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Application of high-performance liquid chromatography-time-of-flight mass spectrometry for determination of neonicotinoid lethal bee intoxicants

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Abstract

The use of uncontrolled toxic concentrations of systemic insecticides belonging to the class of neonicotinoids in agriculture has a negative impact on the life of honeybees. The situation is aggravated by the fact that compared to other pesticides, neonicotinoids have acute toxicity to bees, contributing to their death. This paper presents a developed multimethod for qualitative and quantitative determination of certain lethal bee intoxicants of a number of neonicotinoids: thiamethoxam, clothianidin, Imidacloprid and acetamiprid by high–performance liquid chromatography-quadrupole-time-of-flight tandem mass spectrometry (HPLC-MS/MS). Sample preparation for HPLC-MS/MS was carried out using a modified QuEChERS method, followed by post-treatment of samples by dispersion solid-phase extraction (TFE). Chromatographic separation was performed by gradient reverse-phase HPLC, detecting neonicotinoids in the multiple reaction monitoring (MRM) mode. The assessment and verification of the completeness of the degree of recovery of neonicotinoids by the modified version of QuEChERS, based on the results of HPLC-MS/MS definitions, indicate that a high degree of their recovery has been achieved.

Under the proposed conditions of chromatographic separation, the analytical signals of the determined neonicotinoids are characterized by correlation coefficients (r2) equal to 0.999. The limits of detection (3·Sa/b) of neonicotinoids detected under HPLC-MS/MS conditions are established, which are: 1.6.10-3 mg/kg of thiamethoxam and Imidacloprid; 1.8.10-3 mg/kg of acetamiprid and 1.9.10-3 mg/kg of clothianidine. The developed HPLC-MS/MS multimethod is used for screening the material of dead bees for neonicotinoids, which are their lethal intoxicants.

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