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Detection of Irradiated Foods Using Electron Spin Resonance Spectroscopy

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This study has examined the possibility of using the ESR spectroscopy in the detection of irradiated food by measuring the signal intensity versus the amount of radicals induced in food by irradiation. Twenty-nine items in 8 food groups including meat containing bone, fishes, crabs, shellfish, chicken eggs, spices, dried fruits, and nuts were chosen for the test. All the items were irradiated at room temperatures using a Co-60 irradiator with a varying dose ranging from 0 to 5 or 7 kGy except for the spice group items that were irradiated with the dose of 1, 5, 10, 20, and 30 kGy. The items in meat, fishes, crab, shellfish, and eggs were freeze-dried after irradiation, whereas those in spices, fruits, and nuts were not. The test specimens for the ESR measurement were then taken from bone or skin part of the irradiated food. The measurements were carried out on specimens right after the specimen preparation, and also for those stored for a different amount of time to examine the stability of radicals with the passage of time. The items in meat, eggs, spices, dried fruits and nuts were stored at room temperatures for 63, 77, 96, and 40 days, respectively while those in fishes, crabs, shellfish, and eggs at 5°C for 84, 63, 42, and 77 days, respectively. The measurements on irradiated food specimens produced unique signals that are not observed in those without irradiation. The spectra obtained in irradiated meat, fish, crab, and egg were all similar in appearance, whereas two different spectra were observed in irradiated shellfish. Irradiated spices, dried fruits, and nuts, however, produced variety of spectra depending on specimens. The signal intensity was found linearly proportional to the irradiation level in the range investigated, and high enough for detection even after the period stored at room temperatures or 5°C. The present experimental results verified that the ESR spectroscopy might be used as an effective method to detect irradiated food.