

# SHREE H. N. SHUKLA INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH



**B.PHARM**  
**(SEMESTER -I)**

**SUBJECT NAME: PHARMACEUTICAL INORGANIC  
CHEMISTRY**

**SUBJECT CODE: BP104TP**

**UNIT 4 (a): EXPECTORANT**

## **Content: Definition, Classification, Mechanism of action, Potassium Iodide, Ammonium chloride.**

### **EXPECTORANT**

These are the agents which enhance the secretion of sputum from trachea, bronchi or lungs and hence they are used in the treatment of cough.

#### *Classification of Expectorants –*

Based on their mechanism of action, expectorants are categorized into two types:-

1. **Sedative expectorants**
2. **Stimulant expectorants**

**Sedative expectorants**:- These are stomach irritant which are able to produce their effect through stimulation of gastric reflux. For example bitter drugs such as ipecac, senega Indian squill and compounds such as antimony potassium, tartarate, ammonium chloride, sodium citrate, potassium iodide, etc.

**Stimulant expectorants**:- Expectorant which bring about stimulation of secretory cells of respiratory tract directly or indirectly since these drugs stimulate secretion, more fluid gets produced in respiratory tract and hence sputum is diluted. Eg: eucalyptus, lemon, etc.

#### **Mechanism of action:–**

They act upon respiratory tract in two different ways:

- By decreasing the viscosity of bronchial secretion, it facilitates its easy removal by coughing.
- By increasing the amount of respiratory tract fluids, demulcent action is exerted over dry mucosal linings, their relieving the unproductive cough.

#### **1.) POTASSIUM IODIDE (KI)**

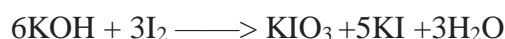
**Chemical formula: KI**

**Molecular weight: 166 g/mole**

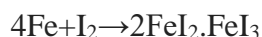
**Category: Expectorant**

**Methods of preparation :** It can be prepared by two different methods :

1. **Laboratory method :** In laboratory, it can be easily prepared by treating slight excess of iodine with a lot aqueous solution of potassium hydroxide. The pale yellow solution obtained is evaporated to dryness and the residue (potassium iodide) is heated with charcoal to reduce iodate to iodide.



2. **Industrial method :** On commercial scale, it can be prepared by using potassium carbonate and iron fillings are agitated in the iodine solution to form ferroferric iodide ( $\text{FeI}_2 \cdot \text{FeI}_3$ ) which on further boiling with concentrated solution of potassium carbonate gives potassium iodide.

**Physical properties:-**

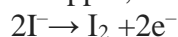
- Cubic crystals
- white granular powder
- hygroscopic in nature
- saline in taste and slightly bitter.
- It is soluble in water, glycerin and alcohol on exposure to air, it becomes due to liberation of iodine.

**Chemical properties:-**

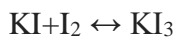
1. With silver nitrate, it gives yellow precipitate of silver iodine.



- Iodide ion gets easily oxidized to iodine when treated with oxidizing agents like chlorine, copper, nitric acid etc.



- Iodine readily get dissolved in aq. solution of KI, forming a dark brown solution of potassium tri-iodide.

**Uses:-**

1. As expectorant in dose of 300 mg 4 times a day.
2. It acts as a source of iodine and potassium simultaneously.
3. It is used in prophylaxis and treatment of goiter.
4. It is saline diuretics.
5. It is also used as antifungal agent in veterinary practices.

**2.) AMMONIUM CHLORIDE (NH<sub>4</sub>Cl)**

**Synonym:-** salmiac, Amchlor, ammonium nitrate

**Method of preparation:-**

1. It is prepared by neutralizing HCl with ammonia  
 $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$

The resulting solution of ammonium chloride is evaporated to dryness.

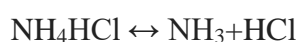
- It is also prepared by treating ammonium sulphate with sodium chloride.  
 $2\text{NaCl} + (\text{NH}_4)_2\text{SO}_4 \rightarrow 2\text{NH}_3 + 2\text{NaCl} + \text{Na}_2\text{SO}_4$

**Physical properties:-**

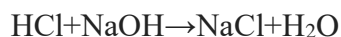
It is a white fine crystalline powder. It is odorless and has cooling saline taste, hygroscopic in nature, freely soluble in water but slightly soluble in alcohol. Its 0.8% w/v solution is isotonic with serum.

**Chemical properties:-**

In its vapour form, it dissociates in ammonia and HCl.

**Assay:-**

It is assayed by acid base titration. The neutral formaldehyde solution is added so that  $\text{NH}_4\text{HCl}$  will be converted to methanimine and  $\text{HCl}$ . The liberated acid is titrated with 0.1 N  $\text{NaOH}$  using phenolphthalein as an indicator.



Each 1 ml of 0.1 N  $\text{NaOH} \equiv 0.05349$  g of ammonium chloride.

**Dose:-** 3-6 gm daily in divided dose

**Uses:-**

1. As expectorant: It is used as an ingredient in expectorant cough mixtures in doses of 300 mg to 1 gm.
2. As diuretics: It is given for its diuretic actions especially to help the excretion of over dosage of basic drugs such as amphetamine and in the treatment of lead poisoning by increasing of its excretion.
3. As systemic acidifier: It is helpful in producing mild acidosis.