MEDIRRADIA 2012

1st Workshop on Food Irradiation in the Mediterranean Region

FINAL PROGRAMME & ABSTRACT BOOK

March 14-17th, 2012 • Thessaloniki, Greece

PORTUGAL

Implementation of Food Irradiation in Portugal: research, economic and industrial perspectives in a case study – chestnuts preservation

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Abstract

Food irradiation is a process that has been regaining an increasing interest for different food products to increase shelf life, for disinfestation or sterilization, being an alternative processing food technology to meet food safety quality parameters.

The development of ionizing radiation applications for industrial purposes in Portugal began near of 1982 with the support of the International Atomic Energy Agency (IAEA). The research activities carried out in this country have been closely related with the main applications of this technology, namely the sterilization of medical devices and pharmaceuticals and other products' decontamination. These activities have frequently been followed through by different industries. Recently, a Cobalt-60 research equipment was upgraded and an electron-beam equipment was implemented in order to sustain the R&D. These equipments are located at Nuclear and Technological Institute, in Lisbon-Portugal, where the industrial and R&D activities are developed.

The chestnut European variety, *Castanea sativa* Miller, is a valuable natural resource in Portugal (3% world production, about 30 kton), with high exportation levels (10 kton, representing an income of 12 M€), that has to be postharvest treated to meet the international fitossanitary regulations. Until now, the most common preservation method used was the chemical fumigation with methyl bromide, a toxic agent that is under strictly use according to Montreal Protocol due to the adverse effects on human health and environment. Its application is forbidden by the European Union (EU) since March 2010. Irradiation is a possible feasible alternative to substitute the traditional quarantine chemical fumigation treatment. This food processing technology is regulated by the EU, Directive 1999/2/EC. To validate this process different approaches are needed and, therefore, we established a interdisciplinary research group between Portugal and Spain, with complementary expertises such as agronomy (disinfestation), microbiology (sterilization), food chemistry and engineering (chemical and physical parameters), physics (dosimetry and dose mapping). Studies in simulation based on Monte-Carlo programs are being developed in order to optimize the irradiation geometry for its technological application. Fundamental and applied research is ongoing for different food products (chestnuts disinfestation, wild mushrooms preservation, food irradiation for immunocompromised persons – supported by national and international funds: EU, IAEA) in order to understand the irradiation mechanisms of action and to apply the technology with safety and quality patterns. Moreover, since food irradiation represents an intensive capital investment, its feasibility is only possible for a unit that processes different food products.

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Acknowledgments to attend the workshop: MEDIRRADIA 2012, QREN/ON.2/EU