





IONIZING RADIATION SOURCES USED IN THE PROCESS OF RADIATION STERILIZATION

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WHAT TYPE OF IONIZING RADIATION?

- Electrons from Particle Accelerators,
- Gamma Rays from Radioactive Nuclides,
- > X-Rays from Accelerated Electrons,

Electrons, gamma rays and X-rays in absorbing materials transfer their energies by ejecting atomic electrons, which can ionize other atoms.

All types of ionizing radiations produce similar effects.

The choice of a radiation source depends on the practical aspects of the treatment process, such as absorbed dose, material thickness, processing rate, capital and operating costs.

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1950-52: M. Dole i A. Charlesby – radiation modification of polyethylene 1957: Johnson & Johnson Corp. – radiation sterilization of medical devices 1957: P. Cook, Raytherm – radiation modification of wires and cables



First International Scientific Conference: "Large Radiation Sources in Industry" Organized by IAEA in Warsaw, 1959

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INDUSTRIAL USES **VOLII** Conference Proceedings, Salzburg, 27-31 May 1963 RADIATION SOURCES INTERNATIONAL ATOMIC ENERGY AGEN

ELECTRON ACCELERATORS FOR RADIATION PROCESSING



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DECAY DATA OF COBALT-60

Creation of cobalt 60 isotope in nuclear reaction with neutron: ${}^{59}Co_{27} + n \rightarrow {}^{60}Co_{27}$ (process in nuclear reactor)

Specific activity: c.a. 120 Ci/g (4x10¹² Bq/g) Half life – 5,2 years

1 day0,99961 week0,99751 month0,98891 year0,876910 years0,268515 years0,139130 years0,0194

1 Ci = 3.7 x 10¹⁰ Bq = 37 GBq



PHYSICAL PROPERTIES OF CONVERSION PROCESS





X-ray radiation is emitted when a charged particle (as electron) is deflected (decelerated) by another charge (as atomic nucleus).

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W.W. Buechner, R.J.Van de Graaff, E.A. Burrill, A. Sperduto, Physical Review, v 74, No 10, 1948

Summary

- Constant growth trends in the demand for radiation-sterilized products,
- Restrictions on the production and distribution of Co-60,
- Trends to shift to sterilization using eb and X,
- The changes will be evolutionary (spread over a relatively long period),
- The implementation of new accelerator technologies may accelerate this process,
- Necessary formal (common) acceptance of electron energy at the level of 7 MeV with eb / X conversion,
- Globalization and controlled reduction of the sterilization dose (VDmax 15-20) as ways to reduce the unit costs of the process,
- Packaging and phytosanitation are growing market segments,
- Quality as an important tool for maintaining the market.



Thank you for your attention