

UNIT – 5

Radiopharmaceuticals:

Radioactivity:

- Radioactivity is the spontaneous emission of radiation from the nucleus of an unstable atom (radioisotope).
- The emitted radiation can be in the form of α particles (alpha), β particles (beta), or γ rays (gamma).

Measurement of Radioactivity:

- Radioactivity is measured using instruments like Geiger-Muller counters and scintillation detectors.
- It is expressed in units like becquerels (Bq) or curies (Ci).

Properties of α , β , γ Radiations:

- **Alpha (α) Radiation:**
 - Consists of helium nuclei (2 protons and 2 neutrons).
 - Highly ionizing but relatively low penetrating power.
 - Stopped by a sheet of paper or human skin.
- **Beta (β) Radiation:**
 - Consists of high-speed electrons (β^-) or positrons (β^+).
 - Moderately ionizing and more penetrating than α radiation.
 - Can be stopped by materials like plastic or glass.
- **Gamma (γ) Radiation:**
 - Consists of high-energy electromagnetic waves.
 - Weakly ionizing but highly penetrating.
 - Requires dense materials like lead or several centimetres of lead for effective shielding.

Half-Life:

- Half-life is the time it takes for half of the radioactive atoms in a sample to decay.
- It is a characteristic property of each radioisotope.

Radioisotopes:

- Radioisotopes are unstable isotopes of elements that undergo radioactive decay.
- Examples include iodine-131 (I-131), technetium-99m (Tc-99m), and carbon-14 (C-14).

Sodium Iodide I-131:

- **Preparation:** Sodium iodide I-131 is typically prepared by irradiating sodium iodide with neutrons in a nuclear reactor.
- **Properties:** It emits β and γ radiation.
- **Half-Life:** I-131 has a half-life of approximately 8 days.
- **Medicinal Uses:**
 - Used as a radiopharmaceutical in nuclear medicine for diagnostic imaging (e.g., thyroid scans) and treatment (e.g., thyroid cancer therapy).

Storage Conditions:

- Radioactive materials should be stored in lead-lined containers in a designated radioactive storage area.
- Storage conditions should comply with regulatory requirements.

Precautions:

- Handling of radioactive materials should be done by trained personnel.
- Protective gear and shielding should be used to minimize exposure.
- Proper disposal procedures must be followed.

Pharmaceutical Applications of Radioactive Substances:

- Radiopharmaceuticals are used in nuclear medicine for diagnostic and therapeutic purposes.
- They are essential for procedures like positron emission tomography (PET) scans and targeted radiation therapy for cancer treatment.
- Radiopharmaceuticals allow for non-invasive imaging and precise treatment of medical conditions.