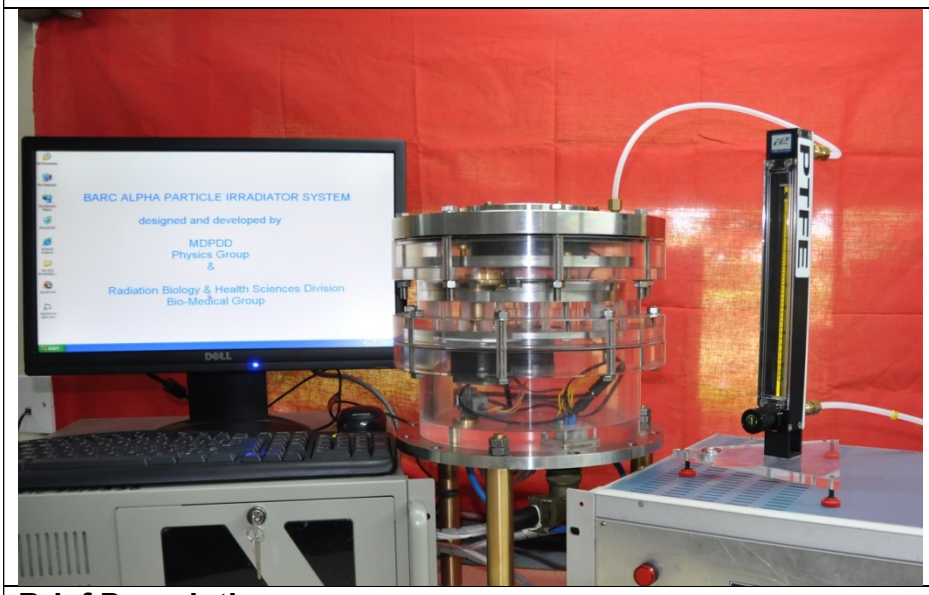
BARC BioAlpha



Brief Description:

Date of completion: 2013 (BioAlpha-1) 2017 (BioAlpha-2)

Detailed Report: Alpha radiation is one of ionizing radiation, which is mainly released during alpha decay from various radioisotopes like thorium, uranium, plutonium, radon etc. Biological effects of alpha particle and consequent adverse health effects have been matter of concern during environmental, occupational and accidental radiation exposure conditions. For example, radon and its progeny during chronic indoor exposure, smoking and mining may cause lung cancer. It is of utmost importance to understand the biological effects of alpha to biological systems (plants, animals and microbes). Alpha being high energy and short range could be exploited for delivery of radiation dose to a localized cancer site, it they can be targeted. Hence, recently understanding the effects of alpha radiation in cancer cells have been gained attention for their targeted cancer alpha radiation therapy. Alpha particles consists of two neutrons and two protons and identical to helium nucleus (generally written as He+2), hence, have both charge as well as mass. When the alpha particles pass through a material (or biological system), they have tendency to transfer its energy in a very short range. Hence, it is also a type of high LET (linear energy transfer) radiation. This property of alpha particles makes them highly damaging when they interact with biological systems.

Hence, understanding radiation effects of alpha particles to biological systems are relevant for evaluate and minimize the radiation risk as well as for improvement of cancer therapy. However, conducting experiments to irradiated samples with alpha particles has following difficulties:

(i) Biological samples containing live cells are required to be irradiated when samples are placed in air. However, short range (few mm) of traversal of alpha in air, makes it difficult to irradiate the biological samples with alpha

particles with accuracy in energy.

(ii) Alpha particles emitted from a point of source will travel in all directions and energy of particles reaching to target will vary depending on length of its path travelled. Hence, irradiation with alpha particles needs collimated particles reaching to target.

(iii) Manual exposure of samples will result is variation in dose due to transit dose.

(iv) Without automation and computerized irradiator, easy irradiation of samples with defined dose/accuracy and to keep record of irradiation parameters will be difficult.

The BioAlpha is designed and fabricated to overcome above limitations for performing smooth and easy experiments to irradiate samples with alpha particles. The indigenously designed and fabricated BioAlpha is first of kind in India and abroad. In practical, the irradiator is suitable to irradiate any biological/non-biological samples within thickness of traversal of alpha particles or a few layers of thickness in case of biological samples.

Following applications BioAlpha can be explored after suitable optimization of protocols:

1. Irradiating pollen grains or bacterial cells or layer of cells placed on mylar membrane of irradiation dish in suitable medium or condition
2. Irradiating a layer of mammalian live tissue sections
3. Irradiating thin devices

Potential users of irradiators: Universities/Institutes/Industries interested to irradiate samples with alpha particles.

Installation:

Two instruments are used in Radiation Biology & Health Sciences Division, BARC and IGCAR.

Its technology has been transferred to the industry.