

# 2016 SCIENTIFIC REPORT



MINISTRY OF FOOD AND DRUG SAFETY

National Institute  
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## Risk Assessment of Disulfoton

Disulfoton is an organophosphorus pesticide mainly used to control insects such as mites, weevils, grasshoppers, leafhoppers, leaf miners, mealybugs, and midges. In some countries, it is applied to Brussels sprouts, napa cabbage, lettuce, coffee, cauliflower, pepper, barley, succulent beans, cottonseeds, and peanuts, but its use is prohibited on herbaceous and shrub plants. Its domestic MRL is set at 0.02–0.2 mg/kg for four foodstuffs, e.g., coffee beans and pineapple (MRLs for Pesticides in Foods, May 31, 2016).

Disulfoton's key toxicity effect that appears after short- or long-term exposure is the inhibited activation of acetylcholinesterase, with no genetic toxicity or carcinogenic effects observed. Its ADI is 0.0003 mg/kg bw/day, which was established by applying the safety factor of 100 (differences between species and individual entities) to the NOAEL of 0.03 mg/kg bw/day obtained from a repeated dose study conducted for two years on dogs. This is in relation to the toxicity endpoint of inhibited activation of cholinesterase in blood plasma, red blood cells, and the brain.

The intake amount of disulfoton was estimated based on an analysis of 3,516 samples of 65 foodstuffs, including rice, in the Monitoring of Agricultural Products in Korea (2006–2009) by the National Institute of Food and Drug Safety Evaluation. Disulfoton was detected in one crown daisy sample (0.02 mg/kg). The pesticide level was below the LOQ and not detected in the rest of the samples. Concerning data lower than the LOQ, in case more than 60% of data were below the LOQ, estimation was made by applying 0 (non-detection) as the lower exposure limit or LOQ (upper exposure limit), according to the “evaluation of low level contamination of foods” recommended by the WHO. Food consumption was calculated through SAS 9.4 using the tertiary food code data from the KNHANES conducted for five

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years (2010–2014). For the average weight of all age groups, 60 kg, the weight currently (as of 2016) applied for establishment and revision of pesticide residue standards, was used. Concerning the average weights of different age groups, the data from KNHANES was used, applying 12.3, 19.2, 37.4, 59.5, 65, and 58.3 kg to the 1–2 year group, 3–6 year group, 7–12 year group, 13–19 year group, 20–64 year group, and the group aged 65 years or older, respectively. Risk characterization was made by calculating the HI in consideration of the EDI calculated in the exposure assessment and the ADI, the safe level of human exposure.

In general, when HI is 1 or higher, adverse effects may occur, and when HI is lower than 1, adverse effects are not expected. The results of the risk assessment of disulfoton in different age groups revealed HI between  $0.2 \times 10^{-5}$  (non-detection data, 0 applied) and 0.107 (non-detection data LOQ applied), as shown in the table below, and that its concentration is within the safe level of human exposure.

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**Table 1.** ADI and HI of disulfoton

Age	EDI (mg/person/day)		Average weight (kg)	EDI (mg/kg bw/day)		ADI (mg/kg bw/day)	HI	
	0	LOQ (mg/kg)		0	LOQ (mg/kg)		0	LOQ (mg/kg)
All	$0.1 \times 10^{-6}$	$0.8 \times 10^{-3}$	60	$0.2 \times 10^{-8}$	$0.1 \times 10^{-4}$	0.0003	$0.1 \times 10^{-4}$	0.043
1-2	$0.1 \times 10^{-7}$	$0.4 \times 10^{-3}$	12.3	$0.1 \times 10^{-8}$	$0.3 \times 10^{-4}$		$0.2 \times 10^{-5}$	0.107
3-6	$0.2 \times 10^{-7}$	$0.5 \times 10^{-3}$	19.2	$0.1 \times 10^{-8}$	$0.3 \times 10^{-4}$		$0.4 \times 10^{-5}$	0.089
7-12	$0.1 \times 10^{-6}$	$0.6 \times 10^{-3}$	37.4	$0.2 \times 10^{-8}$	$0.2 \times 10^{-4}$		$0.1 \times 10^{-4}$	0.053
13-19	$0.1 \times 10^{-6}$	$0.6 \times 10^{-3}$	59.5	$0.1 \times 10^{-8}$	$0.1 \times 10^{-4}$		$0.4 \times 10^{-5}$	0.036
20-64	$0.2 \times 10^{-6}$	$0.8 \times 10^{-3}$	65.0	$0.2 \times 10^{-8}$	$0.1 \times 10^{-4}$		$0.1 \times 10^{-4}$	0.042
$\geq 65$	$0.1 \times 10^{-6}$	$0.8 \times 10^{-3}$	58.3	$0.2 \times 10^{-8}$	$0.1 \times 10^{-4}$		$0.1 \times 10^{-4}$	0.046

**Key words:** Disulfoton, Risk Assessment, Organophosphorus insecticide, ADI, Monitoring, Pesticide