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DETERMINATION OF THIABENDAZOLE FROM ENVIRONMENTAL MATRICES BY HPLC WITH FLUORESCENCE DETECTION

Roxana-Elena Scutariu[1,2], Vasile-Ion Iancu[1], Alina Tatarus[1], Gabriel-Valentin Serban[1], Diana Puiu[1], Marius Simion[1], Toma Galaon[1]

[1]National Research and Development Institute for Industrial Ecology-ECOIND, 71-73 Drumul Podu Dambovitei Street, district 6, 060652, Bucharest, roxgrigoras@gmail.com, Romania

[2] University Politehnica Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Street, district 1, 011061, Bucharest, Romania

INTRODUCTION

Thiabendazole 2-(4-thiazolyl)-1H-benzimidazole (TBZ), known as E233, is a pesticide of the benzimidazole class with an imidazole ring, used as a systemic fungicide in agriculture, and also as a broad-spectrum antiparasitic agent for various animal species. Thiabendazole is also widely used in the treatment of fruits and vegetables, before and after harvesting to control a variety of diseases, such as mold, rot and stains caused by various fungi. TBZ is applied by fruits dipping, by spraying or as an ingredient in the wax applied to the peel of fruits and vegetables to ensure their freshness. Because of these practices, the occurrence of thiabendazole has been reported in surface waters and sediments, in fruits peels and in effluents from the agriculture and food industry.

EXPERIMENTAL

Sample collection

- ✓ The wastewater and surface water samples were collected in October 2019 from two municipal wastewater treatment plants (Targoviste and Campulung Muscel, influent and effluent) and also two surface water samples taken downstream and upstream of the Targoviste wastewater treatment plant.
- ✓ The samples were coded as follows:
- B1, B2 - downstream/upstream wastewater treatment plant Targoviste;
- C1, C2 - influent/effluent wastewater treatment plant Targoviste;
- D1, D2 - influent/effluent wastewater treatment plant Campulung Muscel.

HPLC-FLD instrumentation and method performance

- ✓ **Agilent 1200 LC** (binary pump, autosampler, column thermostat) with a fluorescence detector (excitation wavelength of 280 nm and monitoring analyte emission at 315 nm);
- ✓ **Column:** Zorbax Eclipse Plus C18 (150 x 4.6 mm, 5 µm dp) (25°C);
- ✓ **Flow-rate:** 1.0 mL/min; 20 µL injection;
- ✓ **Mobile phase:** MeOH:water (60:40, v/v).

Sample extraction and cleanup

- ✓ **SPE** done using a Dionex Autotrace 280 (Thermo Scientific) automated extractor; Strata X cartridges (33 µm, 500 mg/6mL);

Steps:

- *Extraction:* 200 mL wastewater sample (pH adjusted to 8 with NH4OH, 0.24%);
- *Purification:* elution was done with MeOH at a flow rate of 5 mL/min;
- *Concentration*: with a gentle stream of N_2 (40°C); reconstitution to 1 mL with methanol-ultrapure water mixture (60:40, v/v).

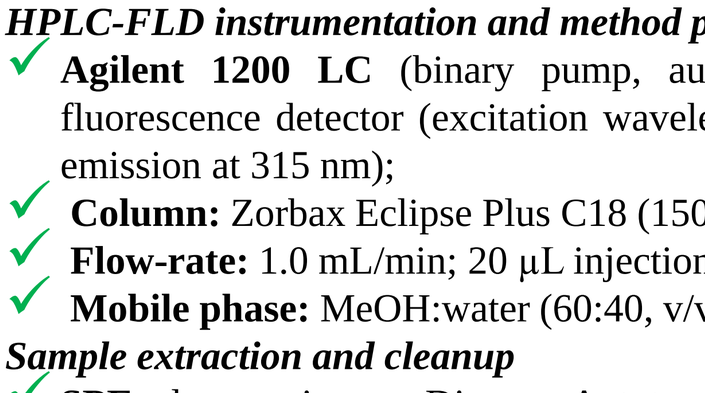

Fig. 1. Linear regression of TBZ

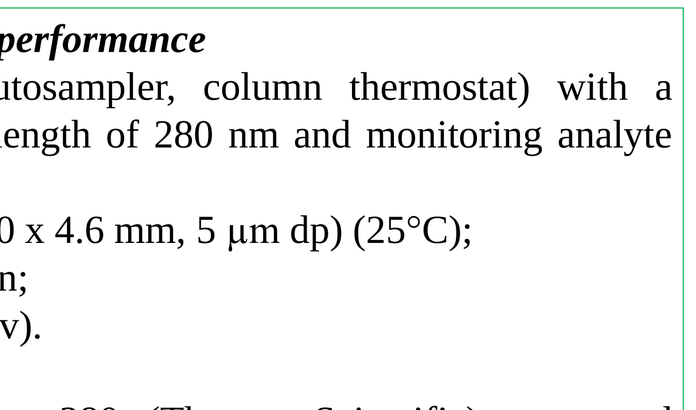

Fig. 2. Chromatograms of TBZ calibration standards

Fig. 3. Potential sources of contamination of surface water and WWTPs with TBZ

RESULTS

- The method was applied for detection of thiabendazole in wastewater and surface water samples.
- Concentrations in the range 7.6 - 2325.3 µg/L were obtained.

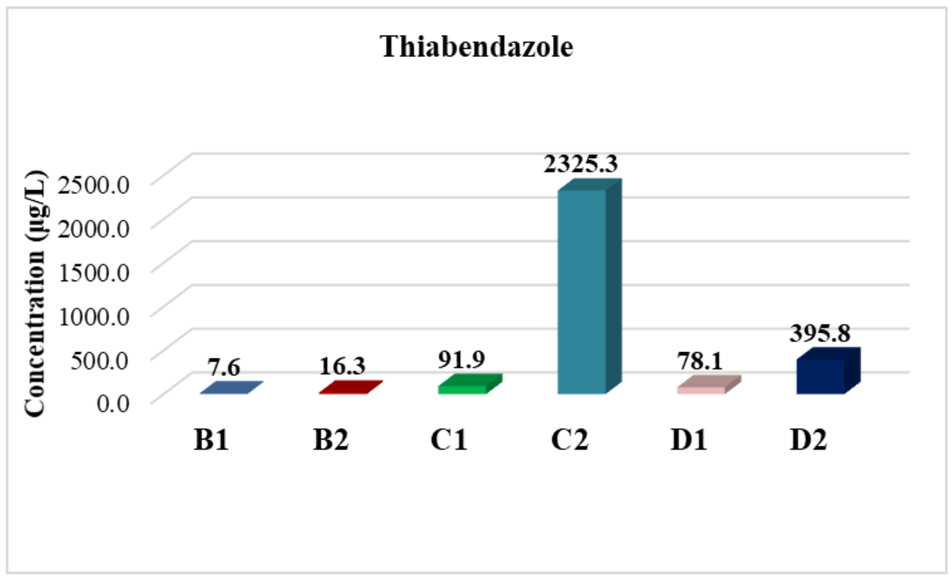

Fig. 4. Concentration of TBZ found in environmental matrices

Table 1. Performance parameters determined for TBZ in wastewater samples.

Compound	Retention time (min)	LOQ (µg/L)	Recovery rate (%)	Precision	
				Intra-day precision (%)	Inter-day precision (%)
Thiabendazole	3.354	0.06	77.5	5.2%	10.6%

CONCLUSIONS

A sensitive method SPE-HPLC-FLD was applied to the analysis of six wastewater samples from different municipal WWTPs. The concentrations of detected thiabendazole in wastewater samples varied greatly from 7.6 µg/L to 2325.3 µg/L.