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Exsudate: Schnittstelle zwischen Organismen, Bodenfestphasen und Wasser

Autoren

M. Colazzo¹, S. Niell¹, L. Pareja², V. Cesio², H. Heinzen^{1,2} ¹Universidad de la Republica, GACT Departamento de Quimica del Litoral, Centro regional Litoral Norte, Montevideo; ²Universidad de la Republica, GACT Farmacognosia & Productos Naturales, Facultad de Quimica, Montevideo

Titel

The influence of different soil types in the pesticide residue analysis method performance

Abstract

Pesticide residues in soils cause increasing environmental problems. The underlying biological activity of herbicides from one cropping season to another could affect the productivity of the new crops. Agricultural practices also influence the herbicide level and their accumulation in soil. They interact with soil particles through absorption or adsorption by ionic interactions and other forces ruled by physicochemical properties such as Kow, Henry's law constant, and Koc, as concentration dependent phenomena but soil texture and composition play a decisive role in their environmental behavior. To understand the general effect, the residues concentrations have to be precisely known. Although traditional pesticides such as organophosphates, pyrethroids and carbamates can be straightforward analysed in soils through general multiresidue methods, the determination of multiherbicide residues is a difficult task because soil is a complex and variable analytical matrix as different analyte/matrix interactions present. Herbicides are seldom applied alone but there are few methods reported capable of analysing high number of compounds. We studied the influence of 4 characteristic soils from Uruguay in 4 different methods for the residue analysis of 18 herbicides. Loam soils are the most common soils in Uruguay followed by clay ones and combinations of the two, with variable amounts of organic matter. The key step in this type of analysis is the extraction step. Seeking for a method useful to analyze most of the soils types in Uruguay, we faced a systematic study using four different extraction procedures (Methanol, Mixtures MeOH-Ethyl Acetate and Methanol-basic water). Nevertheless, in a first approach, we were not able to find a single method with acceptable performance for every soil under study. According to the type of soil, the best extraction solvent varied. The amount of organic matter played a role but also the texture of the soils was determinant for the method success. Finally, a two step extraction method gave the best results. The soil is firstly extracted with MeOH followed by a water extraction. The extracts are combined and analyzed using LC-MS/MS. Herbicides could be determined at 0,1-1 µg/Kg level. The method was successfully applied to the herbicide residue analysis of more than 80 soil samples during three cropping seasons, where many pesticides were detected (Clomazone, Quinclorac, Benzosulfuron, Propanyl, Atrazine, Ametryn, among others).