



Unit- V

pH, Buffers and Isotonic solutions

BUFFERS IN BIOLOGICAL SYSTEMS:

Blood:

- ❖ Blood consists of primary (plasma) and secondary buffer Erythrocytes) systems contributing the pH 7.4.
- ❖ When the pH of the blood is below 7.0 or above 7.8, life is in danger. The pH of the blood in diabetic coma is reported to drop as low as 6.8.
- ❖ **Primary buffers:**
 - ✓ It is present in plasma.
 - ✓ carbonic acid-bicarbonate system
 - ✓ Acid/alkali salts of phosphoric acid system.
- ❖ **Secondary buffers:**
 - ✓ These are present in erythrocytes.
 - ✓ Haemoglobin/oxyhaemoglobin system
 - ✓ Acid/alkali salts of phosphoric acid system.
- ❖ The buffer capacity is $0.0318 + 0.0035$ for the whole blood, in which 0.031 is contributed by the cells and 0.008 is contributed by the plasma.

Lacrimal fluids:

- ❖ Lacrimal fluids (or tears) have been found to have a great degree of buffer capacity, allowing dilution of 1:15 with neutral distilled water.

- ❖ The pH of tears is about 7.4, with a range of 7.0 to 8.0.
- ❖ Normally, pure conjunctival fluid is more acidic than the tear fluids commonly employed in pharmacy.
- ❖ The pH increases rapidly when the sample is removed for analysis because of loss of carbon dioxide from the tear fluid.

Urine:

- ❖ The pH of urine is 6.0 for normal subjects (adults), when 24 h urine was collected.
- ❖ The pH may be as low as 4.5 or as high as 7.8.
- ❖ The pH of urine is maintained in the following manner.
 - ✓ If urine pH is low (4.5), hydronium ions are excreted into it urine by the kidneys.
 - ✓ If urine pH is high (7.4), hydronium ions are retained by the action of kidneys.

Pharmaceutical Buffers:

❖ **Buffers in Tablet formulations**

- ✓ Buffers are used in tablets and capsules to control the pH of the drug particles.
- ✓ Buffers employed in formulations containing acidic drugs to reduce gastric irritation.
- ✓ Buffering agents used in solid oral dosage forms include antacids such as sodium bicarbonate, magnesium carbonate and sodium citrate

❖ **Buffers in Ophthalmic preparations**

- ✓ To maintain the pH within the physiological pH range of the lacrimal fluid

- ✓ To adjust the pH to a value that is best with regard to the solubility and stability of the drug and which tolerated by the eye
- ✓ To prevent discomfort and injury to the surface of the eye
- ✓ Example: borate, phosphate, and carbonate buffers

❖ **Buffers in Parenteral preparations**

- ✓ The ideal pH of a parenteral product is 7.4
- ✓ Because a highly alkaline pH (above 9) can cause tissue necrosis while an acidic pH (below 3) can result in extreme pain at the site of injection

❖ **Buffers in Parenteral preparations**

- ✓ Buffers in parenteral preparations compromise between the stability and solubility of medicament as well as the irritancy of the preparation.
- ✓ Buffers are usually added for adjusting the pH of the parenteral products to a suitable value.
- ✓ Example: acetate, phosphate, citrate and glutamate buffers

❖ **Buffers in Creams and Ointments**

- ✓ Buffers are used to maintain the stability of the product, Because topical products have a tendency to undergo change in pH during storage which may adversely affect the stability of the drug.
- ✓ Example: citric acid and its salts or phosphoric acid and its salt