Cosmetics

Manas Bhowmik

Tooth paste

Problems:

- Acquired pellicle: Saliva may contain mucopolysaccarides, proteins, enzymes, KCl, NaCl, Na2PO4, K2PO4 and bacteria. Due to this 1-3 mm thick film is formed on the tooth surface excluding bacteria is known as acquired pellicle.
- Plaque: Mucus coating on teeth is called plaque. It is erodible but can cause caries. 10-20mg plaque is formed per day. Generally it contains water, carbohydrates, proteins, lipids, calcium, phosphorus and fluorine. Carbohydrate is partially metabolized to dextrin and levan followed by acid formation that causes caries by bacteria.

Tooth paste

- Calculus: Mineral deposition can cause calculus. On tooth it forms sub gingival calculus and on gum it forms super gingival calculus. Calculus consists of 80% inorganic materials like Ca, Mg, P and remaining 20% are carbohydrates, proteins, lipids and bacteria.
- Food debris and material Alba: A mixture of bacteria and polysaccharides forms diffuse and loosely bonded layer on tooth surface is called material alba.
- Periodontal disease: Tissues through which the teeth are attached to the basal bone of the jaw is called periodontal tissues. Any abnormality is called periodontal disease.

Characters

- Adequately clean debris, plaque and stain
- Provide freshness in mouth
- Non-toxic, pleasant
- Stable
- Economic
- Confirm the national standard for abrasivity to enamel and dentine

Components

- Abrasives: Remove food debris, stain and tooth polishing. $CaCO_3$, $Ca_2(PO_4)_2$, $Ca_2(PO_4)_2.2H_2O$, Ca_3PO_4, Calcium pyrophosphate, Sodium metaphosphate, hydrated alumina. Dicalcium phosphate is metastable form that can change to anhydrous form and can cause hardening of paste. In presence of fluoride ions, this change is accelerated. It is stabilized by addition of tri-magnesium phosphate, calcium sodium pyrophosphate, tetra-sodium pyrophosphate. Anhydrous DCP is more abrasive than hydrous form. It has no effect in presence of fluoride. Na-metaphosphate and Ca-pyrophosphate are used with fluoride without any problems. Hydrated alumina is used as abrasive as well as antacid.

Components

- Detergent and foaming agent: SLS, Mg-LS, SL-sarcosinate, SL-sulphoacetate, dioctyl sulphosuccinate, mooglyceride, sulphates, sulphoates. SL-sarcosinate has anti-enzymatic activity
- Humectant: Prevent drying, impart plasticity by retaining moisture. Glycerin, Polypropylene glycol, sorbitol
- Binders: To bind solid and liquid. They are hydrophilic colloids absorb water, swell and form viscous liquid. Tragacanth, Arabic gum, CMC, SCMC, starch, synthetic resins, liquid glucose, glycerin of starch, karaya, carrageenan. MC is not used with glycerin as they are incompatible. Polyox(ethylenoxide polymer) and carbopol are used as synthetic polymers.

Components

- Sweetening and flavoring agents: Na-saccharin is mostly used as sweetening agent. Flavoring agents are chloroform, spearmint. Peppermint, wintergreen, cinnamon mint, clove oil, anise, caraway, coriander, pimento, eucalyptus, nutmeg, thyme, citrus oil, eugenol, encalyptol, ionone, orris, menthol
- Preservatives: Essential oils, chloroform, para-hydroxylbenzoate, propyl hydroxy benzoate, formaldehyde, dichlorophene. Sodium benzoate is not used is tooth paste.
- Astringent: ZnCl2
- Oxidizing agent: KCl, Na-perborate
- Deodorant: Chlorophyll

Components

- Stannous fluoride is combined with tooth enamel to form insoluble film of tin-oxide, tin-phosphate and calcium fluoride which resist from attack of acid.
- Penicillin, Na-n-lauryl sarcosinate and Na-dehydroacetate can decrease rate of fermentation. These are used in mouth wash.

QC test

- **pH**: pH should be 8-9. The alkaline pH helps to neutralize plaque acid.

1gm paste + 10ml fresh boiled and cold water (27°C)
↓Stirring
Homogeneous suspension
↓Stirring
Determination of pH within 5 minutes

QC test

- **Presence of abrasive particles**: In butter paper 15-20cm length of paste is placed and pressed along its length by finger. The gritty particle will be distinguishable readily.

- **Spread-ability**: 1gm of paste is placed in a glass plate (10×10cm). One another glass plate is placed over the first one. At the center of the plates 2kg weight is applied. The diameter of the paste is determined after 30minutes. The maximum spreadability of toothpaste is 8.5 cm according to BIS standards.
- **Fineness**: 10gm of paste is mixed with 50ml of water for 30minutes ad passed through sieve no. 100 and 200 with continuous running water. The retain particles are collected and dried at 105±2°C until a constant weight is achieved. The residual mass should not more than 0.5% for sieve 100 and not more than 0.2% for sieve 200. The fineness of the evaluated formulations ranged from 0.30- 0.32 % by mass which complied with the BIS standard of the toothpaste.

QC test

- **Foaming power:** 5gm of paste is taken with water to form 50 ml of dispersion and transfer into a stoppered measuring cylinder. Shake the cylinder up and down for 10 times at 30°C. The volume is observed within 5minutes. The volume of the foam should not be less than 50ml
- **Antimicrobial activity:** Streptococcus mutants, Porphyromonas gingivalis, lactobacillus acidophilus growth are observed by agar cup plate methods.

Shampoo

Ideal character:

- Remove soil, sebum, residual of hair setting lotion or dressing and scalp
- Produce sufficient foam
- Remove easily with water
- Impart pleasant fragrance

Mechanism: Wetting, foaming, emulsification and peptization.

Difference between detergent and emulsifier is that the polar group of detergent has ability of displacing oils from ay surface.

Components

1. Surfactants:

- Anionic surfactant: Alkyl benzene sulphonate (irritat to skin), Alphaolefin sulphonate (good foaming property, produce less pH), Alkyl sulphates (SLS, SOS, cetyl sulphate has less solubility, octyl and decyl sulphate are foam suppressants, SLS has less solubility but due to its high cloud point and high viscosity making property it is used I cream, paste and shampoo), Alkyl polyethylene glycol sulphate (more than 7 ethylene oxide molecules if present they are irritant, light foaming power, foam booster and stabilizers are added with it), sulphosuccinate (less irritant to eyes, used in baby shampoo), acyl lactylates (condense product of fatty acid and lactic acid, improve texture and manageability), acyl sarcosinate (condense product of fatty acid and sarcosinate), acyl peptide

Components

- Non-ionic surfactant: All has cleaning power but has no sufficient foaming property and stabilizing property. These are not used as principal detergent. Fatty acid alkanolamides (diethonalamine), polyalkoxylated derivatives, amine oxides (foam booster and antistatic agent, coconut oil, dodecyl dimethyl amine oxide).
- Amphoteric surfactant: These are principal foaming agents for hair conditioning property. N-alkyl amino acids (β-amino acid, asparagine derivatives), betains (widely used, Zwitter ionic compouds, trimethyl glycine derivatives. They are cation I acid and anion in base).
- Cationic detergents: cetrimide, benzalkonium chloride, stearyl dimethyl benzyl ammonium chloride. Problems with these detergents are injurious to corneal tissue and weigh down hair.

Components

2. Foam booster: Alkyl polyethylene glycol sulphate (1-2%), Amine oxide

3. Conditioning agent: Improve manageability, feel and hair luster (natural fat containing fatty acids and fatty alcohols like lanolin, mineral oils, polypeptides, egg derivatives, herbal extract, surfactant (acyl lactates), resin)

4. Viscosity modifiers: Electrolytes (NaCl, NH2Cl), gum like karaya, tragacanth, alginate, HEC, HPC, CMC, PVP, PVA, carbopol

5. Opacifying aents: Giving pleasant effect. Transparency may be improved by solubilizing alcohols (ethanol, isopropanol, PEG, hexylene glycol, dimethyl octyne diol), non-ionic solubilizers (polyethoxylated alcohols and esters). Opacifing agents are alkanol amides of higher fatty acids, glycol mono and distearate, PEG-monostearte and palmitate, cetyl and stearyl alcohol, PVP, Mg/Ca/Zn salt of stearic acid, Mg-Al-silicate.

Components

6. Sequestering agent: Prevent deposition of Ca, Mg-salt of soap on hair (EDTA, polyphosphate)

7. Preservatives: Surfactants may interfere with the activity of preservative. High concentration is used. Formaldehyde is unaffected by surfactants and it is mostly used. Parabens are inactivated by non-ionic surfactants). Bronidox (5-bromo-5-nitro dioxin) is not effected by anionic surfactant.

8. Perfume

QC test

- Foam and foam stability
- Detergency and cleaning action

i. Effect of water hardness

ii. Surface Tension and wetting

iii. Surfactant content and analysis

- Rinsing
- Conditioning action

i. Softness

ii. Luster

iii. Lubricity

iv. Body, texture and set retention

v. Irritation and toxicity

vi. Dandruff control

- Microbiological assay
- Eye irritancy test
- Product characteristics

i. Fragnance

ii. Colour

iii. Consistency

iv. Package

Foam and foam stability

Cylinder shake method is used for determining foaming ability. 50ml of the 1% shampoo solution is put in 250ml graduated cylinder, cover the cylinder with hand and shake for 10 times. The total volumes of the foam contents after 1 minute shaking is recorded. The foam volume is calculated. Foam should retain for at least 5mins. Foam Stability = V2-V1

The Ross-Miles foam column test is also accepted. 200 ml of surfactant solution is dropped into a glass column containing 50ml of the same solution. The height of the foam generated is measured immediately and again after a specified time interval, and is considered proportional to the volume.

Barnett and Powers developed a latherometer to measure the effect of variables such as water hardness, type of soil and quantity of soil on foam speed, volume and stability.

Fredell and Read titrated actual standard oiled heads of hair with additive increments of shampoo until a persistent lather end point appeared.

Detergency and cleaning action

Cleansing power is evaluated by the method of Barnet and Powers. 5gm sample of soiled human hair is placed at 35°c in 200 cc of water containing of 1 gm of shampoo. The flask is shaken 50 times a minute for 4 minutes. Then washed once again with sufficient amount of water, then after filter the hair dried and weighed. The amount of soil is removed under these condition is calculated.

Wetting & Rinsing property

Wetting property: Canvas disk is used to determine wetting action. It is one inch in diameter. It floats on the surface of a solution. The time required for it to sink is measured accurately.

Rinsing: Skilled beauticians are employed to make comparisons on the performance of shampoos. How rinsing remove dirt and shampoo should be tested.

Conditioning Action

Conditioning action is a difficult property to assess. This is because it is basically dependent on subjective appraisal. No method has been published for measuring conditioning action. The degree of conditioning given to hair is ultimately judged by shampoo user who is making the evaluation on the basis of past experience and present expectations.

Microbiological assay

PREPARATION OF PRE -INOCULUM: Take the loopful culture of staphylococcus aureus (ATCC6532) aseptically and transfer to sterilized and cooled 100 ml SCDM (broth). Mix well. Incubate the broth at 37oC for 24 hrs.

PREPARATION OF MEDIA Soya bean casein digests medium, soya bean casein digest agar and nutrient agar.

PREPARATION OF POUR PLATES: Sterilized SCD agar (100 ml) is cooled to 40°C and mixed with 5 ml of 24 hrs old pre inoculated culture. This is immediately poured in plates (340 ml each) and allows to set.

MAKING THE WELLS ON AGAR PLATES: The wells are dig on agar plates with sterilised well digger aseptically. Take 100µml of each sample, add to well aseptically. Incubate the plates at 37oC for 24 hrs to 48 hrs. Observe the effectiveness of sample on culture growing on the agar plate and we can see the effectiveness of sample in the form of zone of inhibition around each well containing different sample.

Eye irritancy

The test calls for dropping 0.1 ml of liquid shampoo in the conjunctiva sac of one eye of the rabbit , the other eye serving as control. In the case of the first three animals, the treated eye remains unwashed. Since washing the eye may or may not alleviate symptoms of injury.

The six remaining animals are divided into two equal groups. In the first of these groups eyes instilled with the substances are washed with 20 ml of lukewarm water two seconds after treatment and in the second group after instillation. Readings are then made at 24, 48 and 72 hr and again four and seven days after treatment. If the lesions have not cleared up in seven days the test material is considered as severe irritant.

Viscosity

Viscosity of the liquid shampoo is determined using a Brookefield viscometer. 100 mL of the shampoo is taken in a beaker and the spindle is dipped in it for about 5 min and then the reading is taken. At low shear rates around 1 1/s the shampoo for men and the shampoo for children (infants) have about the same viscosity of about 12 Pas. The shampoo for women has a considerably lower viscosity of about 7.5 Pas.

Moisturizing Cream

This cream restore moisture to the stratum corneum.

Water content in the cream is lost by evaporation when cream is applied to the body.

Ingredients:

Base: White petroleum, Lanolin, Cholesterol

Antioxidant: Vit-C, BHT

Buffers: Citrate and Phosphate buffer

Chelating agent: Citric acid, EDTA

Humectant: Glycerin, Propylene glycol, PEG

Emulsifier: W/O (HLB 3-8) or O/W (HLB 8-16) type

Permeation enhancer: Ethanol, Oleic acid, PEG

Preservative: Benzoic acid, Phenyl ethyl alcohol, Methyl hydroxy benzoate (Methyl paraben), Propyl hydroxy benzoate (Propyl paraben)

Gelling agent: Cellulose, Pectin, Gelatin, Tragacanth

Fragrance: Lavender oil, Rose oil, Lemon oil

Emollients

This products are used for protecting, moisturizing, lubricating and soothing effect on skin.

Various types of moisturizers and Emollients:

Ointments: Thick and greasy. Long lasting hydration. Use at night time.

Creams: Use at day time. Less greasy than ointment and absorb quickly.

Lotion: Thin and light product easy to spread. Less moisturizing than thicker products. Useful where hair grows.

Bath and Shower products: Bath oils or additives can retain moisture during bathing.

Emollient soaps: Used for hand and skin wash.

Aqueous cream: Non-greasy emollient or moisturizer. Used to relieve dry skin conditions such as eczema. It is made from a mixture of emulsifying ointment and water (oil in water emulsion).

Emollients

Main ingredients:

a. Humectant (Absorb moisture from the environment and retain moisture by formation of hydrogen bonds): Glycerin, Urea, Pyrrolidine carboxylic acid.

b. Occlusive agent (Make a continuous layer of oil and prevent water loss): Petrolatum, Waxes, Oils, Silicones.

In psoriasis condition, the emollient may contain one or more of the following ingrediants:

Corticosteroids, salicylic acid, Vitamin-D, Coal tar, Tazarotene, Anthralin, Tacrolimus, Pimecrolimus

Natural ingredients **Aloe vera** may help to reduce symptoms of psoriasis.

Rheological additives

Aqueous Phase additives

Rheoluxe associative thickeners: Non-ionic polymeric thickeners composed of urethane and polyether polyol based polymers. Superior when used with high level of salts or extreme pH. They are soluble in water but to build viscosity lipophilic association is required.

Hectorite: Hectorite is a rare soft, greasy, white clay mineral with a chemical formula of $H_2LiMgNaO_{12}Si_4^{-2}$ It occurs with Bentonite (aluminium phyllosilicate mineral) from volcanic ash. In water it is able to form strong and viscous gels and used as very effective thickeners. Different derivatives like Bentone MA, Bentone EW, Bentone LT, Bentone organophilic clays, Bentone gel

Bentone MA & EW form gels by producing an open 3-dimensional network of individual clay. They are stable across pH 6-11 and good tolerance of electrolytes. They are in compliance with “ECOCERT” the first certification body to develop standards for “natural and organic cosmetics.

Bentone LT forms an open 3-dimensional network but strengthened in presence of cellulose and increase stability and thickening property. It is stable across pH 3-11. It is least electrolyte sensitive.

Surfactants can influence the rheological behavior of hydrophilic clays. Non-ionic surfactants, if they are highly ethoxylated, can adsorb onto the clay surface and causes problem in flow property and also activity. Anionic surfactyants can acts as dispersing agents and weaken the gel structure. Cationic surfactants interact strongly and should be avoided.

Bentone organophilic clays are produced treating hectorite with vegetable quaternary ammonium salts. They can able to thicken and gel organic liquids. The correct choice of bentone is determined by the polarity of the system to be thickened. .

Bentone 27V is used in intermediate to high polarity organic systems like ethers, triglycerides for nail lacquers, skin care, antiperspirants and lip products.

Bentone 38V is used in intermediate to low polarity organic systems like volatile silicones and mineral oil for antiperspirants, creams, lotions, eye and suntan products.

Bentone additives need to be efficiently dispersed with high shear equipment and treatment by activator to get optimum level of rheological property like propylene carbonate.

Bentone organoclays form thixotropic gels by developing hydrogen bond between the edges of adjacent platelates.

Bentone organoclays form thixotropic gels by developing hydrogen bond between the edges of adjacent platelates.

Bentone gels are optimally dispersed and activated.

Thank you