

Influence of Gamma-Radiation Dosimetric Characteristics on the Stability of the Persistent Organic Pollutants

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Abstract : As a result of environmental pollution, the production of agriculture and foodstuffs inevitably contain residual amounts of Persistent Organic Pollutants (POP). The special attention must be given to organic pollutants, including various organochlorinated pesticides (OCP). Among priorities, OCP is DDT (and its metabolite DDE), alfa-HCH, gamma-HCH (lindane). The control of these substances spends proceeding from requirements of sanitary norms and rules. During too time often is lost sight of that the primary product can pass technological processing (in particular irradiation treatment) as a result of which transformation of physicochemical forms of initial polluting substances is possible. The goal of the present work was to study the OCP radiation degradation at a various gamma-radiation dosimetric characteristics. The problems posed for goal achievement: to evaluate the content of the priority of OCPs in food; study the character the degradation of OCP in model solutions (with micro concentrations commensurate with the real content of their agricultural and food products) depending upon dosimetric characteristics of gamma-radiation. Qualitative and quantitative analysis of OCP in food and model solutions by gas chromatograph Varian 3400 (Varian, Inc. (USA)); chromatography-mass spectrometer Varian Saturn 4D (Varian, Inc. (USA)) was carried out. The solutions of DDT, DDE, alpha- and gamma- isomer HCH (0.01, 0.1, 1 ppm) were irradiated on "Issledovatel" (60Co) and "Luch - 1" (60Co) installations at a dose 10 kGy with a variation of dose rate from 0.0083 up to 2.33 kGy/sec. It was established experimentally that OCP residual concentration in individual samples of food products (fish, milk, cereal crops, meat, butter) are evaluated as 10⁻¹-10⁻⁴ mg/kg, the value of which depends on the factor-sensations territory and natural migration processes. The results were used in the preparation of model solutions OCP. The dependence of a degradation extent of OCP from a dose rate gamma-irradiation has complex nature. According to our data at a dose 10 kGy, the degradation extent of OCP at first increase passes through a maximum (over the range 0.23 - 0.43 Gy/sec), and then decrease with the magnification of a dose rate. The character of the dependence of a degradation extent of OCP from a dose rate is kept for various OCP, in polar and nonpolar solvents and does not vary at the change of concentration of the initial substance. Also in work conditions of the maximal radiochemical yield of OCP which were observed at having been certain: influence of gamma radiation with a dose 10 kGy, in a range of doses rate 0.23 - 0.43 Gy/sec; concentration initial OCP 1 ppm; use of solvent - 2-propanol after preliminary removal of oxygen. Based on, that at studying model solutions of OCP has been established that the degradation extent of pesticides and qualitative structure of OCP radiolysis products depend on a dose rate, has been decided to continue researches radiochemical transformations OCP into foodstuffs at various of doses rate.

Keywords : degradation extent, dosimetric characteristics, gamma-radiation, organochlorinated pesticides, persistent organic pollutants

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