

# PRINCIPLES OF COSMETIC EVALUATION

## Points to be covered in this topic

→ SEBUMETER

→ CORNEOMETER

→ MEASUREMENT OF TEWL

→ SKIN COLOR

→ HAIR TENSILE STRENGTH

→ HAIR COMBING PROPERTIES

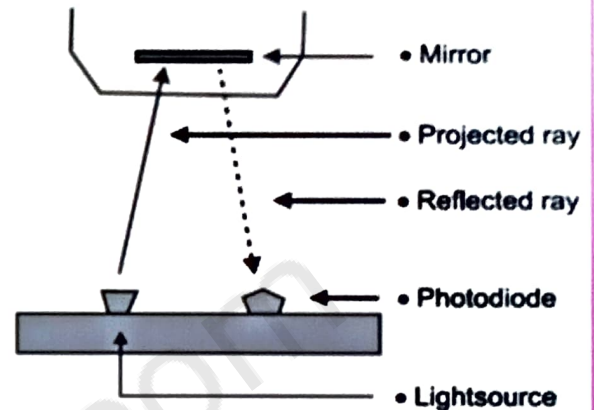
→ MEASUREMENT SOAPS AND SYNDET BARS

# SEBUMETER

- Instrument used for determining the **sebum level** of the **skin surface** as well as on **scalp and hair**.

## ❖ PRINCIPLE

- The measurement is based on the principle of **grease spot photometry**.
- The measuring **head of the cassette** with its special tape is placed on the skin.
- It is then inserted into a slot of the device, where 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/cm<sup>2</sup>** of the skin.



## ❖ MEASUREMENT OF SEBUM

- Sebum is an **oily secretion** from the **sebaceous gland**.
- Sebum **waterproofs and lubricates** the skin and **hair of mammals**.
- Sebum affects the **permeability of skin** and absorptivity of water.
- **Protects skin** against bacteria, fungi.
- **Sebaceous glands** often go into **overdrive during puberty**, and the excess sebum can cause oily skin, odors, and acne.
- There are a **number of disorders** associated with sebum and the **sebaceous glands**.
- Hence measurement of **natural presence** of sebum is of particular interest to **dermatologists and cosmeticians**.

- Lipids are synthesized at a **constant rate** in **sebaceous glands** and secreted onto skin surface an average of 8 days **after synthesis**.
- As a result measurement of the sebum content of a **skin specimen** of known surface area should **allow calculation** of the **sebum production rate** which has been occurring in vivo.
- **Average sebum production** rate of scalp is **1.45mg/10sq.cm/3hr**

### ❖ SEBUMETER PROBE (CARTRIDGE)

- The **measuring head** of the **Cartridge** exposes a **64mm<sup>2</sup>** measuring section of the tape.
- For a measurement the tape is **transported** forward by a trigger at the side of the **Cartridge to expose** a new section of the tape.
- The used tape is rewound **inside the cassette**.
- One Cartridge can be used for **approx. 450 measurements**.
- The scale from **1-0 on the trigger** shows how much of the tape is still unused.
- For **hygienic reasons** when exhausted, the Cartridge is simply replaced.
- The instrument has an **accuracy of  $\pm 5\%$** .
- The reading of sebum may be displayed as a number or as type of skin i.e. **dry; dry/normal; normal; normal/oily; oily**.

### ❖ ADVANTAGES OF THE SEBUMETER

1. **Quick and very easy** measurements.
2. **Zero calibration**.
3. Probe is small and **lightweight**.
4. The accuracy of the device can be **easily checked**.
5. **Constant pressure** on the skin.

### ❖ APPLICATIONS

1. Used in **dermatological**
2. It is important for **claim support and efficacy testing** of all kinds of cosmetic and pharmaceutical products.

# CORNEOMETER

## ➤ PRINCIPLE

- The measurement is based on **capacitance measurement** of a dielectric medium.
- The **corneometer measures** the change in **dielectric constant** due to skin surface hydration changing the capacitance of **precision capacitor**.
- The measurement can detect even **slight changes in the hydration level**.
- The corneometer measures in **arbitrary units from 0 to 120**.



## ❖ ADVANTAGES OF THE CORNEOMETER

1. **Very quick** measurement (1 s)
2. **Continuous measurements**
3. Substances on the skin (e.g. salts or residues of topical applied products) have only **minimal influence** due to **capacitance measurement**.
4. The measurement **depth is very small** (10-20  $\mu\text{m}$  of the stratum corneum) (e.g. from the blood vessels).
5. The probe is **small and lightweight** for easy handling and measurement on **all body sites** (e.g. lips etc.).
6. The spring in the **probe head ensures** constant pressure on the skin enabling exact, **reproducible measurements**.
7. The accuracy of the **Corneometer probe** and the **penetration depth** of the scatter field can be **checked easily anytime**.
8. The probe **head can quickly** be cleaned
9. The Corneometer is **explicitly recommended** is the latest guideline for skin water measurements by the experts of **EEMCO** (European group on efficacy measurement and evaluation of cosmetics and other products)

## ❖ APPLICATION

- The basic measurement for **all bio-medical and cosmetic** applications.
- Ideal instrument for formulation, claim support and efficacy & **safety testing** of **all cosmetics** & skin care products raw materials, pharmaceuticals, household products, detergents, food and food supplements and many more
- **Typical claims (examples)** substantiated with the **Corneometer: hydrating/moisturizing**, against dry skin, for sensitive skin, protecting, restoring/repairing, supports healing, soothing, normalizing, vitalizing, and many more.
- Used as standard in **dermatological** basis research in **humans and animals**.
- Occupational health assesses this **parameter to underline** the importance of **skin protection measures**.

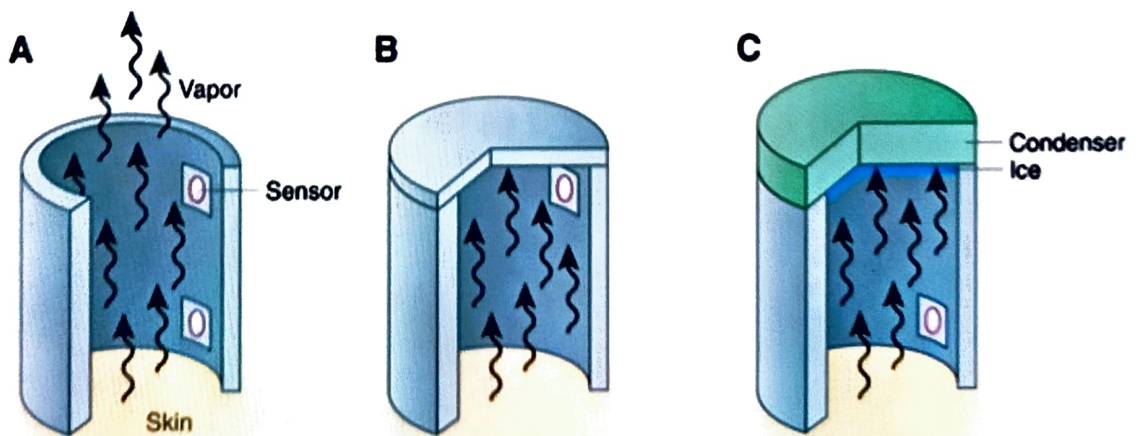
## MEASUREMENT OF TEWL

### ➤ DEFINITION

- The measurement of **quantity of water** that passes from inside a body through the epidermal layer to **surrounding atmosphere** via **diffusion and evaporation processes**.

### ❖ MEASUREMENT OF TEWL

1. Identifying skin damage
2. Environmental factors
3. Moisture content



## ❖ MEASUREMENT PRINCIPLE

- A **certain evaporation** of water from the skin takes always place as part of the **normal skin metabolism**.
- However, as soon as the barrier function of the **skin is slightly damaged**, the water **loss will increase** (even with smallest damages invisible to the human eye).
- Therefore this **measurement is a basis** for all **cosmetic and dermatological research**.
- The **Tewameter probe measures** the density gradient of the water evaporation from the **skin indirectly** by the two pairs of sensors (temperature and relative humidity) inside the hollow cylinder.
- This is an **"open chamber"** measurement. This method is the only to assess the **TEWL continuously** without influencing its micro environment.
- The measured values express the **evaporation rate in g/h/m<sup>2</sup>**.

$$\frac{dm}{dt} = -D.A.\frac{dp}{dx}$$

### ✓ Where

- **A** = surface [m<sup>2</sup>]
- **m** = water transported
- **t** = time
- **D** = diffusion constant
- **p** = vapour pressure of the atmosphere
- **x** = distance from skin surface to point of measurement

### ✓ Advantages

1. **Extremely accurate and quick**
2. **Small size** of the probe **head minimizes** the influence of air
3. **Easy to handling**
4. Display of **RH and °C separately**
5. **Special calculation** i.e. SSWL
6. Accuracy of the **probe can be checked anytime**

## ❖ APPLICATION

- **Scalp, lip, hair** measurements Sweat studies
- Used in **vitro testing**
- Used for **dermatological research Veterinary dermatology** and zoology
- Used for **textile/food/paper/tissue industry.**

## SKIN COLOR

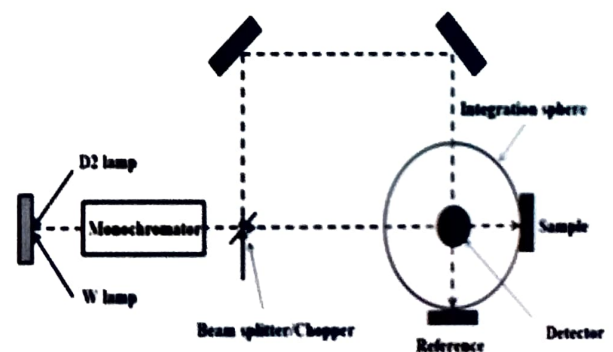
1. **Skin colour** include the **pigments cartotene, haemoglobin, and melanin.**
2. **Epidermis (Refer Unit I PPT)**
3. **Skin type (Refer Unit III PPT)**
4. Measurement of **skin colour**
  - i. **Reflectance spectrophotometer**
  - ii. **Chromameter**
  - iii. **Mexameter**
  - iv. **Derma spectrometer**

## ➤ MEASUREMENT OF SKIN COLOUR

### 1. REFLECTANCE SPECTROPHOTOMETER

- Two types of **skin reflectance instrument** are available

i. **Tristimulus colourimeter (chromameter from Minolta)**



ii. **Narrow band simple reflectance meters** (derma spectrometer from cortex and Mexameter from courage khazaka)

## 2. CHROMAMETER



- It is used for the **observation of skin colour**.
- The **CR-400 chroma meter** is a handheld, portable measurement instrument designed to evaluate the **color of objects**.
- **High accuracy**, reliable colorimeter helps users control the **color quality**, consistency, and appearance of their samples in a **more efficient**.
- It **accurately identifies** color characteristics in objects
- Determines color differences **between objects, and provides pass/fail** assessments to immediately determine if the **sample meets** the defined standard.
- This makes the **CR-400 ideal** for **color inspections** of food, building material, plastic, and dermatological applications within **quality control, quality assurance, and R&D fields**.

## 3. MEXAMETER



- The **Mexameter** is a device that measures simultaneously **two major components** of skin pigmentation: **melanin and hemoglobin**.

### ✓ **Measurement Principle**

- It is based on **light reflection and absorption**.
- The probe emits **three wavelengths** of light, chosen to correspond to the different absorption rates of **melanin and haemoglobin**.
- This light emitted by the **probe is reflected** by the skin and the receiver in the probe measures this **reflected light**.
- It is only the **diffuse and scattered light** that is measured.
- The results are shown in **1 second** as index numbers between **0 and 999**.
- The probe allows the **measurement** to be made quickly (1 second).
- The probe head is **spring loaded** so that a **constant pressure** is provided.

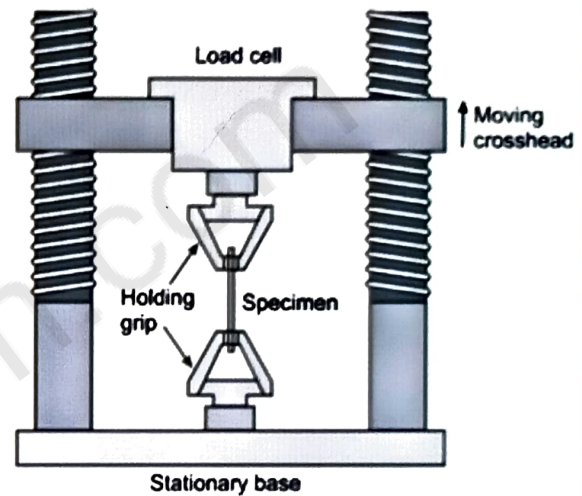


## ✓ **Application**

- Ideally suited for **product development**, **claim support and efficacy testing**
- Can be used for objective **clinical assessment**, **allergy and patch testing**
- Can be used for **monitoring therapies** Measurement of melanoma and scar tissue Suitable for **medical surveys** Assessing melanin and **erythema in a range** of research applications

## **HAIR TENSILE STRENGTH**

- The **strength of hair** is evaluated by **tensile test or tension test**.
- It is made up of a **protein called keratin** which is a **polyamide molecule** with many **disulfide chains** between the bridges. This is responsible for the **strength and stiffness of hair**.
- In general, **human hair** has a tensile strength of **200 - 250 MPa** and yield strength of **140 - 160 MPa**.
- The real challenge in **measuring the tensile strength** of hair is handling single strands of hair which have a diameter of about **0.025 mm to 0.076 mm**.



## ✓ **The instrument used for testing tensile strength is tensile tester**

- Two vises **apply tension** to a **specimen by pulling** at it, stretching the specimen until it fractures. The **maximum stress** it withstands before fracturing is its ultimate **tensile strength**.
- **Tensile strength** is defined as a stress, which is **measured as force per unit area**. For some **non-homogeneous materials** (or for assembled components) it can be reported just as a force or as a force per unit width.

## HAIR COMBING PROPERTIES

- Combability may be defined as the **subjective perception** of the **easy or difficult** way for combing the hair.
- It is **directly related** to the forces which are opposite to the action of **combing the hair**.
- Other factors **related to combability** involve **malleability and mechanical damages**
- **Hair fiber** is composed of **three main structures**.
- On the **cuticle, cosmetic products** are **deposited**.
- Approximately **8 to 11 layers** of the cuticle, which are overlapped.
- **Each layer** is formed by only one cell.
- Each cell of the cuticle has a **rectangular shape** and they overlap in such a way, that **only 1/6** of them are exposed.



### ❖ SEVERAL FACTORS INFLUENCE THE FRICTION

- Friction is higher in **wet hair** than in **dry hair**.
- Due to the **chemical composition** and **high pH** of ingredients during **permanent waving** and **straightening the friction** is increased.
- More is the **detergent powder** in the **shampoo, higher** is the friction. The addition of conditioning substances **promotes a lower friction** coefficient than the one brought by the **shampoo**, without these substances.
- **Conditioning cream, rinse cream** and related products reduce the friction among **hair threads**.

# MEASUREMENT SOAPS AND SYNDET BARS

## ➤ SOAPS

- **Soaps** are **water soluble** sodium or potassium salts of fatty acid.
- Soaps are made from **fats and oils** or their **fatty acid** by treating them chemically with a **strong alkali**.

## ❖ TYPES OF SOAPS

- Transparent soaps
- Bathing bar
- Castile soap
- Superfatted soaps Carbolic and carbonated soaps



## ❖ RAW MATERIALS

### ✓ Fats and oils

- **Fat mixture** containing **saturated and unsaturated** and **long and short chain fatty acid** in suitable proportion are used.
- **Saturated fatty acids** with **12 to 18 carbon atoms** are used.
- Eg. Lauric, Myristic, Palmitic, Stearic and Oleic Acid

### ✓ Alkalis

- **Caustic soda** is used as a **raw material** in the **preparation of soap**.
- **Caustic potash** is used in **making soft soaps**
- **Potassium carbonate** and **soda ash** are used to saponify fatty acids

## ❖ ADDITIVE USED

### ✓ Antioxidants

- These are used to **stabilize the soap against** rancidity. Eg. Sodium silicate, **sodium hyposulphite**, **sodium thiosulphate**.

### ✓ Whiteners

- **Titanium dioxide** and **zinc oxide** are used to improve whiteness.

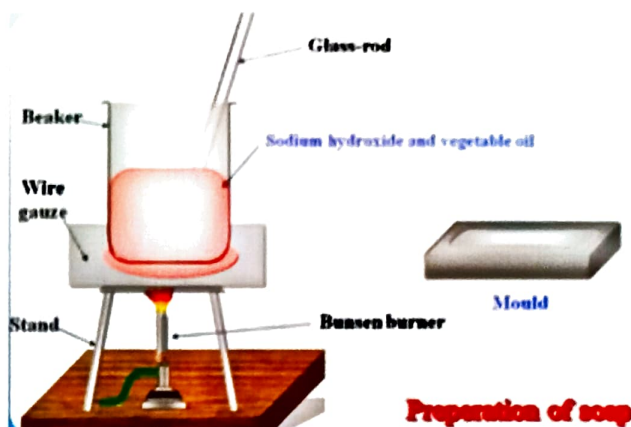
### ✓ Perfumes

- The **pH of the soap** is around **10.0**. The selected perfume should be stable in this **pH range**.

## ➤ SOAP MANUFACTURING

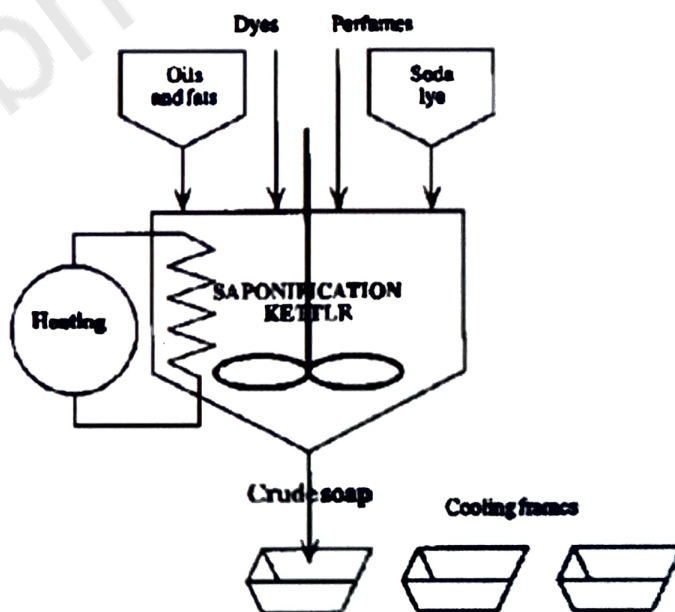
### ❖ COLD PROCESS

- In this process, **mixing of fat** and **strong alkali** is carried out substantially **at room temperature** so that little more than **emulsification** takes place.
- **Saponification** is completed after this mixture is run into **frames** in **several days** at **warm temperature**.
- Since there is **no opportunity** to **adjust proportions** of fat and alkali calculation of quantities to be used should be **made carefully**.



### ❖ SEMI-BOILED PROCESS

- The **semi-boiled process** differs from the **cold process** in the fact that the **saponification mixture** is heated to 70 - 90° C using a **steam-heated coil** to accelerate and complete the **saponification reaction**.
- **Dyes, perfumes,** and additives are added at the end of the process to **prevent** them from evaporating.
- The process allows the quantity of **soda undergoing saponification** to be adjusted before the **crude soap** is drawn off.
- It also allows **manufacturing waste** to be recycled, better incorporation of the additives and a **wider choice** of raw materials.

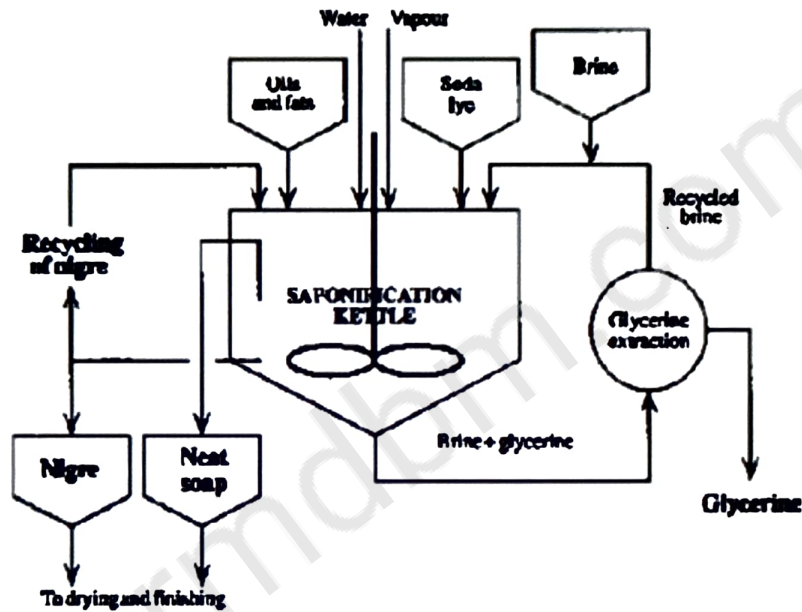


## ❖ FULL BOILED PROCESS

- In this process, **large cylindrical** kettles with cone **bottoms equipped** with open and sometimes with **closed coils** for steam are used.
- The kettles are often provided with **delivery pipes** for fats, water, lye

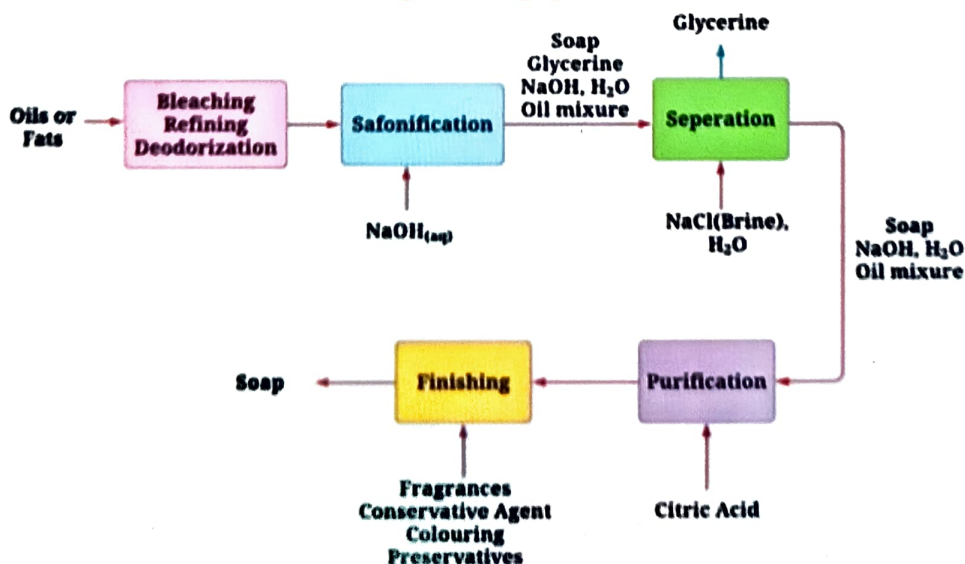
### ✓ **Process includes:**

- **Saponification reaction**
- **Graining out** and washing
- **Strong change**
- Finishing or **fitting operation**



## ❖ CONTINUOUS SAPONIFICATION

- These processes are used when the **production** is on **very large scale**.
- Fats are **first converted into fatty acids and glycerin** using high pressure in continuous fat **splitting process**.



## ➤ SYNDET BARS

- The word "**syndet**" is derived from "**synthetic**" combined with "**detergent**".
- Technically it refers to the binding that occurs between different detergents, also called **surfactants or tensioactive agents**.
- **Syndet soap surfactants** are derived from **oils, fats, or petroleum** products that are processed in a wide range of **chemical processes** other than **traditional saponification**.



## ❖ INGREDIENTS USED

- **Sodium cocoyl isethionate** (the most widely used) Sulfosuccinates
- **Alpha olefin sulfonates**
- **Alkyl glyceryl ether sulfonate**
- **Sodium cocoyl monoglyceride**
- **Sulfate betaines**