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Low-energy electron linacs for phytosanitary processing of agricultural products

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Ionizing radiation is commonly used to suppress the activity of phytopathogens in foodstuffs [1-3]. According to international standards, electron linear accelerators (linacs) with the energy up to 10 MeV are recommended as a safe and reliable technic for irradiation treatment of a wide range of agricultural products [4-6].
It is known that 10 MeV electrons have the penetration depth up to 10 cm, which allows to treat products with the thickness not exceeding 10 cm [5]. While some foodstuffs, such as meat and fish, require deep penetration of the beams, treatment of vegetables contaminated by pathogenic fungi on the surface level is performed with lower energy electrons as they are sufficient for inhibition of the pathogens.
Agricultural products, such as potato, are often infected by a variety of bacterial, viral and fungal diseases, including black scurf caused by Rhizoctonia Solani which can be found in at least 20 % of tubers grown in Russia.
This paper studies the effect of low-energy electron radiation in different doses on the development of R. Solani species grown from sclerotia irradiated using continuous electron accelerator UELR-1-25-T-001 with beam energy of 1 MeV and average beam power of 25 kW. The samples were placed on a duralumin plate. During processing, the value of the charge absorbed by the plate was monitored to determine the dose absorbed by the samples using GEANT 4 source code.
After irradiation, the growth rate of R. Solani fungus was studied. Sclerotia was placed in Petri dishes filled with potato-dextrose agar. The samples were cultured in a thermostat at the temperature of 24℃. The intensity of fungi growth was studied 24, 48, 72, and 96 hours after seeding.
As a result, the dose 1,8 kGy significantly decreases the growth of the fungus during the first two days after seeding. The dose 4,5 kGy completely inhibits the germination of the fungus. In this case, the electron penetration depth is about 3 mm, which allows further irradiation of pathogens directly on the surface of potato tubers and similar crops. Thus, the use of low-energy electron linacs for phytosanitary processing of foodstuffs is an effective method.

1. C.P. Feliciano et al. // Food Chemistry. –2014. –V.163. –P.142-146
2. T. Blessington et al. // American Journal of Potato Research. –2015 –V.92 –P. 609-618
3. H.-A Nam et al. // Food Chemistry. –2019. –V.286. –P.338-345
4. V.I. Shvedunov et al. // Radiation Physics and Chemistry. –2019. –V.159. –P.95-100
5. J. Kim et al. // Journal of Food Engineering. –2008. –V.86. –P.595-603
6. J.A. Carcel et al. // Food and Bioproducts Processing –2015. –V.96. –P.133-144

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