CHAPTER No. III.

REVIEW OF THE DRUG

VANGA-BHASMA

1] VANGA-BHASMA GENERAL.
2] PREPARATION OF VANGA-BHASMA.
3] TIN (VANGA) ACCORDING TO CHEMISTRY.
HISTORICAL BACKGROUND

Indian people are aware of this metal from 'vaidic kal'. In 'TAITARIY SAMHITA' the word TRAPUN is used for Vang or Kathil. In CHHANDOGYA UPNISHAD there are also references of Vanga as follows.

1) 'सींसंचमं अवुशचमं लोहंचमे' (२.४.७.५)
2) लवणं सुवर्णं संदध्यात्, सुवर्णं रजतं, रजतेन अरु, अरुभुना सीसं.

-छन्दोपदेश उपनिषद ४-१७७

This metal is imported from China and Brahmadesh (Burma) to Bengal. Then from Bengal the metal is distributed to other parts of the country. It is mainly due to the fact that the item is imported to Bengal it is called Bang or Vang.

References of Vang are found in SANSKRIT language SHUKRALOHA is an appropriate name according to its
SHUKRA-DHATU means semen. SHUKRA-DHATU is very important to our body. Even a layman is aware of the fact that Shukradhatu is like a king. In the absence of this in our body, man does not function properly. He would be termed as impotent.

It will be interesting to know that, UDHYOG, SAHAS, BAL, BUDHI, and PARAKRAM (उद्योग, साहस, बल, बुद्धि, पराक्रम) are all dependent on SHUKRA DHATU.

Such qualities of SHUKRADHATU, have also relation to vang as a drug.

There is a preparation of a drug known as ‘VANGESHWAR’. During the preparation of Vangeshwar Vang four items namely TEL (OIL) TAKRA (BUTTERMILK) GO-MUTRA (COW’S URINE) and NIRGUNDI (vitex nigundo) are mixed by pouring separately to obtain the drug. The colour of such preparation of Vang is related to the colour of the liquid mixture.
NAMES OF VANG

In different Languages following are the names of vang.
1) Sankrit- Vang, Rang etc.
2) Hindi- Rang.
3) Marathi- Kathil (कथिल).
4) Gujrathi- Kalhai (kalhai).
5) Latin- Stanum.
6) English- Tin.

SYNONYM OF VANG

Various names of vang from Sankrit language described in 10 groups.
1) GATI-SUCHAK (to induce motion)  
   VANGTHU means that which goes  
   वंगथु (वंगथु वा वंगथु इति)
2) SWABHAV-VACHAK TRAPU  
   १(त्रु) TRAPUSHAM  
   २(त्रुष्म) TRAPTE - which can easily mix with other metals)
3) KARM BODHAK (According to action)  
   A) PTCCHITAM (पिच्छितम)  
   B) UCCHATAM (उच्छतम)  
   C) PICHAYATI (पिच्छयति)
D) UCHATATI (उच्हातति)

The meaning of all these words are to cure the diseases.

4) STHAN-SUCHAK (place of source)
   A) SINHALAM - from SILONE
   B) TIRAM - Bank of river
   C) NAGAM - mines

5) VARNANPAR- according to qualities & description
   A) ANILAM (अनिलम्) BLUISH
   B) KIRITAM (किरितम्) Shining
   C) GHANAM (धनम्) Solid
   D) NILAK (निलक) (Bluish Shade)
   E) PUTI-GHNDHAM - (पूतिका) Bad smell पूतिग्न्धम्
   F) PUTIK - Bad Smell
   G) MALINAM - (मलिनम्) It brushed to hand it becomes dirty.
   H) MRUDU-VANGAM- Soft
   I) SHITAM शीतम् COLD
   J) SITAM - सीतम् white

6) SADRUSHY-NIDARSHAK (सादर्श्य निदर्शक) According to similarity
   KURUPYAM (कुरुप्यम्) to make ornament of instead Vang of silver.

7) NAMES OF NAG TO VANG

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1) NAGAM नागम् 2) TAMRAM तम्रम
3) GURU-SHRESHTAM गुरु श्रेष्ठम्
4) GURU-PATRAKAM गुरु पत्रकम्
5) VAPUKAM वपुकम्

8) NAMES OF SHENDUR (शेंदुर)
1) NAGAJAM नागजम् 2) NAG-JIVANAM नागजीवनम्
3) CHITRAKAM चित्रकम् 4) CHITRA-RANJAKAM चित्ररंजकम्

9) PRAKAR-VACHAK According to classification:
1) KHURAKAM खुरकम्
2) MISTRAKAM मिश्रकम् MIXED WITH OTHER METALS
3) KASTIRAM कस्तिरम्

10) CHINTY NAMES
1) SWARNJAM स्वर्णजम् 2) MADHURAM मधुरम्
3) APUSHAM अपुषम्
4) CHAKRASANDNYM चक्र संहाम्

References:-
1) Raj Nighantu (राज निघंटु)
2) Madanpal Nighantu (मदनपाल निघंटु)
3) Ras Tarangini (रस तरंगिनी)
4) Nighantu Shiromani (निघंटु शीरोमणी)
5) Ayurvediy- Aushadhikaran (आयुर्वैदिक औषधालय)
SOURCE OF VANG

It is obtained in very small quantity compared to other metals. In purified form it is more rare. It is Tin as 'Tin stone'. Mostly it is found arsenical iron pirates. The stones are in granule form.

The stones of Vang are called Cassiterite.

Bharatiya Rasshastra.

TYPES OF VANG

This metal is of two types

1) Khuraka- खुरका
2) Mishrak- मिश्रक

खुरका अरिष्टक चैति दिविध वंगमुच्यते।
खुरक तव गुणैः कष्टं मिश्रकं न हितं मलम्।

-रससल्ल समुचय

1) Khurak :-

Vang or tin is found either in its pure or impure forms. This is mostly found in the river beds or on its bank. In river beds it is found in a purified form. So that Khurak is classified in two types.

a) Pravah Kathil
b) Dhhep-Kathil

Kathil which is found in purified form is called Pravah Kathil or Tiram or Tirakam. Both these types are in pure form.
In the form of ore it is mixed with lead, copper, iron, somal, zink tungstan manganese etc.

We have to eliminate the metal from this ore in its purity.

2) Mishrak:

Mishrak Vang is artificial. The composition of the metal is two parts of Vang and one part of lead. The combination is called a good Kastar (कस्तर) and when composition in vice-versa i.e. one part of vang and two part of lead it is an inferior quality of 'Kastar'. The other name of kastar is 'Kalai'. 'Kastar type of vang should not be taken for the drug Vang-Bhasma.

SWABHAV OF THE METAL (BROAD QUALITIES)

1) Due to the shine and whiteness it looks as though silver.

2) It has quick melting property.

3) If it is melted open air it gets mixed with oxygen. By these two qualities we can differentiate the metal from silver.

4) Its melting point is 233. It is the lowest melting point than that of other metals.

5) In weight it is lighter than silver. The specific gravity of this metal is 7.28.

5) When the metal is bended there is a sound just
like friction.
7) It is harder than lead.
8) It is softer than zink.
9) It is usually flattened by hammering so that tin foil can be made.
10) By heating more and more it fumes and gives out smoke vapour.
11) It is less elastic than other metals and therefore it can be drawn into wires.
12) There is no effect of air and water on this metal.
13) It can be diluted in Alkali.

By these qualities it can be differentiated from silver.

(BHARATIYA RAS SHAASTRA) (भारतीय रसशास्त्र)

USES OF VANG

It is used for making fast colours or in making 'KALHAI' (tin plating) to vessels with the help of NAVSAGAR.

There's special community who by their occupational heredity, take up to this job of KALHAI (plating).

This metal is also used for making ornaments. It is an alloy to make vessels/pots to look as though silver.

The metal is made use of in Muradabad, Kashmir and other places.

In the medieval times it was used for making mirrors by coating. Mercury and this metal combines readily.
combination is now used for mirror-making. It is melted in iron container and also stirred with an iron ladle till a white cream layear is formed on the surface. This liquid should then be transferred to another container and stirred briskly till it is cooled. We will then get a white powder. This is called tin powder. The action of powder is given powder of tin with curd for use for bacteria. In Vagbhata with Trifala, Saindhav and Honey. Now a days it is used for skin disease.
DEFINITION OF BHASMA:

Powder of a substance obtained by calcination is called Bhasma.

METHOD OF PREPARATION:

First stage - SHODHAN (Purification according to Ayurveda)

Bhasmas are prepared from purified minerals, metals, marine, and animal products. In Ayurveda process of purification is called Shodhan.

Chemical purification is different from medicinal (Ayurvedic) purification. In chemical purification it is only elimination of foreign matters. In medical purification the object aimed at
a) Elimination of harmful matters from the drug.
b) Modification of undesirable physical properties of the drug.
c) Conversion of some of the characteristics of the drug.
d) The enhancement of therapeutic action, thereby potentizing the drug.

TYPE OF SHODHAN:

There are two types of SHODHAN.
1) Samanya Shodhan (सामान्य शोधन)
2) Vishesh Shodhan (विशेष शोधन)

1) Samanya Shodhan (सामान्य शोधन)

Which is applicable to large number of metals or minerals as heating the thin sheets of the metals and immersing them in Tail Takra (तक्र) Gomutra (गोमृत) etc.

Vishes Shodhan (विशेष शोधन)

Which is applicable only to certain drugs and in certain preparations

Vishes shodhan is consists of

1) Bhavana (भावना) 2) Swedana (स्वेदन)
3) Nirvapana (निर्वापण) 4) Mardana (मर्दन)

VANG BHASMA SAMANYA SHODHAN
ACCEPTABLE VARIETY

Ref: Rasatarangini 18.3, The Ayurvedic Formulary of India

1) Vang Q.S.
2) Tail Q.S.
   (For NIRVAPAN 3 times)
3) Takra Q.S.
   (For NIRVAPAN 3 times)
4) Gomutra Q.S.
   (For NIRVAPAN 3 times)
5) Kanjika Q.S.

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6) Kulatha kashay Q.S.
(For NIRVAPAN 3 times)

PROCESS:

The vang is melted an iron pan, fives. It is poured into an iron pot containing Tail in sufficient quantity.

The pot should be covered with a heavy stone having a hole in the centre and the melted vang is poured through this hole.

This process is to be repeated for three times. After that melted Vang is poured in an iron pot containing TAKRA, in sufficient quantity, as per above. This process is to be repeated for three times.

Thirdly time melted vang is poured into an iron pot containing GOMUTRA in sufficient quantity as per above. This process is to be repeated for three times.

Lastly, again melted vang is poured in to an iron pot containing Kulatha Kashay, in sufficient quantity repeated for three times.
VISHESH SHODHAN (विशेष शोधन)
OF VANG (बंग)

Ref. Ras tarangini (रस तरंगिनी) 18, The Ayurvedic Formulary of India
1) Vang O.S.
2) Sindhuvara Drava Q.S. (For NIRVAPAN)
3) Haridra Q.S. (For NIRVAPAN)

The melted vang is poured in the pot containing Sindhuvar-ras and Haridra Churna this process should be repeated three times.
JARAN OF VANG: (जारण वंग)

TYPE A:

Ref AYURVED PRAKASH 3-177-178 (आयुर्वेद प्रकाश 3-177-178)

1) VANG (Shudha) (शुध्द वंग) 1 part
2) Chinch-twakchurn (चिंचच्चक्षुर्ण) 1/2 part
3) Ashvatha-twal churna (अश्वत्थच्चक्षुर्ण) 1/2 part

The Shodhit Vang (शुध्द वंग) is kept in a iron poud and heated. While it is melting the powder of Chinch twak and Ashwatha are prinkled quantities and stirred with Loha Darvi, (Astirrer of iron)

This process is containued till the melted vang is reduced to power form.
TYPE B
Ref Rasatarangini 3-88-93 (रसतरंगिणी ৩-৮৮-৯৩) The Ayurvedic formulary of India
1) Vang (Shudha) (शुद्ध वंग) 1 part
2) Apamarg Churna (अपामार्ग चूर्ण) 1/2 part
3) Kukkutanda-twak-churna (कुक्कुटाण्डत्वक चूर्ण) 1/2 part or Ashawatha twak churna (अश्वाथ त्वक चूर्ण) 1/2 part

PROCESS:
Shodhit vang (purified vang) is kept in an iron pan and heated.
While vang in melting powders of Apamarg and kukkutand churna are sprinkled in quantities and stirred with loha darvi a iron rod.
This process is continued till the melted vang is reduced to powder form.
SECOND STAGE: 
THE MARAN (मारण)

Maran is the second stage of preparation of bhasma (भस्म) The purified drug is put into a Khalva (खल्व) and ground with Juices of specified plants or KASHAYAS (खस्याज) of drugs mentioned for a particular mineral or metal. It is ground for the specific period of time.

Then the small cakes are made. The size and thinkness of the cakes depend on the haviness of the drug the heavier the drugs the thinner ate cakes.

These cakes are dried well under sunlight and placed in one single layer in a shallow earthen plate and closed with another plate. The edge is seated with clay-smeared cloth in seven consecutive layers and dried.

A pit is drug in an open space. The diameter and the depth of pit depends on the metal or menaral that is to be calcined.

Half the pit is filled with cow dung cakes.

The seated earthen container is placed in it and the remaining space is filled with more cow dung cakes.

Fire is put in all four sides and the middle of the pit. When the burning is over it is allowed to cool completely. Then the earthen container is removed. The seal is opened and the containers taken out. The medicine is ground into a fine powder in khalva.
This process is repeated as many times as prescribed in the tents.

**MARAN OF VANG**

A) Ref: Ayurved Prakash 3-179-180 (आयुर्वेद प्रकाश 3-179-180)

1) Shudha vang - 1 part
2) Tal (Hartal) 1 part
3) Amla (Nimbu nira) Q.S.(Formarder)

Jarit vanga is mixed with hARTal churna and ground well in nimburas. Small thin chakrikas are prepared dried and placed in Sharao samput and ardha Gajaput is given. This process is repeated 10 times one forth part of Hartal is added to Vanga from the second put on wards.
B) Ref: Rasamrut 3-94-94/12 (रसामृत 3-९४-९४/१२)
1) Jarit vang 1 part
2) Kumari swaras Q.S. (Formarder)

The jarit vang is ground with two prescribed drug and small thin Chakrika are prepared and dried. This is kept in Sharao samput and subjected to ardha Gajput. This process is repeated 7 times.

CHARACTERISTICS OF BHASMA

The tests for property prepared Bhasma are
1) Nischandrika
2) Rekha purntwa
3) Varitartwa
4) Apunarbhao

1) Nischandrika
There should be no chandrika in bhasma. Chandrika means metals lustre.

2) Rekha purntwa:
The Bhasma when taken between the index finger and thumb and spread. It should be so fine as to get easily into the finger lines.

3) Varitartwa
The Bhasma when a small quantity is spread on cold and still water it should be float on the surface.

4) Apunarbha
The Bhasma should not revert to the original state.

GUNDHARMAS OF VANG-BHASMA

Following qualities are given in various Ayurved Grantha

1) Ras-Tikta Lavan
2) Virya-Ushna
3) Vipak-Katu some times madhur
4) Krimighna
5) Laghu
6) Ruksha
7) Mehnashak
8) Sara
9) Kaph Krumighna
10) Pandughna
11) Shwasghna
12) Chakshushya
13) Deepan
14) Pachan
15) Ruchikar
16) Pradnyakar
17) Shital
18) Saundarya vrdhak
19) Vranha
20) Khayah
21) Pramehhar
22) Shukra Kuhyha
MARAN-DRAVYAS

Following Dravyas are prescribed for the maran sanskar in various Ayurved texts.

Totally seventeen drug are prescribed out of first three are from minerals and metal and remaining fourteen are from herbs

1) Parada (Mercury)
2) Gandhak (Sulphar)
3) Hartal
4) Aniphen (Papaver Somniferum)
5) Apamarg (Achyranthes aspera)
6) Ajmoda (Carum roxburghianum)
7) Chinch (Tamarindus indica)
8) Atasi (Linium usitaitisimum)
9) Tirak
10) Tila (Sesamum indicum)
11) Plaksh (Ficus laor)
12) Palreh
13) Bhallatak (Semicarpus anacardium)
14) Babhul (Acacia arabica)
15) Arka (Calotropis procerae)
16) Haridra (Curcuma longa)
17) Karpasbi (Gossypium herbaceum)
Tin (vang)

According to Chemistry

Metals of Group IV - Sub Group (B) Sn and P.b.

Tin

Symbol- Sn At.Wt.-119 At No. 50

History- Tin has been known from pre-historic time.

Occurrence- The metal is said to occur in the native state in Siberia. Its oxide, Tinstone or cassiterie, SnO₂, however forms the chief source of commercial Tin. It is also met with in nodules known as stream tin.

Indian Tin- Very small amounts of Tinstone occur in Hazaribagh. Comparatively large amount of it occur in the Tavoy Dist of Burma. There the ore is found mixed with Wolfram.
Extraction - The extraction of Tin from Tinstone consists of four operations.

1. Calcining: The crushed ore after being washed from earthy impurities, is calcined in a revolving calciner. The ore is fed in at the top and as it comes down it meets the hot gases travelling upwards from the furnace when sulphur and Arsenic are expelled as SO₂ and AS₄O₆ respectively. The later is condensed Cu and Fe, also present are converted into their sulphates and oxides.

2. Washing: The calcined ore is next cooled and washed with water, whereby soluble substances dissolve and the oxide of Iron and other light matters are washed away. On now allowing the liquid to stand, Tinstone being heavy, collect at the bottom. The ore now known as Black-Tin, contains 60-70 percent of SnO₂.

When however Tinstone contains wolfram, it (i.e. Tinstone) cannot be purified by washing operation alone, because the density of Wolfram is also very high and it collects, along with Tinstone at the bottom; wolfram is usually removed from Tinstone by electromagnetic separation.
31 Reduction or Smelting: Black Tin is mixed with Anthracita Limestone, land sand (flux), and smelted either in a reverberatory furnace or in a blast furanace Tin oxide is reduced to metallic Tin, which melts down and collects at the bottom, while the molten stag flouts on the surface. The stag is removed and the metal is cast in to cast in to bars.

\[ \text{SnO}_2 \text{C} + 2\text{C} = \text{Sn} + 2\text{Co}. \]

41 Refining: The method of refining Tin, thus obtained, Consists of two operations.

I] Liquation and

II] Poling.

Liquation: Bars of Tin are heated on the hearth of a reverberatory furnace when the readily fusible Tin flows away leaving the impurities like Copper, Iron, Tungsten, Arsenic etc. behind.

Poling process: Liquated Tin is nex fused in a pot, and the fused mass is stirred with poles of green wood. When the evolved Hydrocarbons bubbling out of the molten mass, expose it to the oxidizing action of air, and the impurities still present, like Iorn, etc. are oxidized which separate out as scum. The scum is removed. We get commercial pure Tin.
Electro-refining of Tin - In New Jersey Tin is refined like Copper, Silver etc. by modern Electrolytic process. Blocks of impure Tin are suspended from the anode in an electrolytic cell, containing a solution of Tin sulphate acidited with dil H₂SO₄ to which a little glue and Phenol sulphonic acid are added. The cathode is a sheet of pure Tin. On electrolysis, Tin from the blocks dissolves and is finally deposited on the cathode.

PROPERTIES

Physical: Tin is a white metal with a brilliant lustre and a sp. gr. 7.3. It is soft and malleable. So that it can be hammered out into thin foils (tin.foil). It becomes brittle when heated to 200°C. Grain tin is prepared by heating the metal to 200°C and then breaking it into pieces by hammering. The metal melts at 232°C. When a bar of Tin is bent, it emits a peculiar noise, the so-called cry of Tin; which is probably produced by the friction of the crystals of Tin over one another. When ordinary Tin is cooled below 18°C, it crumbles down to a gray powder. Which is an allotropic form of the metal and is called Gray-tin. In Russia and in other cold countries. Where the tempt. is some times below 18°C articles of Tin,
like medals buttons, Organ - pipes, etc. slowly undergo this peculiar change, especially in severe winter. This is known as Tin pest or Tin plague.

**Chemical** :-

1] Action of Air - Dry air has no action on the metal. It also remains unchanged in air at the ordinary tempt but becomes covered with a thin crust of oxide when exposed to the air fused state. At while heat (1500°C-1600°C), it burns in air in the white light giving SnO₂.

2] Action of water :- Tin is not attacked by water, especially when both are pure.

3] Action of acid :- It dissolves slowly in dilute HCL and rapidly in conc HCL. Specially not forming stannous chloride and Hydrogen.

\[ \text{Sn} + 2\text{HCl} \rightarrow \text{SnCl}_2 + \text{H}_2. \]

Tin is only slowly attacked by cold dil. H₂SO₄ giving SnSO₄ and evolving H₂, not conc H₂SO₄ dissolves the metal readily giving stannic sulphate Sn(So₄)₂ (with some basic salt) and SO₂. Cold and dil. HNO₃ reacts with Tin giving Stannous nitrate and Ammonium nitrate.

\[ 4\text{Sn} + 10\text{HNO}_3 = 4\text{Sn(NO}_3)_2 + 3\text{H}_2\text{O} + \text{NH}_4\text{NO}_3 \]

Use - It is used for preparing alloys, in preparing vessels of household and technical use for the manufacture of tin foils, for tining (or tin-plating). Copper and Iron articles. Tin amalgam is sometimes used in the manufacture of mirrors.
Allotropic Modifications of Tin

Tin exists in allotropic forms. Ordinary Tin is called White and is tetragonal in crystalline structure. It is stable between the tempt. 18° C. Below 18° C it is changed into grey tin. Above 170° C it slowly changes into Rhombic tin. A reverse set of changes also takes place.

\[
\begin{array}{cc}
18^\circ C & 170^\circ C \\
\text{Grey tin} & \text{White tin} & \text{Rhombic tin} \\
\text{sp. gr. 58.} & \text{sp. gr. 728} & \text{sp. gr. 6.56.}
\end{array}
\]

Alloys of Tin:

Common alloys of Tin are:

1) Peoter: It is an alloy of Tin (4 parts) and Lead (1 part).

2) Soft solder: It is an alloy of lead (1 part) and tin (1 part).

3) Gun metal, Speculum metal, etc. They are alloy's of Cu and Sn. Britannia metal is an alloy of Sn, Cu and Sb.

Tinning or Tin plating: Metals like Iron, Copper and alloys like Brass, etc. are tinned by dipping the heated metals into a bath of molten tin where by a thin coating of Tin is produced on their surface. Tinning may also be effected by rubbing the surface of the heated metals with NH₄Cl and molten Tin.
Tin plates: are thin sheets of mild steel provided with a coating of Tin on the surface. The steel plates are fresh pickled with dilute H₂SO₄ and finally washed. They are now dipped into baths of molten Tin to which fused ZnCl₂ is added to avoid the formation of Tin oxide. The plates are taken out and pass through palm oil.

Use of Tin plates: They are used in the manufacture of Tin canisters, trunks, cans, boxes, etc. for canning meat and fruits, and in the manufacture of vessels for storing petroleum.

Electrical Tining: Here the cleansed article is suspended from the cathode in a bath of SnCl₂ sol. containing Ammonium oxalate and sodium phosphate. The anode is a plate of pure Tin. On passing electric current Tin is deposited on the article.

Stannous oxide SnO₂: It is obtained by heating stannous Oxalate in absence of air. SnC₂O₄ = SnO₂ + CO₂ + CO. It may also be obtained by heating stannous hydroxide Sn(OH)₂ in CO₂.

Properties: It is a black powder, insoluble in water, but is soluble in acids. It is oxidized in to Stannic Oxide. When heated in air.
Stannous chloride \( \text{SnCl}_2 \cdot 2\text{H}_2\text{O} \) (Tin salt)

Preparation:-

1] The anhydrous salt is obtained by heating Tin in dry HCl gas.

2] The hydrated salt is readily prepared by dissolving Tin in not conc. Hydrochloric acid \( \text{Sn} + 2\text{HCl} = \text{SnCl}_2 + \text{H}_2 \)

On evaporation the salt crystalizes out with two molecules of water of crystallization. \( \text{SnCl}_2 \cdot 2\text{H}_2\text{O} \) and is known as Tin salt.

N.B. :- The action is much accelerated by the addition on a few scraps of platinum foil or a few drops of platinic chloride sol. The contact of platinum with Tin makes the latter far more electropositive and causes it to dissolve more quickly.

Properties :- It is a colourless crystalline solid, soluble in water. With excess of water it undergoes hydrolysis giving a white ppt. of the oxy-chloride of Tin. \( \text{SnCl}_2 + \text{H}_2\text{O} = \text{Sn} (\text{OH}) \text{Cl} + \text{HCl} \).

The same ppt. is formed when the clear sol. is exposed to air.

\[ 6\text{SnCl}_2 + 2\text{H}_2\text{O} + \text{O}_2 = 2\text{SnCl}_4 + 4\text{Sn} (\text{OH}) \text{Cl}. \]

Stannous chloride is a powerful reducing agent. It reduces Mercuric Chloride first into Mercurous chloride.
and then on boiling with excess of SnCl₂ into grey metallic Mercury. It reduces Ferric and Cupric salts to the Ferrous and Cuprous salts respectively and Iodine to HI₂. It is soluble in alcohol and in ether absorbs Oxygen from the air. Hence SnCl₂ solution is always kept in contact with pieces of Tin and HCl.

\[ 2\text{FeCl}_3 + \text{SnCl}_2 = 3\text{FeCl}_2 + \text{SnCl}_4, \]

\[ 2\text{CuCl}_2 + \text{SnCl}_2 = \text{Cu}_2 \text{Cl}_2 + \text{SnCl}_4. \]

Use :- It is used in dyeing industry and as a reducing agent stannic oxide SnO₂. It may be prepared

1) By burning Tin in air

2) By treating Tin with conc. Nitric acid of sp. gr. 1.25 and then igniting the metastannic acid formed.

Properties :-

It is a white solid insoluble in water. Ignited Tin dioxide is insoluble in acids. It reacts with fused NaOH or KOH giving the stannate.

\[ \text{SnO}_2 + 2 \text{NaOH} = \text{Na}_2 \text{SnO}_3 + \text{H}_2\text{O} \]

Stannic acid H₂SnO₃ :- It is obtained either by the action of NaOH or chalk on SnCl₄ Sol. or by the decomposition of Sodium stanoate with HCl.

Metastannic acid (H₂Sn₅O₁₁ 4H₂O). It is sometimes regarded as a polymer of stannic acid. It is obtained as
a white, amorphus powder when Tin is acted upon by conc. Nitric acid of sp. gr. 1.25 or stannic acid is boiled with dilute HCl. Since only two of the Hydrogen atoms in the molecule are replaceable, the acid is dibasic. Alkalies convert Metastannic acid into stannic acid.

**Stannic chloride** :- \( \text{SnCl}_4 \)

I] Pass dry chlorine over melted Tin taken in a distilling flask. Insert the side tube into a small flask kept cooled by water Tin reacts with chlorine and gradually disappears from the flask while a colourles fuming liquid distil over and collects in a receiver. \( \text{Sn} + \text{Cl}_2 = \text{SnCl}_4 \).

II] Distil a mixture of powdered Tin with an excess of \( \text{HgCl}_2 \)

\[ 2\text{HgCl}_2 + \text{Sn} \longrightarrow \text{SnCl}_4 + 2\text{Hg} \]

III] Dissolve Tin in aqua regia. We get stannic chloride.

**Properties :-**

It is a heavy, Colourless liquid of sp. gr. 2.28 and boiling at 114⁰C. It fumes strongly in moist air, and hisses when dropped into water forming the hydrated salts, \( \text{SnCl}_4\cdot 3\text{H}_2\text{O}, \text{SnCl}_4\cdot 5\text{H}_2\text{O} \) and \( \text{SnCl}_4\cdot 8\text{H}_2\text{O} \) A dilute solution of \( \text{SnCl}_4 \) in water decomposes ( hydrolyzes ) giving tivist the basic chlorides and
finally stannic hydroxide. It combines with NH₃ giving SnCl₄, 4NH₃.

**Use** - The hydrated salt SnCl₄ 5H₂O Known as oxy muriate of Tin or butter of Tin is used as a mordant. The double compound with Ammonium chloride, SnCl₄, 2NH₄ Cl, Known as the pink salt is used by calico printers.

Stannous sulphide, SnS - It is obtain -

I] As a grey solid when Sn. foil is heated in Sulphur vapour or

II] As a chocolate brown ppt. when H₂S is passed into acidulated Stannous salt solution.

**Properties** -

It is a chocolate brown solid insoluble in water, but dissolves in acids giving stannous salts, and in yellow Ammonium sulphide, giving Ammonium thiostannate.

**Stannic sulphide SnS₂** - It is obtained I] in the dry way as golden scales (mosaic gold) by heating Tin amalgam, Sulphur and Ammonium chloride in a report and

II] in the wet way as a yellow ppt. by passing H₂S into an acidified solution of a stannic salt.
Properties:

Obtained in the dry way it is known as mosaic gold. It is more stable than precipitated SnS\(_2\) and is not attacked by conc HCl or HNO\(_3\). Precipitated SnS disolves in yellow Ammonium sulphide.

Use - Mosaic gold is used for cheap gilding.

Detection of Tin

Dry test:- 1) Thin compacts heated on charcoal with Na\(_2\)CO\(_3\) and KCN under reducing blow pipe flame, yield malleable, White metallic scattered beads which do not mark paper when the beads are dissolved in dil. HCl and the solution of SnCl\(_2\), thus obtained, is treated with a mixture of K\(_2\)Fe(CN)\(_6\) and FeCl\(_3\) solutions. We get a blue ppt.

Borax bead test - Borax bead coloured blue by Cu - salts turns red in the oxidising flame in presence of Tin or Stannous salts.
**Wet Test:**

(Distinction between stannous and stannic salts).

<table>
<thead>
<tr>
<th>Reagent</th>
<th>stannous salt sol.</th>
<th>stannic salt sol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $\text{H}_2\text{S}$</td>
<td>Chocolate brown ppt. of Sn$\text{S}_2$, soluble in conc HCl and in yellow ammonium sulphide out sparingly sol. in NaOH or KOH sol</td>
<td>Yellow ppt. of SnS$_2$, Soluble in conc HCl in yellow ammonium sulphide and in NaOH or KOH sol</td>
</tr>
<tr>
<td>2. $\text{HgCl}_2$ sol.</td>
<td>While ppt. of $\text{Hg}_3\text{Cl}_2$ turning grey if stannous salt be in excess and the mixture is boiled</td>
<td>No ppt.</td>
</tr>
<tr>
<td>3. $\text{FeCl}_3$ sol + Freshly prepared $\text{KFe(CN)}_6$ Sol</td>
<td>Blue ppt. of ferrous ferricyanide (Turnbulls blue)</td>
<td>No ppt.</td>
</tr>
</tbody>
</table>

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