ADSORPTION AND DEGRADATION OF PESTICIDES IN A BIOMIX USABLE AS BIOBED

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INTRODUCTION

Biobed is an economic and easy bio-prophylaxis system filled with a mixture of topsoil, peat and straw (25%:25%:50%) designed to prevent water bodies from pesticide "point sources" contamination. In order to adapt this biological system to a vineyard farm in Italy it needs to find a peat-substitute organic substrate for degrading pesticides mixtures at high concentrations. Organic residues (urban waste or garden compost, agricultural residues etc.) contain numerous and diverse active micro-organisms. This high variability means a high probability that a pesticide can encounter in a degrading microbial pool. Further municipal waste compost showed a good pesticides retention capacity.

Tab.1 Chlorpyrifos and Metalaxyl adsorption parameters

Pesticides	K_f (L kg^{-1})	n	K_{oc} (L kg^{-1})	R^2
CH	778,6	0,98	6348	0,910
M	7,31	1,04	56,9	0,919

RESULTS AND DISCUSSION

Adsorption and Degradation rate

The *adsorption* parameters found for CH were one hundred times higher than M.

M and CH showed half-lives values higher in the biomix than in soil.

No concentration effect was found in the *degradation* rate between *CH(10)* and *CH(50)*.

The co-application of the two pesticides had a synergistic effect on CH degradation rate reducing CH half life from 87,7 to 57,7 days and from 88,8 to 56,8 days in [*M(100)+CH(10)*] and [*M(100)+CH(50)*] treatments respectively. No synergistic effect was found for M.

Tab. 2 Chlorpyrifos and Metalaxyl half-lives (*)(**)

Pesticides (ppm)	$t_{1/2}$ (days)
(*)***CH(10)***	87.7
(*)***CH(50)***	88.8
(*)***M(100)***	37.1
(**)***CH(10)*** + ***M(100)***	57.7 33.5
(**)***CH(50)*** + ***M(100)***	56.8 42.0

(*) Single pesticide (**) Pesticides co-application

MATERIALS AND METHODS

A biomix constituted by urban waste-garden compost, vine-branch and topsoil *(40/40/20 v/v, 2 mm, 60 WHC, pH 7,6, C/N = 13,58)* was treated with:

- Chlorpyrifos [K_{ow}= 4,7; solubility (H_2O)=1,4 mg/L] at 10 and 50 ppm; [*CH(10)*; *CH(50)*]

- Metalaxyl [K_{ow}= 1,65; solubility (H_2O)=8,4 g/L] at 100 ppm; [*M(100)*]

- their co-application: [*M(100)+CH(10)*]; [*M(100)+CH(50)*]

and incubated at 20°C for 1, 7, 14, 21, 35, 65, 90 and 120 days

Untreated biomix samples in the same experimental conditions was used as control.

Studies of:

- *Adsorption parameters:* batch-equilibrium experiments (CaCl2 0,02M/biomix): M (1, 2, 4, 8 ppm); CH (2, 5, 10, 50, 100 ppm)

- *Degradation parameters*

- *Biochemical parameters:*

Microbial Biomass Carbon (MBC) = Fumigation-Extraction (FE) method

Total Hydrolitic Activity = FDA-Hydrolysis

Fig. 4. Total Hydrolytic Activity percentage variation in all the treatments

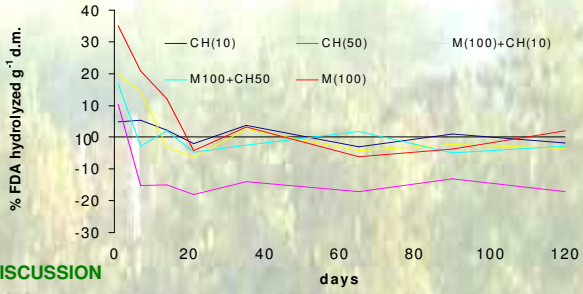
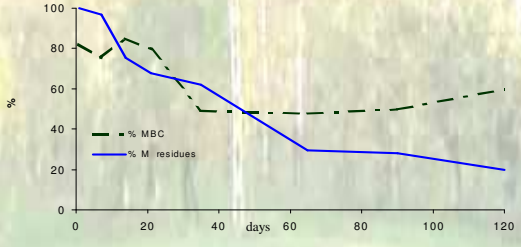


Fig. 1. MBC percentage variation related to Metalaxyl residues.



RESULTS AND DISCUSSION

Total Hydrolytic Activity (T.Hy.A.)

An initial increase of FDA-hydrolysis was observed in all treated samples. However after 7-14 days of incubation T.Hy.A. returned on the same level of the control value except in *CH(50)* where FDA-hydrolysis remained 20% lower for all the incubation period. It was hypothesized that: 1) the initial activity increase was due to the hydrolases released by microbial cells death; 2) a T.Hy.A. inhibition effect exerted by the highest CH concentration on a part of the biomix microflora.

Fig. 2. MBC percentage variation related to Chlorpyrifos residues.

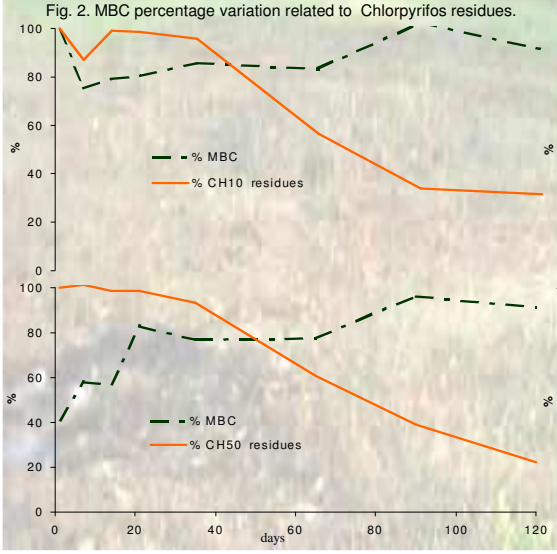
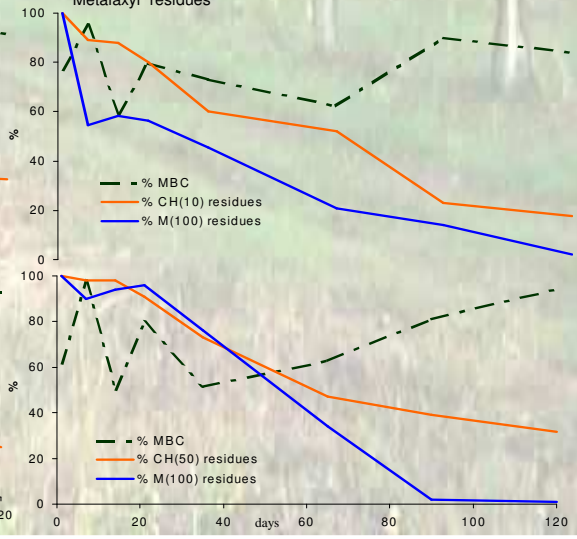


Fig. 3. MBC percentage variation related to Chlorpyrifos and Metalaxyl residues



RESULTS AND DISCUSSION

Microbial Biomass - C

The MBC patterns observed were different for each pesticides and their co-application. In particular *CH(50)* caused the highest MBC initial decrease (after 1 day) when individually applied (- 60% of MBC initial value) and in co-application with M (- 40% of MBC initial value). Anyway this parameter returned at the control value when total pesticides residues reached 40% of the initial concentration, except *for M(100)* where MBC remained lower (about 60% of the control value) for all 120 days of incubation.

It was hypothesized the presence of two different CH and M tollerant/degrading microbial pool that seemed to show a synergistic degradation actvity when the two pesticides are co-applied.