

Testing the genotoxicity of composted sewage sludge using the direct contact *Vicia faba*-root micronucleus test

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Introduction

Sludge is a valuable by-product in wastewater plants, containing nutrients like nitrogen, phosphorus, and potassium which are essential for plant growth. It is a slow-release fertilizer and its organic material can improve soil quality. However, this sludge may also contain toxic elements (metal and organic micro-pollutants), limiting their recycling (Amir, 2005; Jouraiphy, 2005). Composting could be suggested as a detoxification process of sludge that can reduce pathogens and the organic contaminants in the sludge. In the present work, the *Vicia faba* root-micronucleus test was used to evaluate the genotoxicity of compost.

Materials and methods

Composting test

Raw sewage sludge was composted in a pile of 3.5 m³, mixed with green waste in equal volumetric proportions (Table 1)



sewage sludge

Green waste



The microbial activity was followed daily by measuring the temperature in the compost

Physico-chemical properties of raw materials

Settings	sewage sludge	Green waste
humidity (%)	64.8	64
pH	7.9	6
NTK (%)	3.14	1.5
COT (%)	31.8	52.8
C/N	28.3	35.2
Ashes rate (%)	45	8.33

Genotoxicity test

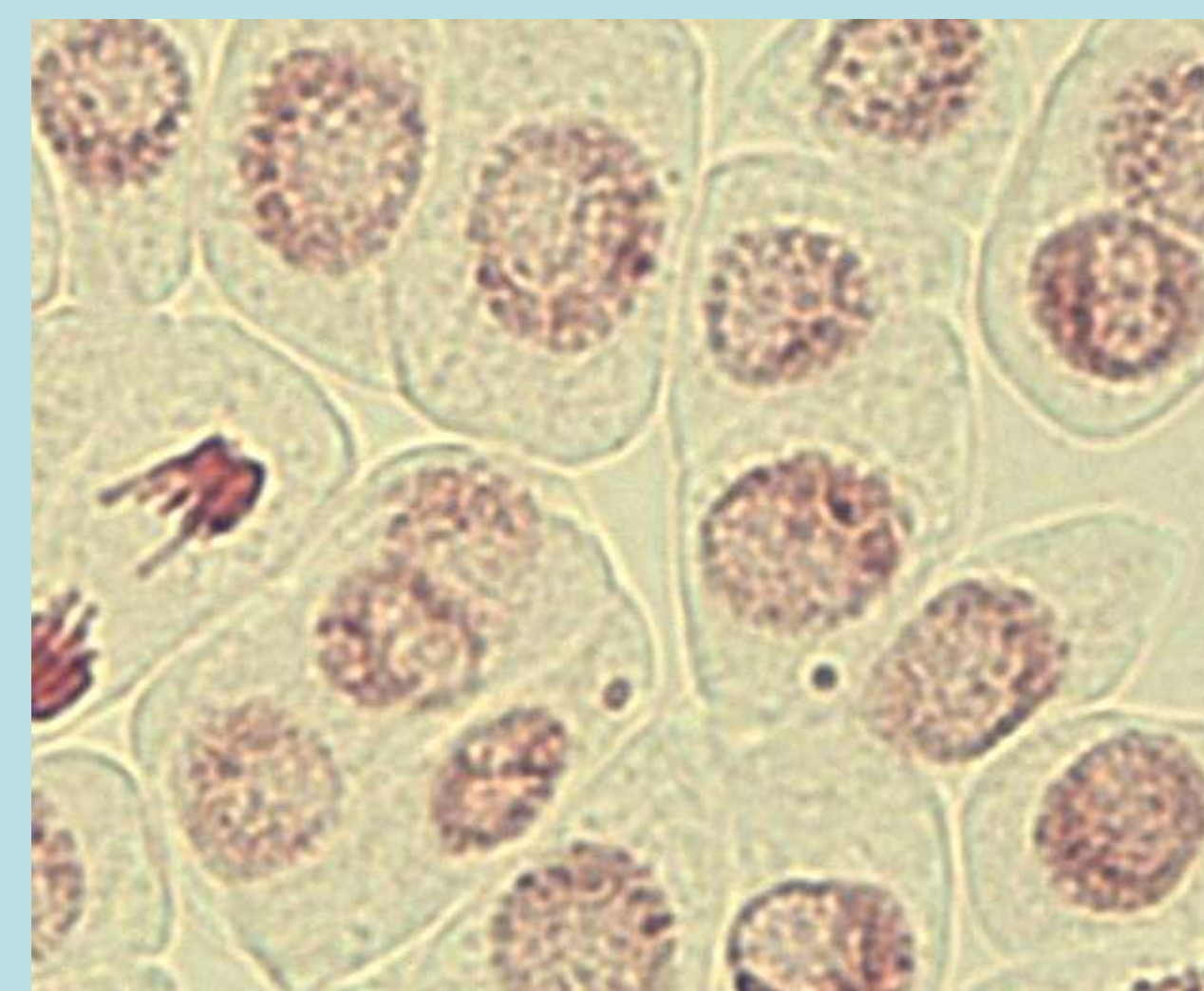
The direct contact method developed by Marcat_ Romain CE et al (2009) was used for assessment of compost quality. The direct contact method was applied at 30% dilution of compost obtained by mixing compost with the standard LUFA soil for three stages of composting. Roots were collected after a 2-days exposure. Controls used LUFA soil wetted with distilled water (NC) or a 10⁻⁵ M solution of maleic hydrazide (PC).



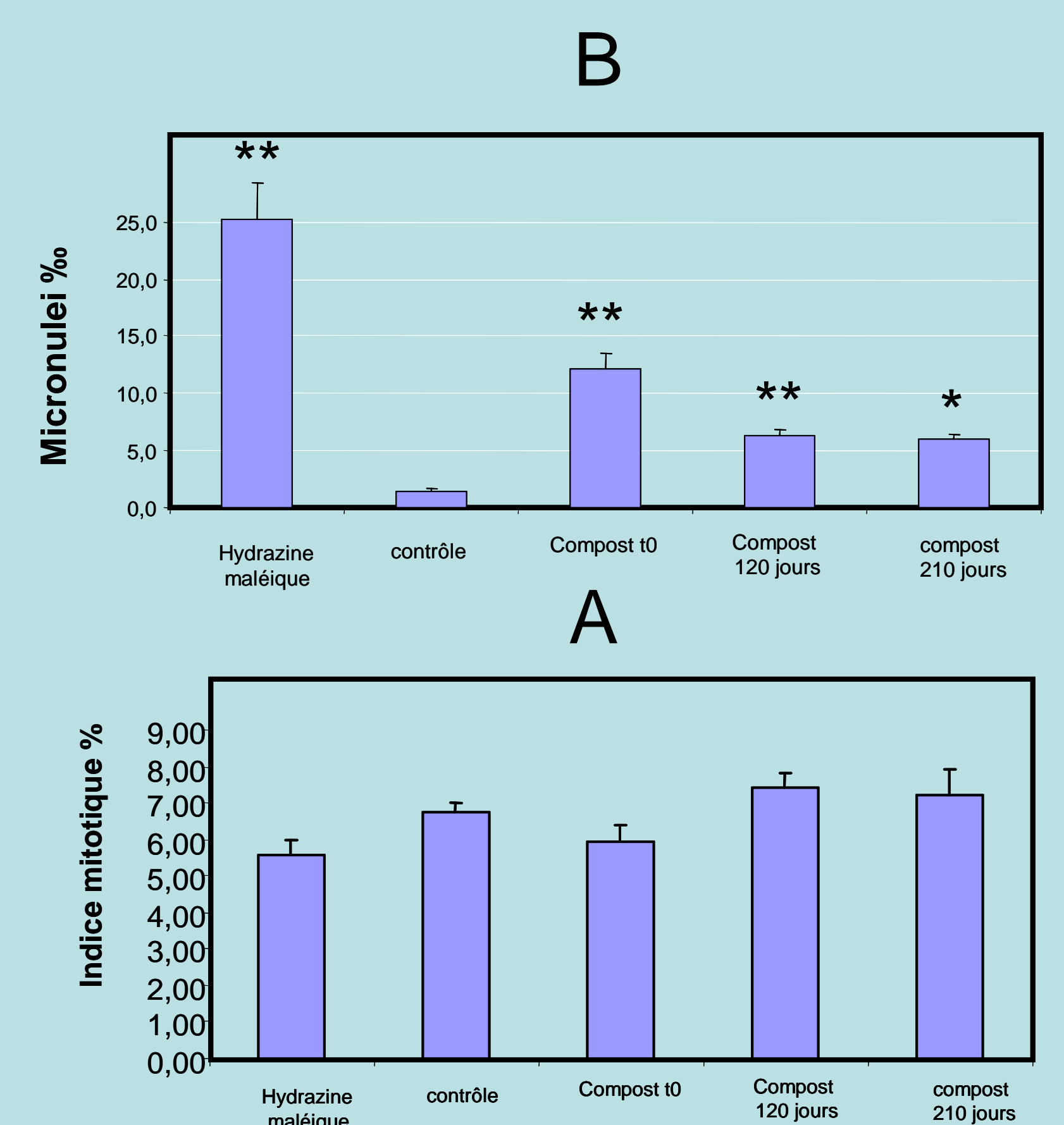
RESULTS AND DISCUSSION

Physico-chemical properties of Raw materials and green plant waste at different times of composting

Composting time	pH	Corg*	NTK	C/N	ashes	Dec%	Pass* mg/1g
T0d	7.55	34.37	2.11	16.28	34	-	1.42
T15d	7.43	32.4	2.04	15.68	0.4	22	2.12
T30d	7.84	31.53	2.45	12.86	43	31.71	1.9
T60d	8.93	29.4	2.32	12.64	50	48.48	2.07
T90d	7.97	27.46	2.41	11.53	52	52.44	2.23



Micronuclei induced by sewage sludge in *Vicia faba* cell roots.



Mitotic index (A) and micronucleus frequency (B) values in *Vicia faba* roots exposed to samples of compost at different stages.

CONCLUSION

The direct contact method was applied at 30% dilution of compost obtained by mixing compost with the standard LUFA soil for three stages of composting. Maleic hydrazide was used as a positive control and LUFA standard soil was used as a negative control in all direct contact tests. Results show that the tested sewage sludge at 30% dilution increased the mitotic index (MI), and causes a significant decrease in micronucleus frequency. During sludge composting, after the maturation phase, the reduction in micronucleus frequency reached 55%. Composting could be suggested as a detoxification process of sludge after a sufficient time of treatment ensuring a safe end product.