Effects of gamma radiation in mycotoxin decontamination of *Aloysia citrodora* Paláu

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Introduction

The interest and demand for aromatic and medicinal plants have been growing due to their combined organoleptic and bioactive properties. However, in general these plants suffer natural contamination by fungi and associated toxins during growth as also in harvesting, storage and drying processes, which represents a threat to public health. The rigorous standards required by the industrial sector in terms of good quality of raw materials demand efficient decontamination procedures [1-3]. Gamma radiation is assumed as an accredited methodology for the decontamination of medicinal and aromatic plants, with numerous advantages not only to the product itself but also to the consumer and the environment [4].

Objectives

In this study, efficient methods for detecting aflatoxins (AFB_1, AFB_2, AFG_1 and AFG_2) and ocratoxin A (OTA), were optimized and validated, and afterwards, applied to spiked samples of *Aloysia citrodora* Paláu submitted to gamma radiation treatment at different doses (1, 5 and 10 kGy), to evaluate the effectiveness of irradiation as a decontamination technique for dry plants.

Sample

Methodology

Mycotoxin levels were determined by reversed-phase high-performance liquid chromatography (HPLC) with fluorescence detection, after immunoaffinity column (IAC) cleanup.

Results

Table 1. Performance and precision of Aflatoxins and Ochratoxin A extraction method for spikimg with 10 ng/g of OTA, AFB_1 and AFG_1, and 3 ng/g of AFB_2 and AFG_2.

	AFB_1		AFB_2		AFG_1		AFG_2		OTA	
	10 ng/g	30 ng/g	3 ng/g	9 ng/g	10 ng/g	30 ng/g	3 ng/g	9 ng/g	10 ng/g	30 ng/g
Mean Recovery (%)	88.3	88.9	94.2	77.5	85.5	75.6	62.4	66.1	76.4	92.0
RSD_r(%)	8.3-14.4	0.1	5.4-7.3	0.1	8.9-12.7	0.1	2.7-44.5	0.1	2.5-9.3	5.1
RSD_R(%)	3.3	-	1.5	-	8.4	-	24.3	-	5.6	-
Recommended Range (European Regulation No 401/2006)										
Recovery (%)	70-110									
RSD_r (%)	<21		<22		<21		<22		<20	
RSD_R(%)	<32		<34		<32		<34		<30	

All the applied gamma radiation doses conducted to a degradation of the studied mycotoxins. In relation to the control sample (0 kGy), the reduction rates in the irradiated samples ranged from 4.9 and 5.2% in OTA, 5.3 and 9.6% in AFB_1, 12.3 and 13.5 in AFB_2, 16.4 and 23.6 in AFG_1 and, finally, 52.6 and 62.7% in AFG_2. The gamma radiation dose of 5 kGy stood out as the best decontamination dose for AFB_1 and AFG_1, which are the most significant aflatoxins naturally found in food commodities. For OTA, AFG_2 and AFB_2 there was no significant difference in decontamination between doses.

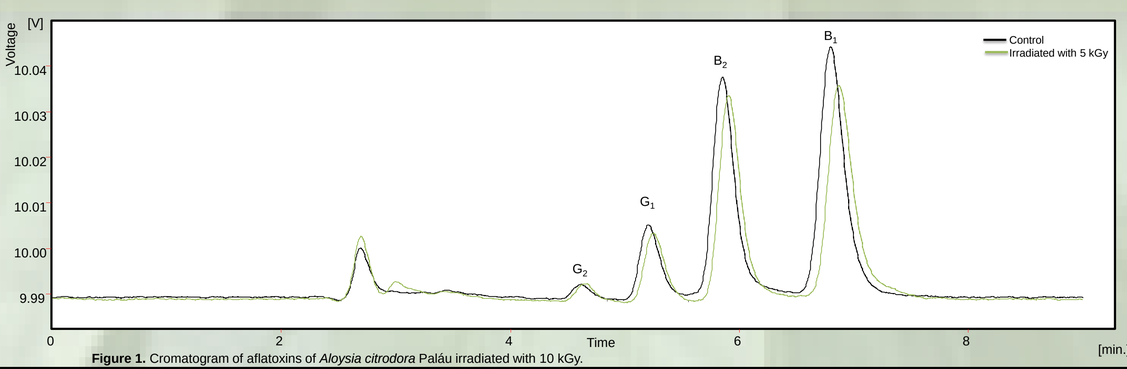

Figure 1. Cromatogram of aflatoxins of *Aloysia citrodora* Paláu irradiated with 10 kGy.

Table 2. Reduction (%) (mean ± SD) of aflatoxins and ochratoxin A (ng/g) in *Aloysia citrodora* Paláu samples spiked at 30 ng/g of each mycotoxin after irradiation treatment

	Degradation (%)				
	OTA	AFB_1	AFB_2	AFG_1	AFG_2
0 kGy	n.a.	n.a.	n.a.	n.a.	n.a.
1 kGy	5.0 ± 0.3	5.3 ± 1.6	12.3 ± 2.1	20.6 ± 19.1	62.7 ± 11.8
5 kGy	4.9 ± 0.7	9.6 ± 5.6	13.5 ± 7.1	23.6 ± 16.6	58.0 ± 10.5
10 kGy	5.2 ± 1.4	6.9 ± 12.6	12.5 ± 13.3	16.4 ± 13.3	52.6 ± 6.5

n.a. - not applicable. In each column different letters mean significant differences ($p < 0.05$).

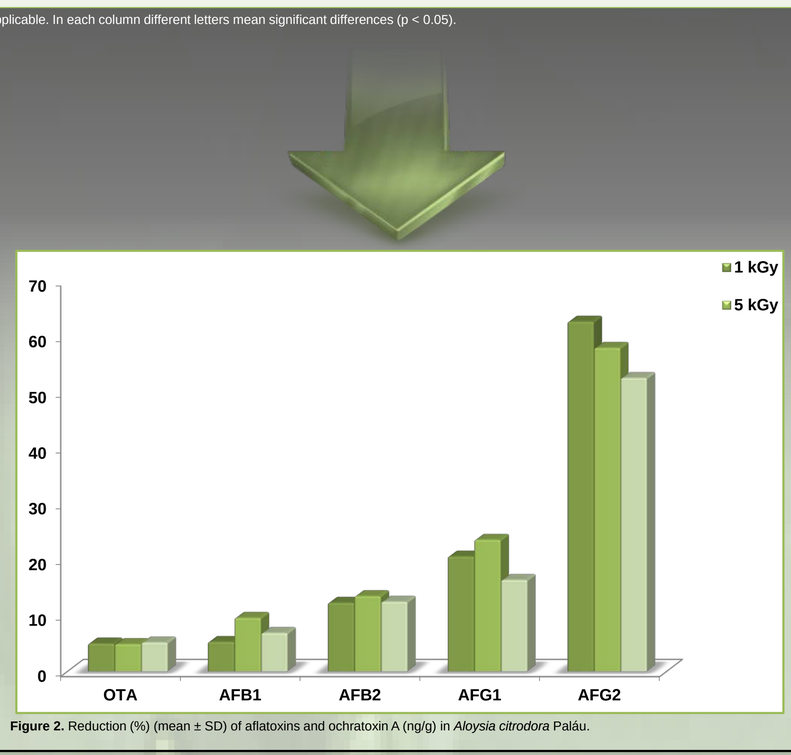

Figure 2. Reduction (%) (mean ± SD) of aflatoxins and ochratoxin A (ng/g) in *Aloysia citrodora* Paláu.

Conclusion

In conclusion, the extraction and analysis methods proved to be suitable for detection of aflatoxins and ocratoxin A in *A. citrodora*. Gamma radiation seems to be an effective technique for reducing aflatoxins G in A. citrodora, and eventually other medicinal and aromatic plants. On the other hand, aflatoxins B and OTA are less affected by this treatment.

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