SNS COLLEGE OF ALLIED HEALTH SCIENCES- COIMBATORE 35

DEPARTMENT : RADIOGRAPHY AND IMAGNG TECHNOLOGY

SUBJECT : GENERAL PHYSICS, RADIATION PHYSICS AND PHYSICS OF DIAGNOSTIC RADIOLOGY

PAPER : PAPER II (UNIT 3 – RADIOACTIVITY)

TOPIC : 1. REACTOR PRODUCED RADIATION ISOTOPES

NUCLEAR REACTOR PRODUCED RADIONUCLIDES

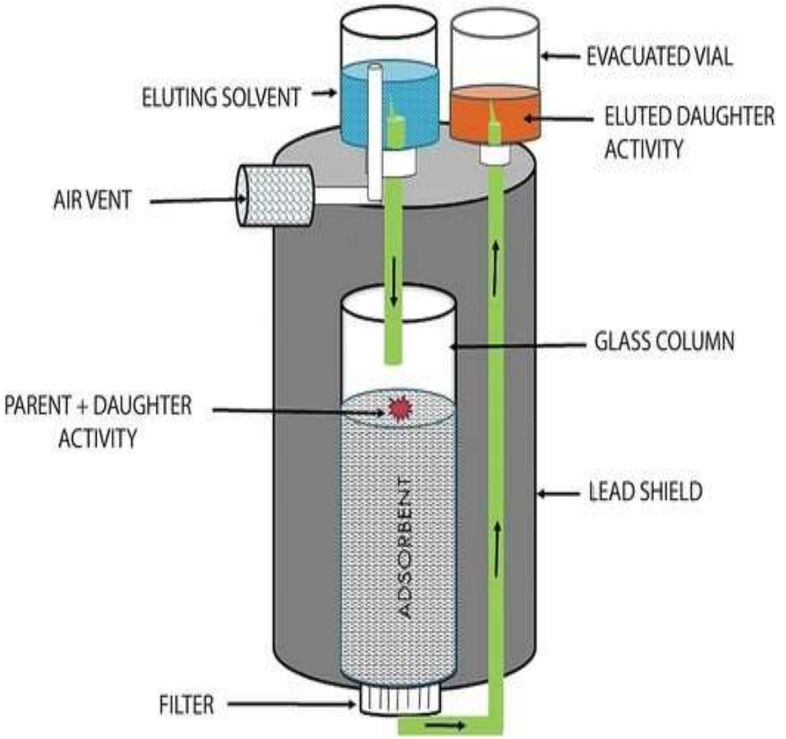
- Nuclear reactors are also used to produce radionuclides. Neutrons, being uncharged, have an advantage of penetrating through the nucleus without being accelerated to high energies.
- The nuclear reactor uses two methods, namely,
- (I) Nuclear fission (II) neutron activation, to produce radionuclides.
- The radionuclides, obtained from the fission process are molybdenum -99 (Mo-99) , iodine (I-131) and xenon-133 (Xe-133)
- The examples of radionuclides produced by neutron activation are P-32 and Cr-51.

TECHNETIUM GENERATOR

- Tc-99m emits gamma energy of 140 keV with a half life 6hours and has 90% of clinical use. Its energy is suitable for easy absorption and collimation by a thin crystal with good spatial resolution.
- Its half life and pure gamma emission helps to inject large activity to the patient, resulting in reduces noise in the image.
- It is obtained from Mo-99 on daily basis from the generator, which is a lead shielded container.
- It contains an exchange column of alumina beads, in which the parent Mo-99 compound is absorbed.

WORKING PRINCIPLE OF TECHNETIUM GENERATOR

- Mo-99m is produced by nuclear fission of U-235, and is in the form of ammonium molybdenate (NH_4 + MoO_4 −) . And has a half life of 67 hours. When it is supplied to the hospitals, the Tc-99m activity has built up to a maximum, equal to the parent (Mo). The daughter and parent said to be in transient equilibrium.
- The ammonium molybdenate is loaded onto the alumina column (porus) and the Mo-99 decays to Tc-99m. Sterile isotonic saline (0.9%) is passed through the column to remove Tc-99m. This process is called elusion and takes only few minutes.



WORKING PRINCIPLE OF TECHNETIUM GENERATOR

- The Mo-99 is not soluble in saline and hence remains in he column. When the saline is passed through column, the chloride ions easily exchange with the TCO_4 - ions., producing sodium pertechnetate Na^+ ($99m_{TcO4-}$). This flows under pressure and is collected in sterile rubber caped vial. After the elusion, the Tc-99m decays with the half life of 6 hours.
- The Tc-99m is used in clinical medicine as sodium pertechnetate -99m which is used for imaging tissues, e,g thyroid, gastric mucosa and salivary glands and it can be used for cerebral blood flow, and testicular imaging.

INTERROGATIONS

1. What is reactor produced radionuclides.
2. Half life of Tc-99m ?
3. What is the mother product of Tc-99m ?
4. Explain the working principle of Tc-99m generator.

REFERENCES

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2. Ball and mores essential physics radiographers, IV edition, Blackwell publishing.
3. Basic Medical Radiation physics – Stanton.
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5. The physics of Radiology and Imaging – K Thayalan.

THANK YOU