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Soil quality — Simultaneous determination of multi-class pesticide residues in soil using gas chromatography-tandem mass spectrometry (GC-MS/MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis

Qualité du sol — Détermination simultanée de résidus de pesticides multiclasses dans le sol par chromatographie en phase gazeuse couplée à la spectrométrie de masse en tandem (CG-SM/SM) et par chromatographie en phase liquide couplée à la spectrométrie de masse en tandem (CL-SM/SM)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical and physical characterization*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Pesticides are primarily used to protect plants and enhance crop yields. The global average consumption of pesticides sprayed on cultivated land is approximately 2,69 kg/10 000 m^2 This value reflects an increase compared to the past few decades. This upward trend in pesticide consumption contributes to continuous exposure to pesticides in environmental matrices such as soil, water and air. The presence of pesticide residues in soils can degrade soil quality and have adverse effects on soil biodiversity, impacting non-target biota, as well as other ecosystem through the off-site transport of contaminated soil particles and soil pore water into air or water. Pesticide residues in soil can potentially move downward to groundwater through leaching process or run off to surface water resulting in water contamination.

Information at the national level regarding the presence of pesticides residue in soil has been limited due to low number of soil samples and monitoring projects and it primarily focuses on the highly toxic pesticides used in the past. However, some recent studies have reported the detection of various types of current fungicides, herbicides and insecticides in arable soil, playground, urban park areas, ground water and surface water.

With respect to toxicologically characterized pesticide residues, environmental agencies throughout the world have established specific values that are used in risk assessment. Developing a standard analytical method targeting currently used pesticides in soil is crucial for conducting risk assessment at pesticide contaminated sites. A method available in analysing multi-class pesticide residues in soil simultaneously would be very effective due to the variety of pesticide used. In this context, the QuEChERS (quick easy cheap effective rugged safe) method can be an alternative method to analyse a number of pesticide residues simultaneously in soil with relatively simple pretreatment applicable to both GC-MS/MS and LC-MS/MS.

The QuEChERS methods has already been incorporated into EN 15662.

This document can support the creation of an analytical framework for various pesticide residues in soil. It can be the starting point for future work including additional pesticide residues that are not target analytes in this document.

Soil quality — Simultaneous determination of multi-class pesticide residues in soil using gas chromatography-tandem mass spectrometry (GC-MS/MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis

1 Scope

This document provides a method for the simultaneous analysis of multi-class pesticide residues in soil using gas chromatography-tandem mass spectrometry (GC-MS/MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis following extraction with acetonitrile and buffering salts mixture, and cleanup via dispersive solid-phase extraction (d-SPE). This document is applicable to the 30 target analytes listed in Table 1. This document can be applicable to other pesticide residues if their validity is confirmed.

Table 1 — Target analytes of this document

Type of pesticide	Pesticide residues	Instrumental analysis	CAS-RN[a]
Fungicide	Azoxystrobin	LC-MS/MS	131860-33-8
	Carbendazim	LC-MS/MS	10605-21-7
	Difenoconazole (2 isomer)	GC-MS/MS	119446-68-3
	Fludioxonil	LC-MS/MS	131341-86-1
	Fluopicolide	LC-MS/MS	239110-15-7
	Fluopyram	GC-MS/MS	658066-35-4
	Flutolanil	LC-MS/MS	66332-96-5
	Isopyrazam	GC-MS/MS	881685-58-1
	Metconazole	LC-MS/MS	125116-23-6
	Metrafenone	LC-MS/MS	220899-03-6
	Paclobutrazol	GC-MS/MS	76738-62-0
	Propiconazole (2 isomer)	GC-MS/MS	60207-90-1
	Pyraclostrobin	LC-MS/MS	175013-18-0
	Tebuconazole	GC-MS/MS	107534-96-3
	Tetraconazole	GC-MS/MS	67915-31-5
	Triadimefon	GC-MS/MS	43121-43-3
Herbicide	Alachlor	GC-MS/MS	15972-60-8
	Linuron	LC-MS/MS	330-55-2
	Metolachlor	GC-MS/MS	51218-45-2
	Pendimethalin	GC-MS/MS	40487-42-1
	Simazine	LC-MS/MS	122-34-9
	Trifluralin	GC-MS/MS	1582-09-8

NOTE Under the specified conditions in this document, a limit of quantitation (LOQ) less than 0,1 mg/kg (expressed as dry matter basis) can be achieved for the target analytes (refer to Annex C).

[a] Chemical Abstracts Service (CAS) Registry Number® is a trademark of the American Chemical Society (ACS). This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.