Quadrant II – Transcript and Related Materials

Programme : Bachelor of Science

Subject : Chemistry

Paper Code : CHC108

Paper Title : Physical Chemistry.

Unit : Nuclear Chemistry

Module Name: Applications of radioisotopes

Module No :27

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Applications of Radioisotopes

I. Agricultural Applications

P-32

- Added with phosphate fertilizer to the soil to improve plant growth.
- The uptake of P-32 from the soil by plants is determined by measuring the radioactivity at different parts of the plants. The total amt of phosphorous taken up by the whole plant is determined by chemical analysis and that of the added fertilizer by the activity measurement.
- The difference is the natural phosphorous present in the soil.

P-32

- Used to investigate relationship between root growth and P uptake.
- P -32 is placed at different depths and distances from growing plants

Radioactive Iron

- Used to investigate the disease chlorosis developed in the plant due to shortage of chlorophyll.

S-35

- Many fungicide contain S, the use of S-35 tracer indicates the advantage & disadvantages caused by this fungicide.

C-14

- Helpful in understanding the mechanism of photosynthesis in plants.

II. Industrial applications

- Mix of radioactive thorium & ZnS :Exhibit permanent luminescence used to .coat pointers & figures of clocks & watches for rendering visible signs.
- Small amounts of radioactive substance can be allowed to flow along a underground leaky pipeline of gas, oil or water. The reading from a G-M counter will rise as you pass the point where there is a leak.
- In the production of metals & alloys, the radioisotopes are incorporated into the metal & it is possible to know what is happening to metal subjected to a particular treatment like annealing, quenching, cold rolling.
- Controlling the thickness of paper, rubber sheets can be done using tracers.

III. Medical applications

- The application of tracer method in the field of medicine can be broadly divided into 2 groups.

1. Use of tracers (micro curie doses) in diagnostic methods for localizing bodily disorders and
2. The use of tracers (in large doses)for therapeutic purposes in the treatment of certain abnormal conditions in the body.

I-131

Helps to detect disorders of thyroid glands, and cure some of such disorders. It is preferentially adsorbed by cancerous cells. This fact has been made use in locating brain tumours.

Na-24

- Used for examining circulation of blood.
- Small amt of NaCl solution containing Na-24 is injected into the patient
- Any local obstruction can be indicated & treatment can be made accordingly
- Na—24 can also be used to assess the volume of blood in a patient of anaemia.

P-32

- Used for locating bone fractures.
- Fast growing cells tend to concentrate phosphorous more than the normal cells this fact has been made use of in locating some forms cancer and malignant growths

Fe-59

- Used to examine the disorders associated with pregnancy.
- Also used to improve methods for storing blood for transfusions

Co-60

- Is a gamma emitter used in curing cancer
- Gamma rays *(or high-energy X-rays)* can be used to shrink/ destroy tumours.
- The rapidly-dividing cancer cells are more susceptible to damage from ionising radiation than normal cells

Gold-198

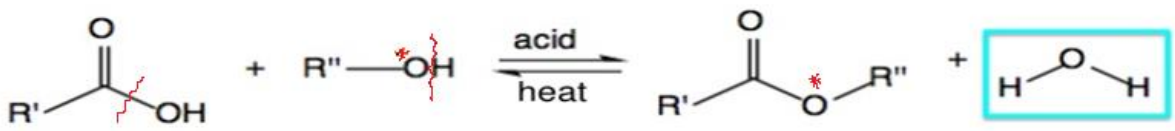
- Also used for curing some forms of cancer.

Fluorine-18

- Used as tracer in Positron Emission Tomography(PET)
- Positron-emitting radionuclide is introduced and accumulates in the target tissue.
- Organ malfunction can be indicated if the isotope is either partially taken up in the organ, or taken up in excess.

IV. Tracers in chemical Investigation:

- Radio isotopes are used in the study of Reaction mechanism
- **In esterification reaction** the C—OH bond in acid and
- H—O bond in alcohol undergoes cleavage, shows O* in ester comes from alcohol



V. Dating

Geological Dating:

- **Radioisotopes are used for calculating the accurate age of rocks from the analysis of rocks containing radioelements.**
- **U-238 is used for dating rocks. U-238(half-life of 4.5 billion years) decays to lead-206.**
- **The ratio of U-238 to Pb-206, present in a rock, can be used to determine the age of a rock.**

Carbon Dating

- **C-14 Radioisotope is used to estimate the age of**

archaeological and biological specimens.

- **The technique was first developed by W.F.Libby for which he was awarded the Nobel prize in 1960.**
- **C-14 which is formed in the earths atmosphere has a half life of 5730 years.**
- **C-14 is converted to CO_2 and is utilized by plants and passes through them to animals**
- **The proportion of C-14 to C-12 remains constant in all living organisms**
- **but once they are dead the C-14 in their bodies starts decaying with a half life of 5730 years.**
- **The time that has elapsed since the death can be calculated by determining the C-14 in the body.**