Gamma irradiation technologies: a promising approach from cultural heritage to agri-food and space applications

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Gamma irradiation technologies have emerged as a versatile and potent tool across a broad spectrum of fields, ranging from the preservation of cultural heritage artifacts to advancements in agri-food and space exploration. Despite the use of ionizing radiation, such as gamma rays, for these applications is becoming widespread in many countries, operators in cultural heritage and food treatments worry about potential physico-chemical changes or degradation that gamma irradiation might cause to artifacts or food products. To overcome such concerns, the present contribution focuses on the numerous benefits of gamma irradiation, showcasing its efficacy in disinfection and discussing the possible physico-chemical modifications, or secondary effects, induced by radiation on different classes of materials.

In cultural heritage context, gamma irradiation provides a non-invasive solution to decontaminate valuable artifacts damaged by biodeteriogens (fungi, molds, insects), safeguarding them for future generations. In the agri-food industry, it enhances food safety and extends shelf-life by eliminating pathogens, thus supporting global food security with the consequent food-waste reduction [3]. Furthermore, gamma irradiation role in space applications will be discussed, highlighting its potential in preserving food supplies for long-duration missions].

By presenting case studies and recent research findings, this contribution aims to emphasize the impact of gamma irradiation technologies, encouraging for their adoption and integration into diverse fields to address contemporary challenges. The irradiation tests were performed at the Calliope gamma irradiation facility (ENEA Casaccia R.C., Rome, Italy) equipped with a Co-60 radio-isotopic source array (mean energy of 1.25 MeV).