Dental Products

Dental caries (tooth decay) is a chronic infectious disease, called dental plague, in which the active agents are members of the indigenous oral flora. It is a colourless sticky mixture of bacterial products, mucin, saliva and foods stuff attached to enamel covering the dentine on the crown. Dental plague is resulted by the combined action of bacteria. Streptococcus mutans, on teeth and a periodental disease, in which inflammation and swelling of gingiva occurs. The bacteria survive on carbohydrates and swelling including the sugar taken in tea and produce acids, esperially lactic acids, proteolytic enzymes. Calcium salts are dissolved in acidic medium, the remaining organic matrix is readily digested by the proteolytic enzymes and cavities are formed. When a cavity deepens, inflammation of the pulp results. A regular dental care eliminates dental plague.

Modification of food habits such as less frequent eating, particularly less in between meals, and avoidance of use of sugar containing food materials that are retained on tooth surface, are the precautionary measures.

☆ Dicalcium Phosphate

(Dibasic Calcium Phosphate, Calcium Hydrogen Phosphate).

$CaHPO_4$: Mol. Weight = 136.06.
$CaHPO_4.2H_2O$; Mol. Weight = 172.1.

Dicalcium phosphate is anhydrous or contains two molecules of water of hydration. It contains not less than 30.9 per cent and not more than 31.7 per cent of calcium, calculated with reference to the ignited substance.

Preparation

$$CaCl_2 + Na_2HPO_4 \longrightarrow CaHPO_4 + 2NaCl$$

$$Ca_3(PO_4)_2 + 3H_2SO_4 \longrightarrow \underset{\text{Phosphoric acid}}{2H_3PO_4} + 3CaSO_4.$$

$$H_3PO_4 + Ca(OH)_2 \longrightarrow CaHPO_4 + 2H_2O$$

Physical Characters :

- It occurs as a white, odourless, tasteless, crystalline powder.

- It is stable in air ;
- It is practically insoluble in cold water and alcohol ; soluble in dilute hydrochloric acid and nitric acids. It loses water of crystallisation slowly below 100°c.

Test for Purity :

Tests for carbonate ; chloride ; fluoride ; sulphate ; arsenic ; barium ; iron ; monocalcium and tricalcium phosphates ; heavy metals.

Test for Identification.

1. The substance is dissolved in dilute hydrochloric acid ; the solution gives the reactions of calcium.
2. A solution gives the reactions of phosphates in dilute nitric acid.

Assay

The assay is based on complexometric titration as discussed for calcium gluconate and magnesium sulphate.

✱ Sodium Fluoride

NaF ; Mol. Weight = 42.0

Sodium fluoride contains 98.5 to 100.5% of NaF.

Preparation

$$Na_2CO_3 + 2HF \rightarrow 2NaF + H_2O + CO_2$$

$$Na_2SiF_6 + 2H_2O \rightarrow 2NaF + 4HF + SiO_2$$

Physical Characters :

- Sodium fluoride occurs as a white, odourless powder or colourless crystals; m.p. 99.3°.

Chemical Reactions

$$Na_2SiO_3 + 6HF \longrightarrow Na_2SiF_6 + 3H_2O.$$

Test for Purity :

Tests for lead ; fluorosilicate ; sulphate ; clarity and colour of solution ; acidity or alkalinity ; loss on drying.

Tests for Identification

- The substance is dissolved in water and then calcium chloride solution added. A gelatinous white precipitate is produced which dissolves on adding 5 ml of ferric chloride solution.

Assay.

To the substance (80 mg) a mixture of acetic anhydride and anhydrous acetic acid is mixed and heated to dissolve.

Uses :-

Sodium fluoride is used as an adjunct to diet and oral hygiene for the prevention of dental caries.

★ Sodium Metaphosphate

(Sodium metaphosphosphate, Maddrell's salt)

$(NaPO_3)_n$

Sodium metaphosphate is prepared by dehydration of sodium phosphates (eg. $Na_2H_2P_2O_7$, NaH_2PO_4, Na_2HPO_4).

$$NaH_2PO_4 \rightleftharpoons NaPO_3 + H_2O$$

→ It occurs as a white powder; practically insoluble in water but soluble in mineral acids.

→ Sodium metaphosphate is used as a 5% dusting powder in hyperhidrosis and bromidrosis, as a prophylactic against athlete's foot, a water softner and in food industry as emulsifying and chelating agent.

✱ Stannous Fluoride.

SnF_2 : Mol. Weight = 156.70

Stannous fluoride is prepared by evaporating a solution of stannous oxide in hydrofluoric acid in the absence of oxygen or by reacting tin with hydrogen fluoride

$$SnO + 2HF \longrightarrow SnF_2 + H_2O$$

$$Sn + 2HF \longrightarrow SnF_2 + H_2$$

Test for Purity :

Tests for antimony ; water-insoluble substances ; loss on drying ; pH.

Tests for Identification

→ When calcium chloride solution is added to a solution of the substance, white precipitate of calcium fluoride is formed.

Assay (U.S.P.)

For Stannous Ion :

A mixture of stannous fluoride dissolved in 3N hydrochloric acid and potassium iodide is titrated with 0.1N potassium iodide-iodate, adding starch as the end-point is approached.

Assay for Fluoride :

The standard preparations of 4,5-dihydroxy-3-(p-sulphophenylazo)-2,7-naphthalene-disulphonic acid trisodium, zirconium oxychloride, hydrochloric acid, and sodium fluoride after addition as indicated in the USP monograph are screened at a wavelength of maximum absorbance at about 590 nm

and the quantity of F is determined.

Uses :

→ Stannous fluoride has similar actions to sodium flouride and is used as ingredient of caries-preventing tooth pastes, in dentrifrices and mouth rinses.

→ It increases teeth discolouration.

☆ Strontium Chloride

$SrCl_2$; Mol. Weight = 158.52.

$SrCl_2 . 6H_2O$; Mol. Weight = 266.6

→ Strontium chloride hexahydrate occurs as colourless, odourless crystals or white granules. It effloresces in air.

→ It is soluble in water and alcohol.

→ The aqueous solution is neutral.

Uses:

→ Strontium chloride is used as a 10% tooth paste for the relief of dental hypersensitivity.

✱ Zinc Chloride

$ZnCl_2$; Mol. Weight = 136.3

Zinc chloride contains .95 to 100.5 per cent of $ZnCl_2$.

Zinc chloride is prepared by heating excess of metallic zinc with mildly concentrated hydrochloric acid.

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2.$$

$$Zn + HgCl_2 \longrightarrow ZnCl_2 + Hg.$$

Characters

→ Zinc chloride occurs as a white, odourless, deliquescent crystalline powder or granules or opaque white masses or sticks ; m.p. 290°.

→ It is soluble in water, alcohol and glycerol; freely soluble in acetone.

Test for Purity :

Tests for oxychloride, sulphate; ammonium salts; calcium; iron; magnesium; alkali and alkaline earths; heavy metals; acidity.

Tests for Identification

→ An aqueous solutions is acidified with 2N hydrochloric acid, until the solution is complete. The resulting solution is complies the tests for zinc.

→ A 5% solution in 2N nitric acid gives the reactions of chloride.

Assay :

The assay is based on the complexometric titration as discussed for zinc sulphate and calcium gluconate.

Uses :

→ Zinc chloride is a powerful caustic and astringent (protein precipitant).

→ It is also used as an obtundent in dentistry; as deodorant, disinfecting, embalming material, as a desensitizer of dentin, as mouthwashes, in ulcers, fistulas and pododermatities.