



SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

Sathy Main Road, SNS Kalvi Nagar,
Saravanampatti Post, Coimbatore - 641 035,
Tamil Nadu.



MAJOR INTRA & EXTRACELLULAR ELECTROLYTES

WHAT ARE ELECTROLYTES?

- Substance when dissolved in solution separates into ions & is able to carry an electrical current
- Cation - positively charged electrolyte e.g. Ca^{++}
- Anion - negatively charged electrolyte e.g. Cl^-
- No of Cations must equal to no of Anions for homeostasis to exist in each fluid compartment

ELECTROLYTES IN BODY FLUID COMPARTMENTS:

Intracellular: K, Mg, P

Extracellular: Na, Cl, HCO_3^-



- Various organic and inorganic compounds are present in body fluids and concentration of them is maintained in such a way that body cell and tissue have same environment (homeostasis)
- To maintain this internal homeostasis, there are regulatory mechanisms that control pH, ionic balances, osmotic balances etc.
- There are a large number of products under the general heading of replacement therapy which can be used by the physician when the body itself is unable to correct an electrolyte imbalance due to a change in the composition of its fluids.
- These products include electrolytes, acids and bases, blood products, carbohydrates, amino acids and proteins.



- **The electrolyte concentration will vary with a particular fluid compartment.**

The three compartments are :

1. intracellular fluid (45-50% of body weight)
 2. interstitial fluid (12- 15% of body weight)
 3. plasma or vascular fluid (4-5% of body weight)
- The term 'extracellular fluid' includes both interstitial and vascular fluids.
 - These three compartments are separated from each other by membranes that are permeable to water and many organic and inorganic solutes.
 - They are nearly impermeable to macromolecules such as proteins and are selectively permeable to certain ions such as Na⁺, K⁺, Mg²⁺



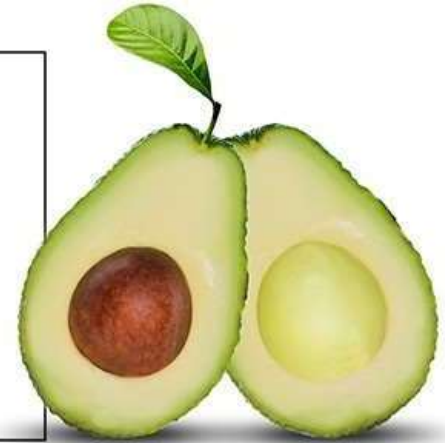
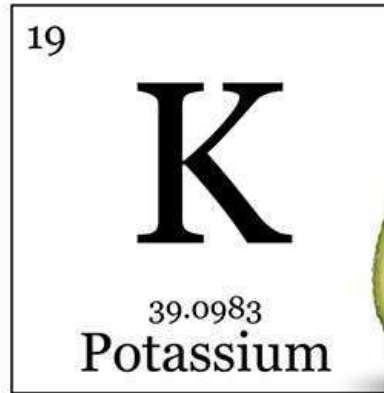
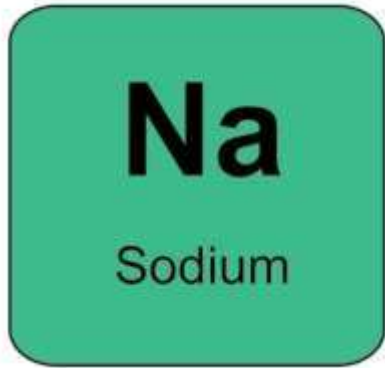
INORGANIC IONS PRESENT IN BODY FLUID

ANIONIC	CATIONIC
HCO ₃ ⁻	Sodium
Cl ⁻	Potassium
SO ₄ ⁻	Calcium
HPO ₄ ⁻	Magnesium



- Electrolytes are express in terms of mEq/L i.e. Miliequivalent per Litre rather than weight/volume (w/v).
- Equivalent weight is obtained by dividing the atomic or molecular weight by the valence.
- $\text{mEq/L} = \frac{\text{mg of substance}}{\text{litre}}$
- Equivalent weight
- $\text{Equivalent weight} = \frac{\text{Molecular weight}}{\text{Valency}}$
- Valency





MAJOR CATION PRESENT IN BODY



1. SODIUM

- Location- extracellular compartment as a salt.
- Normal level- 136-142 mEq/L
- Functions- 1. absorb and excreted by cells
- 2. along with chloride maintain osmotic balance of all fluid.



Condition	Hyponatremia	Hypernatremia
	Low level of Na ⁺	High level of Na ⁺
Reason	Extreme urine loss, diarrhea, kidney damage, vomiting, excessive sweating	Dehydration. High sodium intake
Symptoms	Muscular weakness, headache, respiratory depression.	Intense thirst, fatigue
Treatment	Electrolyte replacement	Low sodium diet, diuretics.



2. POTASSIUM

- Location- intracellular fluid.
- Normal level- 3.0-5.0 mEq/L
- Functions- 1. contraction of muscles. (Cardiac)
- 2. along with chloride maintain osmotic balance of all fluid.
- 3. nerve impulse transmission.



Condition	Hypokalemia
Decrease K ⁺ level in body	
Reasons	Lower absorption, urine loss, Heart disease Kidney damage, cardiac disease, CNS depression
Symptoms	Mental confusion. Muscle weakness.





MAJOR ANION PRESENT IN BODY



1. CHLORIDE

- Location- Nearly found in all body fluids. 66% of ion content in plasma is chloride ions.
- Normal level- 50 mEq/Kg
- Functions- 1. absorb and excreted by cells (maintain charge in body fluid)
- 2. along with sodium maintain osmotic balance of all fluid.
- 3. in formation of gastric acid.



Condition	Hypochloremia	Hyperchloremia
	Decrease calcium level in body	Increase calcium level in body
Reason	<ol style="list-style-type: none">1. Metabolic acidosis2. Vomiting3. Lack of reabsorption	Excess loss of bicarbonate ions and dehydration
Symptoms	Alkalosis and muscle spasm	



ELECTROLYTE USED IN REPLACEMENT THERAPY

- Sodium chloride and its preparations
- Potassium chloride and its preparations



SODIUM CHLORIDE

- Molecular formula- NaCl
- Molecular weight- 58.54

SODIUM CHLORIDE



METHOD OF PREPARATION

- Sodium Chloride (NaCl) can be obtained from natural source as well as it can also be prepared in laboratory.
- Naturally It can be obtained from Rock salt strata & Sea water. But from these sources it can be obtained in impure form. The pure form of salt can be obtained by the filtration process & finally the dried form can be collected by evaporation process.
- It can also be prepared in laboratory in small scale by the acid- base reaction. In which strong acid (HCl) reacts with strong base (NaOH) & finally it gives Sodium Chloride.



PHYSICAL PROPERTIES



- It is white, anhydrous crystalline solid.
- Odourless but having salty taste.
- It is soluble in water but insoluble in alcohol.
- Its 0.9% Solution is Isotonic (That means having same Osmotic pressure) to blood.



CHEMICAL PROPERTIES

- When react with permanganate it liberate chlorine gas.
- It reacts with Silver nitrate and forms white precipitates of Silver chloride.



USES

- It is used as electrolyte replenisher.
- Its 0.9% solution is isotonic (having same osmotic pressure) as blood.
- It is also used as taste enhancer in the preparation of dishes.
- It is also used in Wet dressings & irrigation of body cavities.



OFFICIAL PREPARATION OF SODIUM CHLORIDE

1. Sodium chloride injection I.P
2. Sodium chloride hypertonic injection I.P
3. Sodium chloride eye lotion B.P
4. Sodium chloride solution B.P
5. Sodium chloride & Dextrose injection I.P
6. Sodium chloride & Mannitol injection I.P
7. Sodium chloride tablets U.S.P



SODIUM CHLORIDE INJECTION I.P

- It is sterile isotonic solution of NaCl in water for injection.
- I.P.- 0.85-0.95% w/v (150 millimoles of sodium chloride ions per litre)
- B.P.- 95-105% w/v
- When it is required as diluent for other pharmacopoeial injections, 0.9% w/v solution of NaCl is used.



SODIUM CHLORIDE HYPERTONIC INJECTION

I.P

- It is sterile isotonic solution of NaCl in water for injection contain not less than 1.52% and not more than 1.68% w/v of sodium chloride.
- (270 millimoles of sodium chloride ions per litre)
- no antimicrobial ions are present.



◦ Sodium chloride eye lotion B.P
0.85-0.95% w/v of NaCl

◦ Sodium chloride solution B.P
0.9% w/v solution

Normal saline solution

If sterile- it is completely free from micro organisms.



SODIUM CHLORIDE & DEXTROSE INJECTION I.P

Sterile solution of sodium chloride and dextrose.

Concentration of Dextrose	Concentration of Sodium chloride
5 % w/v	0.11, 0.18, 0.20, 0.225, 0.30, 0.33 %
2.5, 5, 10%	0.45%
2.5, 5, 10 , 25 % w/v	0.9%

1000 mL

NDC 0409-7926-09

5% DEXTROSE and 0.45% SODIUM CHLORIDE Injection, USP

EACH 100 mL CONTAINS DEXTROSE, HYDROUS 5 g; SODIUM CHLORIDE 450 mg IN WATER FOR INJECTION. ELECTROLYTES PER 1000 mL: SODIUM 77 mEq; CHLORIDE 77 mEq. 406 mOsmol/LITER (CALC). pH 4.3 (3.5 to 6.5).

ADDITIVES MAY BE INCOMPATIBLE. CONSULT WITH PHARMACIST, IF AVAILABLE. WHEN INTRODUCING ADDITIVES, USE ASEPTIC TECHNIQUE, MIX THOROUGHLY AND DO NOT STORE. SINGLE-DOSE CONTAINER. FOR I.V. USE. USUAL DOSAGE: SEE INSERT. STERILE, NONPYROGENIC. USE ONLY IF SOLUTION IS CLEAR AND CONTAINER IS UNDAMAGED. MUST NOT BE USED IN SERIES CONNECTIONS.

Rx ONLY



CONTAINS DEHP

©HOSPIRA 2004 IM-0165 (10/04) PRINTED IN USA
HOSPIRA, INC., LAKE FOREST, IL 60045 USA



-1
-2
-3
-4
-5
-6
-7
-8
-9



SODIUM CHLORIDE & MANNITOL INJECTION U.S.P

- Sterile solution of sodium chloride and mannitol.

Concentration of Mannitol	Concentration of Sodium chloride
5-10%	0.3%
15-20%	0.45%



SODIUM CHLORIDE TABLETS I.P

- 95-105% w/v of stated amount
- Strength available- 180,300,500mg



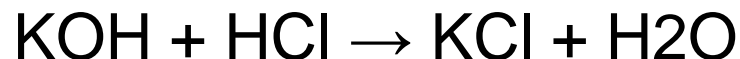
POTASSIUM CHLORIDE

- Molecular formula- KCl
- Molecular weight- 74.55
- Synonym- potassium muriate, potash muriate



METHOD OF PREPARATION

- It can be commonly obtained by mining its
- minerals, followed by extraction.
- It is also extracted from brine (salt water).
- It can also be prepared in the laboratory in small scales by reacting potassium hydroxide (KOH) with hydrochloric acid (HCl).



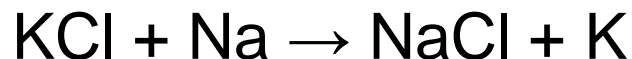
PROPERTIES

- **Physical properties-**

- It is white crystalline powder, odourless & strong saline taste.
- Like Sodium Chloride it is freely soluble in Water, & insoluble in alcohols.

- **Chemical properties-**

- Another important reaction of KCl is used to produce metallic potassium, by reducing KCl with metallic sodium at 850 °C.



USES

- It is used as electrolytes replenisher.
- pH buffers
- Preparation of fertilizers, explosives, potassium metal and potassium hydroxide.
- In treatment of hypokalemia (potassium deficiency disorder)
- Used in treatment of digitalis poisoning
- Used in treatment of myasthenia gravis



OFFICIAL PREPARATION OF POTASSIUM CHLORIDE

- Potassium chloride and glucose IV infusion B.P. injection I.P
- Potassium chloride & Sodium chloride I.V Infusion I.P/ Injection
- Potassium chloride & Dextrose(Glucose) I.V infusion I.P

