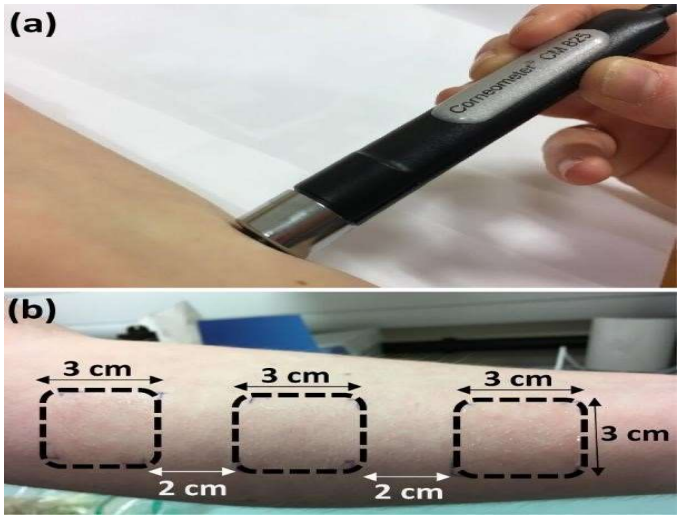
CORNEOMETER:

The presence of an adequate amount of water is an essential prerequisite for the maintenance of the normal structure and function of the stratum corneum. It has been known since many years that the electrical resistance (impedance)of the skin to an alternating current of frequency F is the most widely used method for assessing the hydration State of the skin surface. The total impedance (Z) depends on two components, a resistance R and a capacitance C, as explained by a simple theoretical model where the skin is submitted to an electrical alternating circuit with a resistance in parallel with a capacitor as pointed out by many authors, the complex electrical impedance properties of the horney layer are dependent on the water content of this layer but also on a variety of other factors (ions, protein, natural moisturizing factors, etc.)[3].Many physical factors may play

a role in impedance measurements, design of the oscillating electronic circuit and frequency of the electrical current, geometry of applied electrode on the skin (micrometer or millimeter distance between the electrodes), measuring depth of the electrical field in the skin, direct galavonic contact or not with the skin surface, pressure of application of the electrode etc.

The Corneometer CM 825 is the most used instrument worldwide to determine the hydration level of the skin surface, mainly the stratum corneum. The hydration State of the stratum corneum (SC) is a valuable parameter in different dermato-cosmetic applications. Its determination is generally based on electrical measurements on the skin surface. Most instruments measure either the capacitance or the conductance of the superficial skin layers. Technical aspects such as type of probe surface, direct galavonic contact with the skin or not, distance between the electrodes (mm or lm),and depth of measurement vary when comparing the different technologies. The Corneometer CM 825 is based on the capacitance method. It is a well-known and efficient instrument to measure the hydration of the SC. The measuring probe of the.





Corneometer which used an analogue signal in the past has been updated to digital technology, resulting in higher stability and less interference.

The principles and characteristics of this capacitance-based instrument manufactured by courage-Khazaka have been published by several research groups. The instrument has a flat measuring probe with an interdigitating grid of gold -covered electrodes.[3]. During the measurement there is no direct galavonic contact of the electrode surface with the skin since the inter digitating grid is covered with a low dielectric vitrified material. The pressure of application of the measuring probe is lower than 1N as assured by a spring system triggering the capacitance measurements. The frequency shifts from 0.95 MHZ for a hydrated medium to 1.15 MHz for a dry medium. The variable total capacitance of the surface is converted in arbitrary units (a.u.) of skin hydration ranging from 20 (very dry) to 120 (well-hydrated) units. Skin penetration depth of the electrical current is about 45 mm.

Fields of application:

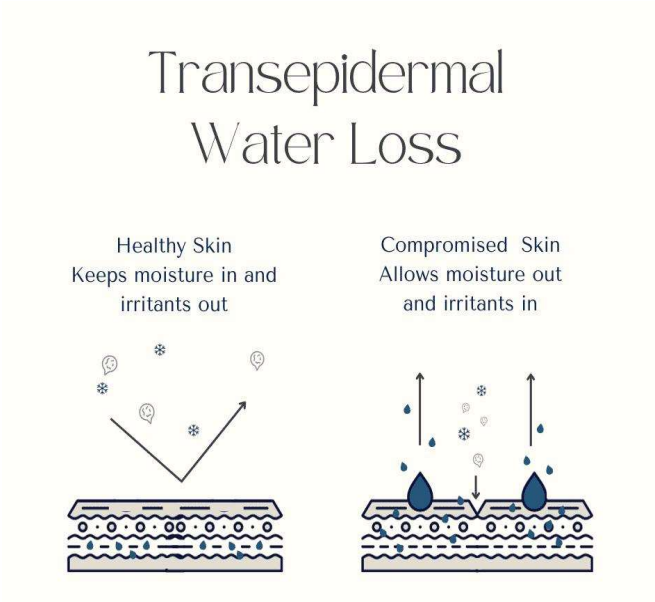
The hydration measurement is the basic measurement for all applications in basic research and cosmetics.

- Ideal instrument for formulation, claim support and efficacy testing of moisturizers.
- It is used for objective clinical trails and their monitoring.
- It gives information on the course of cosmetic treatments.
- Demonstrative to alert people to specific occupational skin hazards.

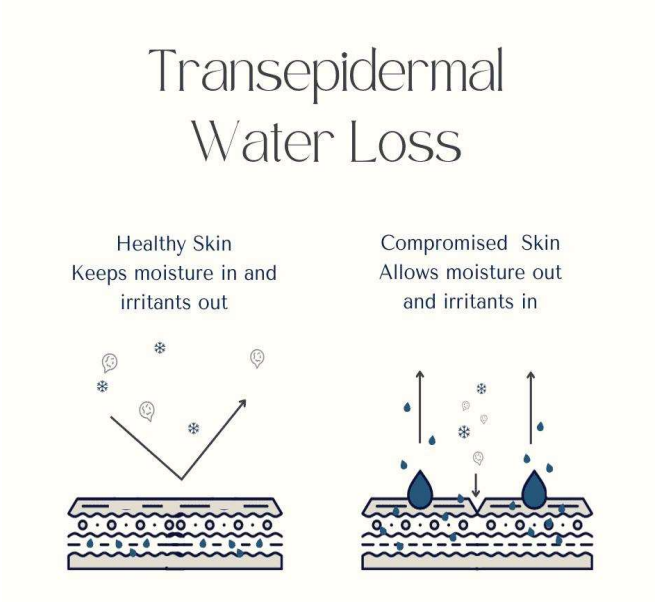
Advantages:

- The measurement is not influenced by substances in the skin (e.g. salts).
- The modern, high quality electronic of the probe allow a very quick measurement (1s).
- The measurement depth is very small (10-20 m of the stratum corneum) to avoid the influence of water in deeper skin layers.
- The probe is small and lightweight for easy handling and measurement on all body sites.
- The spring in the probe head ensures constant pressure on the skin, enabling exact, reproducible measurements which do not influence the skin.
- Worldwide established as Corneometer with a broad range of studies.
- Even used for the SKIN-B project on the ISS in space.

Transepidermal Water Loss (TEWL) Measurements: Transe



Pidermal water loss (TEWL) measurements:



Measurement of the transepidermal water loss expressed in grams per square meter and per hour is used for studying the water barrier function of the human skin. The more perfect the skin protective coat, the higher the water content and lower the TEWL. The outer part of the skin is the stratum corneum which forms a barrier against diffusion of water and is also an effective barrier for microbes and chemical substances. The stratum corneum contains much water and is flexible in the healthy state, but it becomes hard and brittle when dehydrated. Disorders such as atopic dermatitis arise when this barrier function does not work properly.[4]. Several techniques have been developed to measure the skin properties that are influenced by the water content. One

possibility is the measurement of the transepidermal water loss of skin. One possibility is the measurement of the transepidermal water loss of the skin. TEWL measurements allow to discover disturbances in the skin protective function in an early stage, even before they are visible. Normal skin allows water loss only in small amounts. In the case of atopic skin the water loss is much higher. The determination of the TEWL is an important support to investigate the skin irritation that occurs by various physical and chemical influences. Typical fields of application are allergic tests, occupational medicine, observation of the newborn, supervision the healing process of skin damages and burns or testing the effectiveness and biocompatibility of cosmetic products.

However, it is difficult to determine TWEL with accuracy for several reasons:

1. The small amount of water vapour involved is difficult to measure.
2. Measurement devices often interact with the horney layer.
3. Physical parameters, and biological or psychological conditions need to be monitored strictly.

The first devices employed for the measurement of TEWL were based on dry nitrogen flow collecting water vapour while passing over the skin surface [4]. No matter which device was used to measure the amount of water vapour in the gas flow, the results were questionable, thus:

- Measured amounts of water are partly TEWL and partly water of hydration.
- Diffusion properties through stratum corneum are modified by desorption.
- The increase of water vapour pressure gradient through the horney layers modifies the TEWL.

For some years devices have been designed which allow TEWL to be measured under equilibrium conditions. The best system should have the following characteristics:

1. The measuring device should not alter the physical and chemical of stratum corneum. This involves using an air flow sufficiently small to avoid any modification of the local microclimate of the skin surface.
2. Too large a measuring surface 2. Too large a measuring surface combines areas having different values of TEWL, resulting in the determination of an average TEWL value. With too small a surface of We may only measure a particular zone.
3. Measuring should be differential, I.e. should be able to record TEWL differences between two distinct zones. This is particularly necessary in case of minute variations.
4. Lastly, measurement should not take more than two or three minutes to avoid stressing the volunteer.

Different methods for TEWL measurement from local skin sites have been described: Closed chamber methods and open chamber methods. The open chamber, water vapour evaporation, gradient estimation method provides continuous measurement in ambient air, with little alteration of the water vapour boundary layer overlying the skin.

Open chamber method:

We will discuss the open chamber method, concentrating on the commercially available Evaporimeter EPI (ServoMed, Stockholm, Sweden), which has gained wide use. To perform accurate and reliable measurements, several factors and sources of variation need be known and taken into account. Variation is mainly related to the individual, the environment and the instrument. The Evaporimeter should be turned on least 15 min before measurements are performed, and, if the instrument is being used intermittently during the day, it should not be switched off between measurements. After the warm-up period, the instrument should be zeroed only if necessary [5]. Note that regularly calibrated and well-maintained instruments will not require this zeroing daily, if the offset knob is not used for zeroing in between measurements.

The built -in damping filters may also be used to smooth these fluctuations in TEWL .2 filters giving time constants of 10 and 20s are available, and thus the instrument can be operated with variable time constants 0,10,20 and 30 (10+20) s. When using the filter, press filters, press filter button 10 after stabilization, Wait about 5s and then press button 20. The TEWL value registered during the next 30-s period is to be considered the measured value. With the filters “on the investigator obtains no information about fluctuations and artifacts, therefore a direct recording on a pen recorder is preferable. The prescribed stabilization period of 30-45 s is for baseline TEWL measurements only. If, however, measurements are made on excessively diseased or damaged skin sites, where high water evaporation rates are expected, or at high ambient relative humidities, a

longer stabilization period may be necessary. The prescribed period is not a hard -and-fast rule, as it may also vary from instrument to instrument.[5].

As a general rule, calibration of the Evaporimeter, according to the manufacturer's specifications, should be performed at regular intervals. The Evaporimeter may also be checked against the standard constant water evaporation device periodically to check the ageing of the sensors.

Closed chamber method:

Here two novel TEWL instruments based on the closed chamber method are discussed. The first two instrument is based on a ceramic chip carrying an interdigital electrode structure which is covered by a hygroscopic an organic salt film. The main sensing effect used in this instrument is the conductance change of the hygroscopic film represented by the real part of the admittance. The measuring frequency is 500 kHz.[11]. The admittance Y is measured by using a precision LCR meter. Furthermore, it is necessary to measure the relative humidity skin the change of admittance is recorded. The TEWL value is calculated from tm,(Ym-Ys) and RH by using an experimentally determined function.[6].

The second instrument described is based ona silicon chip, which is mounted on a Peltier couple. The sensing effect of this instrument is the change of the dew point temperature by the emission of water from the skin. At the moment of touching the skin the actual dew point recording process is started. Depending on the humidity value the hygrometer takes about 5 readings per second. After the time interval tm (5 s) the dew point temperature Ts is recorded. A value of TEWL is calculated with an experimentally determined function based on Ts and tm.

SKIN COLOUR:

Human skin colour is one of the most conspicuous human poltypic variations and has attracted probably more scholarly attention than any other aspect of human variability. It was the very first character used for racial classification and has served as a primary feature in most systems of racial classifications. Variation in human skin colour is mainly due to the presence of four pigments, namely, Melanin, Hemoglobin, Carotene and Melanoid. In addition to this, effect produced by the scattering of light from the skin surface is also involved in giving a particular skin colour to the person.[7].

Melanin pigmentation:

The Melanin pigment granules are mostly found in the basal layer or the stratum germinativum inside the melanocytes. The metabolic pathway involved in melanin synthesis is extremely complicated involving several intermediate steps. It starts with amino acid tyrosine oxidized by the copper containing enzyme tyrosinase (TYR) to dihydroxyphenylalanine (DOPA) and then to

dopaquinone. A mutation in the gene for enzyme tyrosinase (TYR) that produces a protein with decreased functionality will result in a reduced production of melanin and under extreme decrease in the functionality this produces a genetic form of albinism. Dopaquinone undergoes a series of nonenzymatic reactions and rearrangements forming the different molecules that are copolymerized to make one of the two types of melanin: Eumelanin, which is the dark brown/purple/black compound found in skin/hair, and phaeomelanin, which is yellow to reddish brown pigment present in red hair and rarely in skin/hair, and rarely in human skin. Both forms of melanin combine with other proteins to form the melanosome that is distributed from the melanocytes to the surrounding cells. There is a gradient of melanosome size and number from dark to. Intermediate to light skin colour besides melanosomes of dark skins being more widely dispersed.

Activation of the melanocortin 1 receptor (MCIR) promotes the synthesis of eumelanin at the expense of phaeomelanin, although oxidation of tyrosine by tyrosinase (TYR) is needed for synthesis of both the types of pigments. The extent of pigment synthesis within melanosomes is affected by the membrane associated transport protein (MATP) and the pink-eyed dilution protein (P) which are the melanosomal membrane components.

Total amount of melanin produced is more important than the ratio of the two types of melanin. Both the light and the dark-skinned individuals have similar number of melanocytes for the same body region, but melanosomes that contains the pigments are more numerous and more pigmented in darker people than in light skinned people [8]. Reflectance spectrophotometry has been extensively used for measuring skin pigmentation.

Genetics of skin colour:

Skin colour is a polygenic trait and multiple genetic loci are involved in determining it besides the environmental factors. Multiple genes working together produce a continuous distribution in a bell-shaped curve of skin colour varying from light to dark. Early models suggested 2-5 additive /equal / unequal genes being responsible for it. Recent works suggest many genes working together in very complex additive and nonaddictive combinations to give rise to various shades of human skin colour. The non enzymatic conversions of dopaquinone into eumelanin and phaeomelanin, and their combination into melanosomes, are affected by several genetic loci. Of nearly 100 different genes 15 to 20 mutations of mouse coat colour genes are found to have human homologous in which null mutations cause albinism. Loss of functional alleles in a single gene, the melanocortin 1 receptor MCIR, causes the characteristic phenotype of fair skin coupled with freckling and carrot red hair because of large amounts of phaeomelanin and small amounts of

eumelanin. However, the MCIR variation significantly affects pigmentation only in populations who commonly have red hair and fair skin and it's primary effects-to promote synthesis of eumelanin at the cost of phaeomelanin or vice versa contribute little too the variation of skin reflectance among or between major groups.[9].

The TYR, P and MATP genes are well known causes of albinism and their primary effects are limited to pigment cells, of these gene p is highly polymorphic but the phenotypical consequences of p gene polymorphism are not yet known.

HAIR TENSILE STRENGTH:

Hair is undoubtedly one of the most important personal features of people in all cultures. For the past several centuries hair has played an important role. Style, length, and colour changes are influenced by fashion trends. Hair often allows for feelings of health and beauty, and thus it influence is of great importance. Three major types of hair are known: African, Asian, and caucasian. The differences between these hair types are related to diameter, geometry, and other physical parameters. Closely related to these parameters are biophysical factors, tensile strength, and combing forces, which might be influenced by cosmetic formulations that are applied to hair. Hair fibers are very durable and strong primarily due to a protein called keratin located in the cortex ; a polyamide molecule with many disulfide bridges between the chains which gives the hair is strength and stiffness. The colour is due to eumelanin or phaeomelanin. Grey hair lacks either colouring pigment. In keeping with other man-made fibers the strength of hair will depend to a large extent on the nature of the intermolecular bonds, the more there are the stiffer the hair will be, and the higher it's tensile strength.

Healthy hair fibers have a tensile strength similar to that of a copper wire of the same diameter. However, to resist externally applied forces, a healthy cuticle is also necessary. Damage to the cuticle significantly weakness the overall strength of the hair and may result in splitting and breakage[10]. The demand for hair care is closely related to the condition and length of the hair and fashion trends. Hair is exposed daily to a wide variety of influences that can damage it to a greater or lesser degree. Especially the surface of hair that has been exposed to environmental influences or chemical treatments carries a stronger negative charge than the surface of untreated hair. The resulting change in the hair's structure may reduce its natural gloss or cause a mild build up of static charge, and in extreme cases the hair may break, especially in the region of the tip. Chemical hair treatments such as cold waving, the cortex, because they influence or change, e.g., the disulfide bonds between and in proteins.

Mechanical stresses such as frequent combing and brushing, blow drying, and intensive exposure to sunlight cause damage to the cuticle; scales either break off completely or along their edges. This makes the hair rougher and reduces it's natural gloss. There is large demand in the cosmetic and health industries for mechanical testing data on human hair. Tensile test data on hair can be useful in designing hair combs and brushes, as well as jewelry for hair. Friction data is needed for design verification for hair conditioners and gels. To provide statistical reliability, the measurements are usually carried out with large number of fibers, and a question may arise as to what extent the cuticle might be a factor in data analysis. The rationale behind the question seems reasonable bearing in mind that in case of fine, fibers, the cuticle layer account for as much as 35 % of the total mass of the hair. We normally stretch fibers 5 cm in length to 20 % more than their original length at an extension and recovery rate of 0.25 cm/min [11]. The cortex and not the cuticle is responsible for the tensile properties of human hair, and that severe damage can occur in the cuticle which cannot be detected by tensile property evaluation. The usual procedure for evaluating the stretching properties of human hair is via load elongation methods; that is, a fiber of known length is at a fixed rate in water, in buffer, or at a fixed relative humidity 60% relative humidity, near room temperature on an automated instrument such as an Instron Tensile Tester. Stretching hair fibers under ambient conditions can cause damage well before thee fiber breaks apart.

Other approaches for evaluating stretching properties of hair:

Vibrational Methods:

In this scheme, a fiber is attached to a beam with a known natural resonant frequency. Tension to the fiber. The beam is then deflected, and, from the change in oscillation frequency of the beam

with the fibre attached compared with the natural resonant frequency of the freely vibrating beam, one can calculate the elastic modulus of the fibre.

Stress relaxation:

Stress relaxation is a technique in which the fiber is stretched to a given length, treated, and maintained at the stretched length while the decaying. Stresses are followed with time. Stretch rotation in this test the elongation of hair under a steadily increasing load, together with a rotational movement is done and attempts made to explain this combination of stretching and torision in terms of molecular structure.

Set and super contraction:

Set has been defined as a treatment that enables a keratin fiber to maintain a length greater than its original length. Super contradiction although not a stretching phenomenon, is the condition in which a keratin fiber is fixed at a length less than its original length.[12].

HAIR COMBING PROPERTIES:

1.Hair physical properties:

Physical properties of hair mostly depend on its geometry. Causian hair is oval; Asian hair is circular; afro hair is elliptic. Several mechanical properties are directly related with fibers diameter.

2.Hair mechanical properties:

Hair is surprisingly strong. Cortex keratin is responsible for this property and it's long chains are compressed to form a regular structure which, besides being strong, is flexible. The physical properties of hair involve: resistance to stretching, and hydrophilic power.

A) Resistance to stretching

In general, the weight need to produce a natural hair thread rupture is 50-100 g. An average head has about 1,20,000 threads of hair and would support about 12 tons. The resistance to breakage is a function of the diameter of the thread, of the cortex condition, and it is negatively affected by chemical treatments.

When a certain load is applied on a hair and its elongation is measured, we obtain the graphic representation of its several characteristic regions:

- Hookean's region or pre-recovering: during the stretching between 0 and 2% the elongation is proportional to the load applied.
- Recovering region: between 25-30 % of stretching, the elongation considerably increases without a relationship with the load applied.

- After – recovering region: from 30 % stretching load and fiber extension are proportional again.

B) Hair elasticity:

Hair fibers has an elastic characteristic, and it may undergo moderate stretching either wet or dry. Stretching is a hair attribute under the action of a distal force and the thread returns to the original status, when this force stops acting. When dry, the hair thread may stretch 20-30 %of it's length, and in contact with water, this may reach up to 50%. In contact with ammonia it becomes more elastic. Chemical and physical treatments, sun exposition and use of electric dryers and heated plates affect this propriety.

C) Hydrophilic cpower:

Hair absorbs water under both liquid and steam form. Keratin may absorb up to 40% of its own weight in water. Hydration is favoured by temperature increase, by changing pH and by all the polar solvents which break hydrogen bonds. Hydration changes fiber elasticity. Keratin has special affinity for water. This absorption depends on the air relative humidity rate and greatly interferes on all the properties of the hair, as: stretching ability, diameter and internal viscosity of the fibers.

Hair tends also to be precious to water in its liquid form. This absorption is followed by a swelling in the hair, with 15-10 % increase in its thread diameter and 0.5-1.0 % in its length.

3.Surface properties of hair:

The hair existing in the normal scalp represents a huge surface, if we consider a mean value of 20 cm long for a thread with an 80 mm diameter. Surface conditions are different as a function of the individual, hair and length of each thread.

A) Hair surface porosity:

When the hair is porous, chemical treatments as dyeing and straightening occur more rapidly.

Some situations influence on porosity:

- Alkaline pH over 8 increases permeability.
- High temperature accelerates water penetration.
- Chemical process as permanent waving, discoloration, straightening and dyeing affects the porosity.
- Air relative humidity.

B) Absorption:

Hair surface retains the thread natural oils composed by tensoactive ingredients and some dyers. Absorption of fatty substances is due to a physical process of surface tention. The sebum absorption over the hair occurs by contact with the scalp and transference from a thread to each

other. Chemical treatments enhance the surface anionic nature of the hair thread, which becomes electronegative, causing its physical -chemical affinity with cationic components, as tensoactive and dyeing ingredients.

C) Friction:

Friction is the force resisting the movement when a body slides over another one. The cuticle surface has high friction coefficient due to its scale shape and it depends on the cuticle geometry and on the physical -chemical status of the hair. The continuous attrition of a thread over another one damages the cuticle. From the roots to the extremities the friction coefficient differs in the dry and wet hair thread, and it is enough combing to damage the hair. Several factors influence the friction, such as :

- Relative humidity: friction is higher in wet than in dry hair.
- Discoloration of the hair: discoloration increases the friction among threads.
- Permanent waving and straightening: due to the chemical composition and high pH of ingredients the friction is increased.

D) Static load:

When a comb slides over the hair, surface electric load is generated by both friction and high electric resistance of the hair, which makes handling difficult. The static load dispersion is a function of fibers conductivity on the thread surface and reduce the friction. The load potential depends on some factors:

Status of the hair surface, because the presence of an oily layer coming from the sebum or from a cosmetic product influences the static electricity effect, which is reduced or disappears

Grade of humidity of the hair -thread electric load tend to flow easier on wet than on dry hair, due to the lower electric resistance.

E) Isoelectric point:

Hair surface presents both positive and negative electric loads while the cuticle has an electrically neuter point under a pH 3.8, it becomes more negative, since the NH_3^+ group loses its load. However, in pH values under 3.8 the hair becomes more positive, carboxyl groups are protinex and neutralized, and a predominance of the NH_3^+ group occurs.

F) Shine:

Shine is the most important and desired cosmetic attributes of the hair. From the physical point of view, it is related with the way by which the hair reflects and diffuses the incident light beam. Thus, any factor which changes light reflection would have influence on shine. Since this is a

surface propriety, cuticle is the main responsible by it. Damagesbon cuticle as well as dust particles and scalp secretions built up over hair seems to be more brilliant than the light ones.

When a light beam reaches the hair surface, a part of it is reflected, another part is absorbed, and a third part is dispersed. The amount of light corresponding to each of these phenomena depends on the surface geometry, on the refraction index of the thread, and on the light incidence angle. Factors influencing the shine perception, by order of importance are:

Reflection, light dispersion, alignment and colour.

These favorable effect of hair shine:

- Continuous and thin film over the scales.
- Film with high refraction index.
- Reflection being higher than diffuse dispersion.

The present unfavorable effects:

- Higher light dispersion.
- Film coating -irregular or discontinuous -over threads.
- Chemical treatments as permanent waving and discoloration, which cause changes on the flat positioning of the cuticle due to the scales lifting.

G) Compatibility:

Compatibility may be defined as the subjective perception of the easy or difficult way for combing the hair. It is an important attribute in the evaluation of the hair conditioning. Other factors related with comparability reflects a better hair conditioning.[13].

EVOLUTION OF SOAP:

The earliest recorded evidence of the production of soap like materials dates back to around 2800 BC Ancient

Babylon. Inscriptions have been discovered that indicates that the inhabitants boiled fat with ashes. It is unclear precisely what these products were used for, although it is probable that their use was restricted to garment washing until Roman times. It has been suggested that the word soap was derived from Mount Sapo, which was a location for animal sacrifice. Melted animal fats and wood ashes would be washed down from the mountain and, in the clay along the banks of the River Tiber, a crude soap would form. From these very tentative beginnings the product became progressively more refined as better-quality raw materials were used. The general use of soap as a washing medium probably dates back 1000 years or so, when the countries around the Mediterranean were producing modest quantities of soap, using a variety of locally available fatty raw materials.

In addition to animal fats, vegetable oils such as olive oil would have been used. This limited production continued without significant modification until the breakthrough in the nineteenth century brought about by the availability of cheap soda[14]. The French chemist leblank is credited with the invention of the process to convert common salt into soda ash, the same material that is derived from wood ash. The development by the Belgian chemist, Solvay, of the ammonia process further reduced the cost of soda and, at the same time, improved both the quality and quantity of this material which was vital to support the growth of the soap making industry. During World War 1, commercial soap, as we know it today, came into existence. The injuries of war brought an increased need for cleaning agents. However at the same time, the ingredients needed to make soap were scarce. German scientists created a new form of "soap" made with various synthetic compounds and as a result, detergent were born.

Throughout the nineteenth century the chemistry of soap-making became better understood with the discovery of the different fatty acids present in neutral fats and oils and this, in turn, ledu to the establishment of the fundamentals of the modern -day process involving the saponification of neutral fats or fatty acids with the appropriate caustic material. Caustic soda will produce harder sodium soap while caustic potash will yield the softer potassium soaps. The selection of specific fats and oils will yield a liquid soap. Although production methods and techniques may have changed drastically from those earliest days it is worth remembering that the basic chemistry of soap remains virtually unchanged.

SOAP:

Soap is one of the oldest and most important cosmetic and personal care products. Soap is a product used in conjunction with water for washing and cleaning. It usually comes in a solid molded form but may also come in the form of liquids dispersed from dispensers. Soaps typically contain surfactants that, when applied to a soiled surface in combination with water wet the dirt and effectively holds particles in suspension so it can be rinsed off with clean water.

Soap is the alkali salt of fatty acid. of the important fatty acids used in soap manufacture are lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, reicinolenic acid. Fatty acids have varying chain length and may be saturated or unsaturated. Fatty acid content of the oils varies. Unsaturated fatty acids give softer soap with lower melting point and are less stable while soap from saturated fatty acids are firm, slowly soluble, milder and have good detergency. Total fatty acid is considered beneficial ingredient of toilet soap. Property of soap depends on the chain length of fatty acids in blend, amount of saturation and unsaturation,

formulation and soap structure. A judicious blend of oils and fats are necessary to obtain soaps of ideal properties.

Soaps have been graded in terms of total fatty matter. Soap may be categorized as toilet soaps or bathing soap or specially soap like baby, transparent, herbal and antibacterial soap. Bureau of Indian standards has categorized on the basis of total fatty matter.

Although soap is a good cleansing agent, it's effectiveness is reduced when used in hard water. Hardness in water is caused by the presence of mineral salts, mostly those of calcium and magnesium. The mineral salts reacts with soap to form an insoluble precipitate known as soap film or scum. Soap film does not run away easily. It tends to remain behind and produces visible deposits on clothing and makes fabrics feel stiff. It also attaches to the inside of bathtubs.[14].

Raw material for soap:

Soaps are commonly made from fats and oil and sodium hydroxide. Oils and fats can be classified either lauric or nonlauric oils/fats. In soap making palm oil , coconut oil, caster oil, neem oil, kernel oil, groundnut oil, rice bran oil and animal fats especially tallow are used. Fatty acids present in tallow are mysteric acid, mysteric acid, palmitic acid, stearic acid, oleic acid, linoleic acid whereas the coconut oil contains lauric acid, mysteric acid, palmitic acid, stearic acid. Different oils produce soaps of varying hardness, odour and lathering properties. Normally 75-85 % tallow and 15-25 % coconut oil is used in soap making.C12 and C14 soaps lather quickly but they produce an unstable, coarse bubble foam while C16 and C18 lather slowly but lead to stable, fine bubble foamed.

Soap making process:

The soap making process consists of reaction of animal fats along with coconut oil with sodium or potassium hydroxide. The traditional process consists of direct saponification of oil and fats in batch process or a continuous process. The production of soap comprises saponification, removal of glycerol, soap purification, finishing which consists of mixing and homogenization of the soap base with additive such as perfumes, coloring matter, skin grooming substances and final extrusion, cutting shaping and packaging. Basic steps in soap manufacture are saponification, glycerin removal, soap purification, finishing.

Saponification:

A mixture of tallow, coconut oil, sodium hydroxide and salt are mixed in fixed proportion and fed to a reactor with and heated with steam. Effective mixing and proper blending of raw material is very important to ensure a consistent reaction. The soap batch is boiled using steam sparging. The soap produced is the salt of a long chain carboxylic acid.

Opening of grain of soap and glycerin removal:

Upon completion of saponification salt to the wet soap causing it to separate out into soap and glycerin in salt water as soap is not very soluble in salt water. Glycerin is very valuable by product soap is converted to two layers. The bottom layer is high level of salt glycerol and only small amount of soap while the top layer is soap which is allowed to settle for several hours. Aqueous solution called lye is drawn from the bottom which consists of most of the glycerin which is sent to the glycerin recovery plant where glycerol is not recovered, purified.

Soap purification and drying:

The soap remaining in the kettle still contains some glycerin which is removed by adding small amount of caustic soda in the wash column. The soap and lye are separated. The lye removed is reduced in the process. The top neat soap layer still contains some caustic soda which is neutralized with a weak acid such as citric acid.

Finishing:

Finally, additives such as preservatives, colour and perfume are added and mixed in with the soap and it is shaped into bars for sale.[14].

CONCLUSION:

The advancement of cosmetic evaluation through instrumental and sensory methods has significantly enhanced the accuracy, reliability, and objectivity of product assessment. Modern instrumental techniques provide precise quantitative data on parameters such as skin hydration, elasticity, texture, and color, while sensory evaluation complements these findings by reflecting real consumer perception and satisfaction. The integration of both approaches ensures a comprehensive understanding of product performance, safety, and efficacy. [15]. As technology continues to evolve, the combination of advanced analytical tools and well-structured sensory panels will play a vital role in developing high-quality, consumer-preferred cosmetic products.[15].

REFERENCE:

1. Zoe Diana Draelos, Lauren A. Thaman. Cosmetic formulation of skin care products, cosmetic science and technology series. Volume 30, Taylor and Francis Group,270 Madison Avenue, New York.
2. Cheryl Burgess. Cosmetic Dermatology.Springer,2005, Berlin Heidelberg, New York.
3. Peter Elsner, Howard, Maibach. Cosmeceuticals, Drugs vs. cosmetics, cosmetic science and technology series. Volume 23, Marcel Dekker, Inc,270 Madison Avenue, New York.

4. Andre O, Barel, Marc Paye, Howard I, Maibach, Handbook of cosmetic science and technology. Marcel Dekker, Inc ,270 Madison Avenue, New York.
5. Gabriella Baki, kenneth S Alexander. Introduction to cosmetic formulation and technology. John Wiley & sons Inc., Hoboken, New Jersey.
6. Hilda Butler, Poucher's Perfumes, Cosmetics and Soaps.10th Edition, Kluwer Academic Publishers, P.O.Box 17,3300, AA Dordrecht, Netherlands.
7. Gaurav Kumar Sharma, Jayesh Gadiya, Meenakshi Dhanawath. Text book of cosmetic formulations.2016 kbuuk publication, Houston and Pothi.com India.
8. Zoe Diana Draelos. Cosmetic dermatology products and procedures. John Wiley & Sons Ltd, Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK.
9. J.B. Wilkinson, R .J . Moore. Harris cosmetic ology 7th Edition. Chemical publishing co., ink,155 W.19 St., New York.
10. P.P. Sharma. Cosmetics-formulations, manufacturing and quality control.4th Edition, Vandana publications Pvt. Ltd., Delhi.
11. Sanju Nanda, Roop K khar. Text book of cosmetic ology, Tata publishers.
12. Barry BW. Dermatological formulations, Percutaneous Absorption. Marcel Dekker,1983,270 Madison Avenue, New York.
13. Barel AO, Paye M, Maibach HI. Hand book of cosmetic science and technology.3rd Edition 2009,Informa.,New York.
14. Kenneth A walters. Dermatological and transdermal formulations. Marcel Dekker, Inc.,270 Madison Avenue, New York.
15. B.M. Mithal ,R.N.Saha, A handbook of cosmetic. Vallabh Prakashan, Delhi.