

CONCENTRATION LEVELS OF PESTICIDE RESIDUES IN VEGETABLE PRODUCTS FROM SANTA FE, ARGENTINA

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INTRODUCTION

Since pesticides are potentially harmful to the environment and consequently to human beings through the consumption of pesticide contaminated food and water, globally different regulatory organisms established maximum residue levels (MRLs) and great efforts are in course in order to harmonize their use between countries, with great concern on international trade of commodities and agricultural food products.

MRLs regulations worldwide are not fully harmonized. For export needs it is quite relevant to consider the current status of different normative.

INTERNATIONAL: Codex Alimentarius Directives on MRLs and Directive 06/135, *Official Journal of the European Union, Plant Protection - Pesticide Residues - Community Legislation, 2006.*

EUROPEAN COMMUNITY: Pesticide EU-MRLs Database. Regulation (EC) N° 396/2005. http://ec.europa.eu/sanco_pesticides/public/index.cfm, 2008.

USA: Code of Federal Regulations (CFR). e-CFR Data is current as of June 1, 2009. <http://www.epa.gov/pesticides/food/viewtols.htm>; <http://www.ecfr.gpoaccess.gov>.

ARGENTINA: Res SAGPYA 507-08 Annex I, Argentina. <http://www.sagpya.mecon.gov.ar>, 2008.

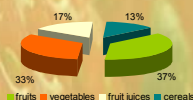
This work presents results on several types of raw vegetal samples (fruits, vegetables, fruit juices and cereals) produced in Santa Fe region destined for export market. Samples were collected during the period 2007-2008.

EXPERIMENTAL PROCEDURE, RESULTS AND CONCLUSIONS

SAMPLES:

A total of 115 samples of fruits, vegetables, fruit juices and cereals were analysed. All of them produced in Santa Fe (Argentina) region and destined for export market, with the aim to fulfill international standards applying good agricultural practices.

- ↳ 43 fruits samples: strawberry, peach, apple and orange
- ↳ 38 vegetable samples: potato and pumpkin
- ↳ 19 fruit juice samples: orange and apple concentrated juice
- ↳ 15 cereal samples: oat and wheat



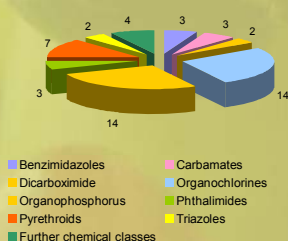
PESTICIDES:

54 compounds of different classes and types selectively adopted depending on the current regulations (banned pesticides) and on their extensive use in the study region.

COMPOUND	GC	LC	Note ^a	COMPOUND	GC	LC	Note ^a
Benzimidazoles				Organophosphorus (cont.)			
Benomyl		X		Dimethoate		X	
Carbendazim		X		Diazinon		X	
Thiabendazole		X		Fenitrothion		X	
Carbamates				Pirimiphos methyl		X	
Carbaryl		X		Chlorpyrifos methyl		X	
Methomyl		X		Chlorpyrifos		X	
Thiophanate methyl		X		Parathion ethyl		X	
Dicarbamide				Parathion methyl		X	B B
Iprodione		X		Phthalimides			
Procymidone		X		Captan		X	
Organochlorines				Chlorothalonil		X	
Hexachlorobenzene		X	B	Folpet		X	
DDT and metabolites		X	B	Pyrethroids			
Methoxychlor total		X	B	Aldrin		X	
Aldrin		X	B	Cyhalothrin lambda		X	
Chlordane		X	B	Cypermethrin		X	
Dieldrin		X	B	Deltamethrin		X	
Endosulfan I		X		Fenvalerate		X	
Endosulfan II		X		Permethrin total		X	
Endosulfan Sulfate		X		Tetramethrin		X	
Endrin		X	B	Triazoles			
Heptachlor		X	B	Difenoconazole		X	
Heptachlor epoxide		X		Imazalil		X	X
HCH		X	B	Myclobutanil		X	
Lindane (BHC gamma)		X	B	Propiconazole		X	
Organophosphorus				Further chemical classes			
Chlorfenvinphos total		X		Azinphos methyl		X	
Methamidophos		X	R	Vinclozolin		X	
Dichlorvos (DDVP)		X		Azoxystrobin		X	
Malathion		X		Hexythiazox		X	
Methidathion		X					
Ethion		X	R				

^a Related with Argentinean Directive

B: Totally banning. R: Restricted use; Ethion, banned in apples and pears. Metamidophos, banned in pip fruits.



ANALYSIS:

The samples were analysed using the buffered QuEChERS multi-residue method by Lehotay *et al.* [1] which allows a very fast, rugged and efficient extraction of a very broad spectrum of GC- and LC-amenable pesticides (> 400 compounds). The sample preparation consists of an extraction step followed by a liquid-liquid partition induced by the addition of salts and a clean-up employing Dispersive Solid-Phase Extraction.

Sample weight: 15 g for fruits and vegetables
5 g for concentrated juices and cereals

The QuEChERS extracts were directly subjected to determinative analysis by LC-UV and evaporated to dryness and redissolved in i-octane by GC-ECD.

VALIDATION [2]:

Recoveries were between 60 to 120 % for most compounds under study.

↳ Limit of quantification was compatible with control purposes ranging 2 to 10 µg/kg for GC-amenable pesticides and ranging 10 to 50 µg/kg for LC-UV amenable pesticides.

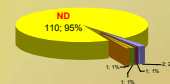
RESULTS:

COMPOUND - SAMPLE:

- ↳ ENDOSULFAN: 2 strawberry samples
- ↳ FOLPET: 1 strawberry sample
- ↳ CAPTAN + CARBENDAZIM: 1 strawberry sample
- ↳ FENITROTHION: 1 wheat sample

No pesticide residues were detected in concentration exceeding the MRLs

- ↳ No pesticide residues were detected in 110 samples



FOUND CONCENTRATION - MRLs

COMPOUND	Conc. [µg/kg]	MRLs [mg/kg]			
		Codex Alimentarius	CE Directive	USDA	SENASA Directive
Strawberry					
Captan	16	20	3 ^f	20	15
Carbendazim ^a	<LOQ ^c	-	0.1	5 ^g	2
Endosulfan ^b	4 - 14	2 ^d	0.05	2	1
Folpet	12	20	3 ^f	5 ^h	10
Wheat					
Fenitrothion	170	2 ^e	0.5	-	10

^a sum of carbendazim and benomyl expressed as carbendazim

^e wheat bran, processed

^b sum of alpha, beta isomers and endosulfan sulfate

^f sum of captan and folpet

^c LOQ = 50 µg/kg

^g mrl for benomyl

^d for fruits in general

^h No US registration

CONCLUSIONS:

- ↳ 5 (4 %) of 115 samples tested contained pesticide residues
- ↳ 1 (0.9 %) of 115 samples tested contained 2 different pesticide residue simultaneously
- ↳ 3 (16 %) of 19 strawberry samples contained pesticide residues

These results suggested responsible utilization of regulated pesticides as a consequence of application of good agricultural practice in compliance with regulatory and contract agreements for export purposes.

On the other hand, the results are different when samples are produced for domestic market according to our experience and many other cases reported in the current bibliography.

REFERENCES

[1] Lehotay, S.J. *et al.*, *J AOAC Intern* 88 (2005) 615-629.

[2] Repetti, M.R. *et al.*, *7th EPRW Berlin, Germany (June 1-4 2008)* PA71 p. 169.

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