Applications of X-ray Irradiation in the Laboratory

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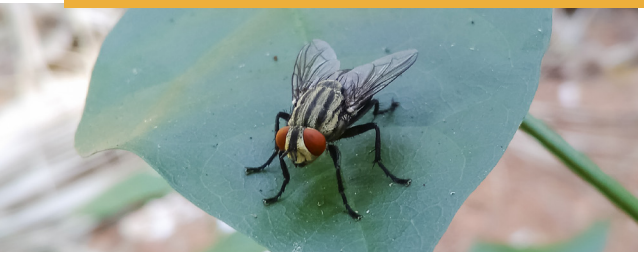
Introduction

The penetrating properties of ionizing radiation can inactivate microorganisms. Ionizing radiation is used for several different purposes, including, virus inactivation for research, as well as to sterilize or reduce the microbial load of many different types of products such as medical devices, packaging, cosmetics, foods, and agricultural products. It is also used to alter the properties of many different polymers through recombination, cross-linkage, and cross scission. Some examples of ionizing radiation in the context of irradiation include sterilization of insects, cell research, mouse studies, immunotherapy and sterilization of virus, bacteria and fungi from surfaces.

APPLICATION: Sterilization of Insects



Advanced biological control utilizing irradiation to perform sterile insect technique (SIT). Sterilization via irradiation involves mass rearing to regulate insect population, preventing procreation. This process has been successful on fruit, tsetse and screwworm flies.

APPLICATION: Cell Research

Cell irradiation is the process of subjecting cells to radiation of certain dosages. The development of specialized cell models for the study of cellular immune systems is an important activity in the Cell Biology Laboratory. While the creation of APCs, hybridomas, and Feeder Cells are critical in maintaining the health of stem cell culture during research, development and differentiation.

APPLICATION: Mouse Studies

Ionizing irradiation of mice creates immunosuppressed or immunocompromised immune systems in order to study immunology and oncology. By altering the hematopoietic system researchers can produce new therapies to combat various diseases.

APPLICATION: Immunotherapy

Irradiators can be used in immunotherapy to assess the effects of radiation on different types of cancer cells in lab experiments. Radiation has the potential to become a critical component of systemic cancer therapy. It is important for cancer research to evaluate the effect of radiation on cancer cells in the lab to make the treatment for human cancer patients more effective and safer.

APPLICATION: Sterilize Virus

Inactivation of bacteria and fungi are critical to preservation of artifacts such as those stored in museums or archives. Ionizing radiation can kill these bacteria along with viruses to reduce overall spread of harmful pathogens.

KUBTEC® Irradiator Study

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Osimertinib (AZD9291) increases radio-sensitivity in EGFR T790M non-small cell lung cancer

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Why use X-ray versus Gamma produced Ionizing Radiation?

Radioactive sources are very dangerous since they are irradiating continuously requiring specialized shipping containers and services with heavy shielding and high levels of security. The radioactive sources once delivered, require specialized rooms and personnel must have background checks, licensure, and radiation badges to operate the radioactive unit. The unstable material is constantly decaying and cannot be turned off. For example, a radioactive source Cobalt-60's has a half-life is 5.27 years while cesium-137's half-life is 30.17 years. Once the radiation source reaches its half-life, it is very expensive and must be disposed of properly. Radioactive sources and the respective facility and personnel also requiring licensing, which is very expensive, by the respective Nuclear Regulatory Commission.

X-ray ionizing radiation is produced by an X-ray tube; therefore, it can be turned off when it is not in use. Utilizing a 225 kVp X-ray source, the x-rays have more than enough penetration power to achieve the desired results and yet require much less shielding than a gamma source. The X-ray unit does not require any special licensing or special room accommodations. Operators of the X-ray unit do not require background checks prior to operation, nor do they require the use of radiation badges (US FDA 21CFR 1020.40 compliant). When the X-ray unit reaches the end of its life cycle, it does not require the expensive disposal costs associated with the transportation and storage of radioactive sources.

KUBTEC Irradiator Study

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ORIGINAL ARTICLE

Cell Proliferation WILEY

RNA-binding protein HuR suppresses senescence through Atg7 mediated autophagy activation in diabetic intervertebral disc degeneration

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KUBTEC Irradiator Study

Enhanced efficacy of AZD3759 and radiation on brain metastasis from EGFR mutant non-small cell lung cancer

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The Importance of the Right Generator

High frequency X-ray generators fully rectify AC current and supply the tube with DC current (High Frequency means – measuring even up to 100KHz instead of standard supply frequency of 50Hz). This results in a constant stream of relatively consistent radiation hence the term kV is used now rather than kVp. The present HF X-ray generators use the frequency-inverter-rectifier technology, to produce near constant potential.

Power and Configuration for Current and Future Samples

Use of high power dose is critical to efficiently irradiate large samples, saving valuable time and boosting the facilities throughput. Add-on features, such as a turntable, rodent shield, and dosimeter can improve workflow by ensuring accurate and uniform irradiation.

Consider Obsolescence and Cybersecurity

The most forward looking systems use Windows 10 for maximum security and flexibility. Previous versions of Windows no longer have mainstream support from Microsoft as of January 2018 and will incur additional costs for them to service.

Make Sure your System is the Right Size

While a smaller system may be more budget friendly initially, it will limit the research capabilities and grant opportunities in the future.

Reliable, Affordable, and Fully Shielded Irradiators

XCELL® 225

Full Size X-ray Irradiator

Why a KUBTEC XCELL 225 Irradiator?

The Largest Irradiation Chamber, allows for the widest range of specimens and dose levels.

HD Optical Camera allows live feed of the irradiation chamber, including remote online access.

High Frequency Solid State X-ray Generator for consistent output and lower maintenance costs.

Windows 10 OS for maximum security, flexibility and remote support capability.

Research Tested in studies on non-small cell lung cancer and protein suppression.

Full Suite of Accessories Including turntable, rodent shield, and dosimeter.

High Output with a maximum of 225 Kv and 30 mA.

XCELL 225 Irradiator Highlights

LARGEST CHAMBER SIZE
W 76cm x D 102cm x H 102cm

USER INTERFACE & CYBERSECURITY
Windows 10 protects your investment from obsolescence.

CABINET PORT
To introduce catheters, anesthesia, and monitoring lines.

THE HIGHEST DOSE OUTPUT
26.65 Gy/min at 225 KVp, 13.3 mA 30cm SOD.

HD OPTICAL CAMERA
For observance of the chamber when the door is closed.

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