

EFFECT OF STARTER CULTURES ON THE DEGRADATION OF ORGANOCHLORINE PESTICIDES

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SUMMARY: This study was conducted to determine the effect of starter cultures of Micrococcus varians strain L₆ and Lactobacillus plantarum strain K₆ as single strain and in combination on the degradation of some organochlorine pesticides. Starter cultures of M.varians strain L₆ and L.plantarum strain K₆, isolated from Bulgarian fermented sausages were used as a suspension with an initial count of 10⁷ and 10⁶ cells/ml, respectively. The organochlorine pesticides lindan and garlon 4E were added in different concentrations (from 0.1 mg/ml to 5 mg/ml) and the degradation ability of the starter cultures was evaluated by gaschromatographic determination of the pesticide residues in the suspension after 24 and 48h of incubation at 30°C.

Obtained results showed that the starter cultures of M.varians strain L₆ and L.plantarum strain K₆ degraded the examined pesticides in the used concentrations. M.varians strain L₆ degraded the pesticides to the highest extent. The intensity of degradation depended on the concentration of the pesticides.

INTRODUCTION: Organochlorine pesticides are of major public health concern when they are ingested through foodstuffs, especially meat and meat products. Various research workers have reported on the residues of organochlorine pesticides in meat and meat products (Cantoni, 1989, Kredl, 1988, Visacki, 1978). The possibility to remove, decrease or detoxify the pesticide residues of this group is connected with examination of the factors influencing their degradation processes. Some microorganisms also may degrade organochlorine pesticides (Peric et al., 1979, Spiric, 1981). However, little information is available on the effect of microorganisms, especially of starters, on the degradation of organochlorine pesticides in meat products (Mirna and Coretti, 1979).

This study was undertaken to determine the effect of starter cultures of Micrococcus varians strain L₆ and Lactobacillus plantarum strain K₆, used in the production of Bulgarian fermented sausages, on the degradation of chlorinated pesticides namely, lindan (γBHC) and garlon 4E.

MATERIALS AND METHODS: Starter cultures of M.varians strain L₆ and L.plantarum strain K₆ were isolated from typical Bulgarian raw-dried sausages. The strains were cultivated on peptone-meat extract agar containing 6% NaCl for M.varians and MRS agar for L.plantarum. They were incubated for 24h at 30°C. After incubation, the strains were washed with sterile physiological solution to a desired concentration. Cell

concentration of 10^7 cells/ml of M. varians strain L₆ and 10^6 cells/ml of L. plantarum strain K₆ singly and in combination of the two strains with the same concentrations were used. Five millilitres of bacterial suspension were poured into small test tubes. An aliquot of 10 ml of solutions of lindan and garlon 4E at concentrations of 0.1, 1 and 5mg/ml were added to each tube under sterile conditions. The tubes were incubated for 24 and 48h at 30°C. The ability of the examined strains to degrade the pesticide residues was evaluated by gaschromatographic method. The method for the quantitative determination of pesticide residues was as described by Peric *et al.*, 1979 with the following modifications : the detector temperature was maintained at 330°C for both the pesticides and the injector temperature was maintained at 220°C for lindan and 250°C for garlon 4E. Similarly, the column temperature was maintained at 210°C for lindan and 240°C for garlon 4E. The nitrogen flow was regulated at 40ml/min and the quantity of the injected sample was 0.5ml. Type PYE Unicam GCV gaschromatograph was used in this study.

RESULTS AND DISCUSSION: The results of the experiments on the percentage degradation of lindan and garlon 4E as effected by starter cultures are presented in Table-1. The values shown are the mean values of a total of 5 experiments. As seen from the results, M. varians strain L₆ singly had the highest capability of pesticide degradation under experimental conditions. This strain showed the highest degradation activity on the examined pesticides after 48 h of incubation. The data also indicated

Table-1. Effect of starter culture on the degradation of lindan and garlon 4E.

Strains	Concentration of pesticides	% degradation of lindan*		% degradation of garlon 4E	
		Time of incubation (h)	Time of incubation (h)	Time of incubation (h)	Time of incubation (h)
		24	48	24	48
<u>M. varians</u> strain L ₆	0.1	64.25	78.5	57.5	69.3
	1	44.7	56.2	35.3	42.4
	5	28.3	36.9	20.7	24.2
<u>L. plantarum</u> strain K ₆	0.1	38.5	47.0	27.3	34.6
	1	25.3	34.8	19.5	23.1
	5	16.3	25.8	9.4	16.3
<u>M. varians</u> strain L ₆ + <u>L. plantarum</u> strain K ₆	0.1	43.8	55.1	32.0	41.1
	1	34.0	41.0	28.5	36.3
	5	21.3	27.4	16.7	24.5

*Quantities of lindan (γ BHC) and garlon 4E in suspension, expressed as per cent of the administered quantity.

a distinct difference in the degradation capability of M. varians strain L₆ with different concentrations of pesticides. Comparatively lower degradation ability was observed at the highest pesticides concentrations of 5mg/ml. This could be due to the adverse effect of the pesticides on the growth of the starter culture at such higher concentrations. M. varians strain L₆ degraded lindan in all used concentrations to a higher extent as compared to garlon 4E. L. plantarum strain K₆ also showed similar tendency as with M. varians strain L₆. The degradation ability of M. varians strain L₆ and L. plantarum K₆ was found to be higher when used as mixed cultures as compared to L. plantarum strain K₆. Interestingly, the combined effect of M. varians strain L₆ and L. plantarum strain K₆ was lower than the individual effect of M. varians strain L₆ at all the concentrations of the pesticides.

Finally, the obtained results evidently showed that the starter cultures of M. varians strain L₆ and L. plantarum strain K₆ had a determined effect on the degradation of organochlorine pesticides lindan and garlon 4E and these strains used these pesticides as the only source of energy for their metabolism. In general, our results are in agreement with the findings of Mirna and Coretti, 1979 and Peric et al., 1979.

CONCLUSIONS: Starter cultures of M. varians strain L₆ and L. plantarum strain K₆ in single and in mixed form could degrade organochlorine pesticides lindan and garlon 4E. The starter cultures of M. varians strain L₆ possessed the highest degradation ability on the examined pesticides under experimental conditions.

The degradation capability of the tested starter cultures depended on the concentrations of the examined organochlorine pesticides.

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