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Dose adjustment for irradiation of foodstuffs of non-rectangular geometry

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These days radiation technologies are widely used in food industry to prolong the shelf life of foodstuffs by inhibiting pathogens [1-2]. With the increase in types of food processed using irradiation, researchers have faced the problem of determining the required dose distribution in foodstuffs of complex geometry as well as heterogeneous chemical composition and structure [3-5].
The purpose of the study performed by Physics Department of MSU in collaboration with Scientific Research Institute of Nuclear Physics is to develop the dose distribution methodology for more uniform irradiation of cylindrical foodstuff.
The experiment involved simulation of water cylindrical object 7 cm in diameter irradiated from the opposite sides by 9.5 MeV electron beam using source code GEANT 4. It was found that the difference between the dose absorbed by the phantom at the perimeter and the dose in the center was up to 80 %.
It is highly important to achieve a more uniform distribution of radiation in prepackaged products, such as ham, sausage and salami, in order to avoid excessive irradiation which can cause detrimental change of organoleptic properties. Thus, it is necessary to modify the dose distribution to make it more uniform throughout the product.
Simulation showed that putting an aluminum plate of different thickness between the irradiated object and the output electron beam can ensure a more uniform irradiation, minimizing the discrepancy between absorbed doses up to 20 %.
This theoretical method requires further experiments to confirm the estimated irradiation parameters and become applicable for a wide variety of foodstuffs.

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