Biobeds for the biodegradation of pesticides used in wine production

C. Rodriguez Ceraolo[a], N. Besil[b], S. Rezende[b], A. Rivero[a], C. Fasiolo[c], A. Coniberti[c], M. Buzchiazzo[2] G. Blumetto[d], H. Heinzen[a], and M. V. Cesio[a]

[a] Grupo de Análisis de Contaminantes Traza, Cátedra de Farmacognosia y Productos Naturales, Facultad de Química, Universidad de la República, Uruguay. [b] Grupo de Análisis de Contaminantes Traza, Departamento de Litoral, Centro Univeristario Paysandu, Universidad de la República, Uruguay. [c] Tecnica Sectorial y Programa de Investigación en Producción Frutícola, INIA Las Brujas. [d] Establecimiento Juanicó S.A. [e] FUCREA-Responsable Técnico Proyecto INIA-FPTA 353: "Producción Integrada en Viticultura".
ceceraolo@gmail.com

1. Introduction

- ✓ Crops dedicated to the production of wine and table grapes are one of the most important ones worldwide. Vineyards are particular ecosystems that can be attacked by several pests and diseases.
- ✓ An intensive pesticide schedule is required to meet qualitative and quantitative production standards.[1] Fungicides are the most employed pesticides in the vineyards treatments.
- ✓ Unsatisfactory management can give rise to pesticide residues in surface waters, groundwater and large soil volumes.
- ✓ On-farm practices for pesticides handling and use are the major source of contamination, being the pouring of pesticide concentrates into the spray tank, their dilution, the spraying in the field, as well as pesticide residues left on of the spray tank, the critical steps[2].
- ✓ The need to prevent the negative impact on human health and the environment has stimulated the research of innovative devices for sustainable agricultural practices.
- ✓ Biobeds are versatile biotechnological solutions to hamper food and environmental point contamination by wastewaters from agricultural activities, but their efficiency must be checked on a case-by-case basis.

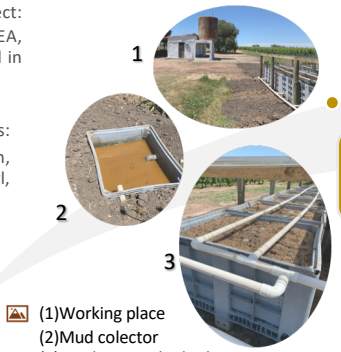
2. Methodology

With the support of INIA-FPTA 353 Project: "Integrated Wine Production" managed by FUCREA, INAVI and VICCA Cooperative, a biobed was installed in Establecimiento Juanico's vineyard.

Analyzed pesticides: 8 fungicides: pyrimethanil, iprodione, boscalid, pyraclostrobin, difenoconazole, carbendazim, thiophanate-methyl, cymoxanil. One insecticide: methoxyfenozide

Biobed design

(1) 50:25:25 % of bran, peat and soil (traditonal design)
(2) substituting bran for grape stem
(3) mixture 50:50 % of soil and oat straw.



Sampling
With drill at five different points within each bin. 14 bins in total

Extraction
AcOEt assisted with Ultrasound bath

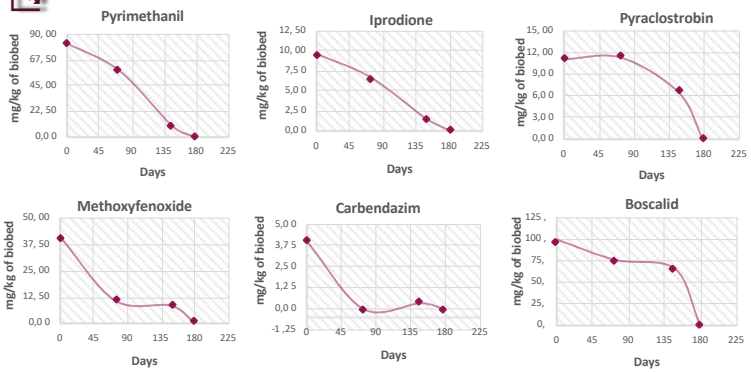
Clean up
Neutral alumina and anh. MgSO4

Instrumental analysis
GC-QqQ-MS: TQ 8050 Shimadzu
LC-QqQ-MS: Agilent 1200 LC - 4000 QTRAP® MS

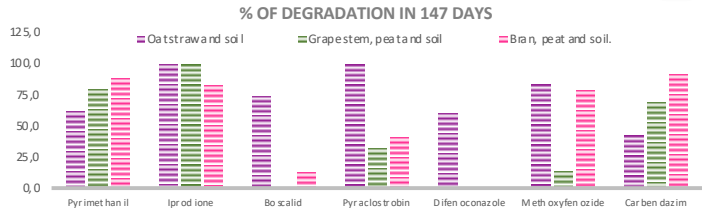
3.1. Validation parameters

Pesticide	Linearity (μg/L)	Recovery, levels (mg/kg)			RSD %			LOQ (mg/kg)
		0,06	0,3	1	0,06	0,3	1	
Pyrimethanil	30-300	107,9	106,8	96,1	6,8	4,2	2,6	0,1
Iprodione	30-300	113,0	108,5	90,3	13,4	8,7	10,7	0,1
Boscalid	5-125		109,7	96,7		8,3	3,1	0,3
Pyraclostrobin	30-300	117,8	104,4	96,1	3,2	3,4	3,1	0,1
Difenoconazole	5-125		90,4	91,4		3,9	7,1	0,3
Cymoxanil	5-125		104,6	93,9		4,2	2,2	0,3
Methoxyfenoxide	5-125		81,4	98,5		7,5	4,4	0,3
Carbendazim	5-125		94,4	89,5		3,1	5,0	0,3

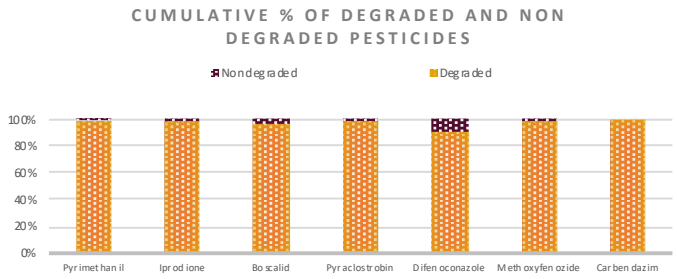
3.2. Dissipation curves in traditional biobed mixture



3.3. Biomixture design comparison



3.4. Traditional biomixture after 6 months



4. Conclusions

➥ The dissipation of commonly used pesticides in vineyards through an "in the field" installed biobed was assesed with a validated QuEChERS approach. Tiophanate methyl was evaluated as carbendazim.

➥ In the 50:25:25 % of bran, peat and soil biomixture most pesticides had >75% degradation after 4 months but pyraclostrobin, difenoconazole and boscalid, showed lower degradation ratios. Similar situation was observed in the grape stem, peat and soil design, where these three fungicides were not degraded in 4 months.

➥ The biomixture of soil and straw reached more than 60% of degradation in 4 months for all evaluated pesticides.

➥ All pesticides were degraded to at least 92% in the biobed using the traditional biomixture after 6 months.

➥ The resting period between two cropping seasons was enough to dissipate all the evaluated pesticides

References

1. Pertot, I. *et al. Crop Prot.* **97**, 70–84 (2017).
2. Castillo, M. D. P., *Jl of Agr.& Food Chem.* vol. **56** 6206–19 (2008).
3. Rivero, et al. *Talanta* **153**, 17–22 (2016).

Acknowledgments

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