



Radio Chemistry a Unique Source for the Multiplicity and Prosperity of Research and Development

Dr.N.Aruna Kumari¹, Dr. Ch. Sree Rama Murthy², D.V.V. Durga Veni³

¹Asso.Prof of Engineering Chemistry, GIET(A), Rajamahendravaram

²Former Sr. Scientist (ICAR) & Professor of Chemistry, GIET Engineering College, RJY

³Asst. Professor, Dept. of Engineering Chemistry, GIET Engineering College, RJY

With globally advanced research activities, it is inevitable to study the application of radiation sources in various fields of science and technology like medical, industrial, agricultural etc., for the prosperity of research and development (R & D) as required in the world scenario.

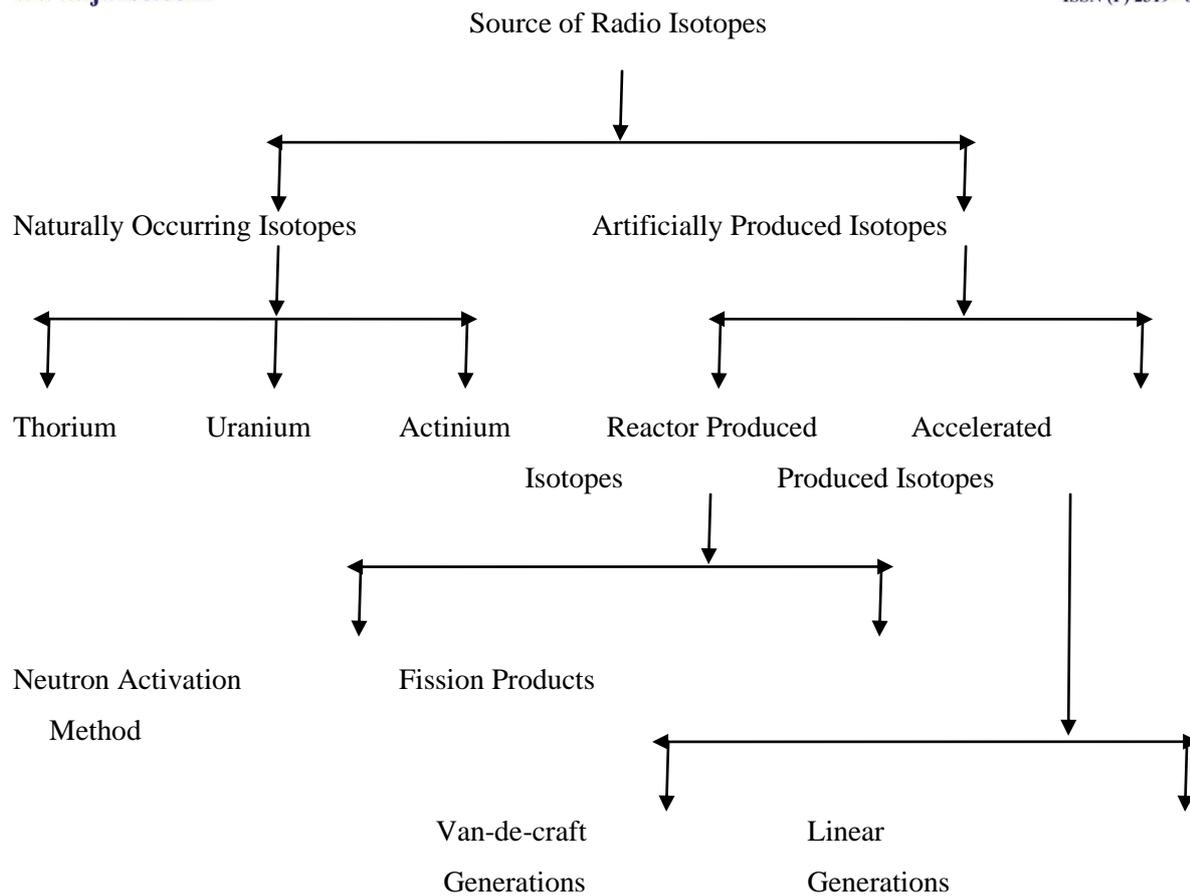
The present article mainly concentrates on the application of different radio isotopes in the field of agricultural research which plays a significant role for the better living and survival of animals, plants and human folk as a whole.

One has to primarily possess the knowledge of any radio isotope and its stable counterpart before their application. The chemical and biological properties of an element are determined by the number of extra nuclear electrons and therefore by atomic number. The mass number of the atom, which corresponds to the total number of neutrons and protons are designated by mean of a superscript C¹², P³², S³⁵ etc.

The atoms of the same element but of different atomic weights or mass numbers are called isotopes.

The atoms of certain elements are known to undergo spontaneous disintegration with the emission of atomic particles (radiations) in the form of α , β and γ rays and leave behind a system lighter than before and possessing physical and chemical properties different from those of parental element. Such unstable atoms are described as radioactive and prefix "Radio" is used to designate this behavior. In other words radio isotopes differ from stable isotopes in which the protons and neutrons of the nuclei of the former are in an unstable arrangement and therefore undergoes spontaneous disintegration, a process that can not be altered in any way known to man. Such atoms of the same radio element with different masses are designated as radio isotopes

Formerly the naturally occurring radio active element called thorium, uranium and actinium were identified. The major contribution of radio isotopes used in biological research are from the availability of artificially produced radio isotopes as shown here under.



The nature of decay is exponential and hence the activity will never vanish all together. Rutherford introduced the term half life period which is the interval in which activity will be reduced to half its original value. The units for the measurement of radio activity are termed in curies, milli curies 10^{-3} ci, micro curies (10^{-6} ci).

Since radio isotopes are chemically identical with their non radio active counter parts, they pass through the same physical chemical and biological processes as the stable isotopes. Hence, a suitable quantity of labeled compound is fed into a specimen and the activity at any subsequent process or location is determined or identified.

In fact this problem is a substitute for difficult chemical analysis. It is more precise and sensitive than chemical methods.

I. APPLICATION:- SOIL AND PLANT NUTRITION STUDIES

Radio active effects in soils and fertilizers:

Radio isotopes have been used to study a variety of problems involving the relationships of soils, fertilizers and plants with change in the specific activity of the applied nutrient element resulting from dilution in the plant is the basis for these studies.



If a tagged (labelled / activity) fertilizer (phosphorus) is added to a soil on which plants are grown the proportion of the fertilizer nutrient used by the crop can be calculated by determining the specific activity of phosphorus in the crop. Use of radio isotope tagged fertilizers is of course based on the consumption that the presence of the radio active element at the concentration used will be no measurable effect beneficial or harmful on the plant. Consumption of the presence of the radio active element at the concentration used will be no measurable effect beneficial or harmful on the plant.

P-32 (T $\frac{1}{2}$ - 14.3 days), S-35 (T $\frac{1}{2}$ - 87.1 days) and Ca-45 (T $\frac{1}{2}$ - 152 days) are the main isotopes used in the above mentioned studies. Most of the tracer techniques are concerned around P - 32 due to.

1. Extremely complex soil phosphorus chemistry.
2. Generally occurring deficiency of phosphorus in agricultural soils.
3. The almost ideal properties of P - 32 for such work.

Other applications involve the study of stage of plant growth at which the application of nutrient is more effective movement of the applied nutrient elements in the soil over relatively short periods of time. One of the main advantages of tagged atom technique in field experiments is that treatment effects can be measured in the absence of yield responses.

The physical properties of soil which influences plant growth are soil moisture, soil aeration, soil temperature and mechanical impedance to root and shoot system.

Measurement of soil density, moisture conditions with time and distance cannot be precisely done by conventional methods. Methods involving the use of radio active isotopes offer considerable advantages. Need of removing soil samples and measuring the density and moisture by excessive disturbance of the sampling site no longer exists. Co-60, Ra-Be sources are widely used for these investigations.

II. ACKNOWLEDGEMENT

Thanks are due to Dr. S. Suryanarayana Raju, Principal, GIET Engineering College, Rajamahendravaram, for his keen interest in the preparation of this article with his valuable suggestions.

REFERENCES

1. Khopkar, S M , Professor, Emeritus, Indian Institute of Technology, Bombay, Basic concepts of Analytical Chemistry.
2. Dr. G. Nagaraj, Dr. Ch. Sri Rama Murthy, Dr. N. C. Gopalachary
An improved method for the determination of P³² in plant material. International journal of applied radiation & isotopes, 1970 Vol. 21.
3. Friedlander, C and Kennedy J. W nuclear and Radio chemistry, wiley, New York (1955).
4. Rachinskiv. Yaglova L.G mamul Y.V and Medveder J. A practical methods in the application of radioactive isotopes in agriculture No. VI. T.C. XA Mosco (1960).



5. Datta N. P and Mistry K. V isotopes in agriculture. Proc. 2nd U.N. Int. Cong. on Peaceful uses of atomic energy Vol. 27 (1958).

6. Dr. N. C. Gopalachari, Dr. B. V. K. Rao and Dr. Ch. Sri Rama Murthy Studies on phosphatic fertilization of Indian flue-cured tobacco using P-32 labelled super phosphate. Food forming & agriculture, June 1969 Vol. 1.