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EFFECT OF GAMMA IRRADIATION ON THE INACTIVATION OF AFLATOXIN B_1 AND FUNGAL FLORA IN PEANUT

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ABSTRACT

The effect of gamma irradiation on aflatoxin B_1 levels and fungal infection were investigated in peanut samples, Tatu Vermelho cultivar. At a radiation dose of 10 KGy, growth of molds was completely inhibited. Doses of 15, 20, 25 and 30 KGy were sufficient for destruction of aflatoxin B_1 by 55-74%. The results suggested that the decontamination of molds by irradiation, before production of aflatoxin B_1, is the most acceptable method in the preservation of peanut.

Key words: peanut, gamma irradiation, aflatoxin B_1.

INTRODUCTION

Aflatoxins are metabolities of the molds *Aspergillus flavus*, *Aspergillus parasiticus* and *Aspergillus nomius* which can grow on a wide variety of agricultural commodities and induce undesirable effects (2).

Different methods have been applied to reduce molds in food, such as fumigation and heat treatment, but none of these methods offers a complete control for toxigenic molds (1).

In september 1997 a Study Group appointed by WHO concluded that "foods treated with doses greater than 10 KGy can be considered safe and nutritionally adequate when produced under established Good Manufacturing Practice" (4,7).

The present study has been conducted to investigate the efficacy of gamma irradiation (^{60}CO) for the decontamination or inactivation of fungi and aflatoxin B_1 occurring in peanut, genotype Tatu Vermelho.

MATERIALS AND METHODS

Sampling

The study was carried out analysing three peanut samples (*Arachis hypogaea* L.) of the Tatu Vermelho cultivar, during the 2003 harvest, of the São Paulo state, Brazil. One sample (A) was naturally contaminated with 248.0 µg/Kg aflatoxin B_1 and another (B) with 86.0 µg/Kg aflatoxin B_1. In the third sample (C) the aflatoxin B_1 was not detected.

Direct Platings

Peanut seeds of the sample C were externally disinfected by immersion in a 0.4 % sodium hypochlorite solution for 2 min

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and then a total of 50 seeds, in four replications, was plated directly (5 particles per plate) onto Dichloran rose bengal chloramphenicol agar (DRBC). The plates were incubated at 25ºC for 5-7 days, then inspected for colony growth visually (8).

Gamma-Irradiation

Samples A e B were packed into polyethlene pouches and irradiated, in three replications, with doses of 0, 15, 20, 25 and 30 KGy by using ^{60}CO source. Sample C was packed into polyethlene pouches and irradiated, in four replications, with doses of 0, 1, 5 and 10 KGy by using ^{60}CO source, too.

Determination of Aflatoxin B_1

A thin layer chromatographic (TLC) method was used for the detection of aflatoxin B_1(9).

Statiscal Analysis

The multiple range test described by Duncan (5) was used to test for statistically significant differences ($p < 0.05$).

RESULTS AND DISCUSSION

The effect of different doses of gamma-irradiation in the percentage infection by fungi is shown in Table 1. The data showed that the percentage infection decreased significantly ($p < 0.05$) by increasing the radiation dose levels from 5 to 10 KGy and the molds were completely inhibited at irradiation dose of 10 KGy.

Table 2 shows the effect of different doses of gamma-irradiation on aflatoxin B_1 levels. The results showed that treatment of peanut seeds with gamma irradiation (15, 20, 25 and 30 KGy) destroyed 69-74% of aflatoxin B_1 in sample A and 55-62% in sample B. Farag *et a*l (6) found that the gamma rays even at 20 KGy were not effective in destroying completely the aflatoxins since 83% reduction was achieved. Recently, Aziz and Youssef (3) showed that a dose of 20 KGy was sufficient for complete destruction of aflatoxin B_1 in peanut, yellow corn, wheat and cotton seed meal.

Table 1. Effect of gamma irradiation in infection percentage of peanut seeds.

Radiation Dose (KGy)	Population (%)[1]
	Sample C
0	24a
1	21a
5	6b
10	0b

[1]Values are means of four replicates. Values within treatments followed by the same letter are not signifficantly different ($p < 0,05$) by the Duncan multiple range test.

Table 2. Effect of gamma – irradiation on the natural occurrence of aflatoxin B_1 in peanut.

Radiation Dose (KGy)	Aflatoxin B_1 (μg/Kg)[1] Sample	
	A	B
0	248.0a	86.0a
15	65.0b	38.6b
20	69.0b	33.0 b
25	69.0b	29.6b
30	78.0b	33.0b

1.Values are means of three replicates. Values within treatments followed by the same letter in the vertical line are not signifficantly different ($p < 0.05$) by the Duncan multiple range test.

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RESUMO

Efeito da irradiação gama na inativação da aflatoxina B_1 e flora fúngica em amendoim

O efeito da irradiação gama nos níveis de aflatoxina B_1 e na infecção fúngica foram investigadas em amostras de amendoim, cultivar Tatu Vermelho. Dose de irradiação gama (^{60}Co) de 10 KGy inibiu completamente o crescimento de fungos. Doses de 15, 20, 25 e 30 KGy foram suficientes para destruição de aflatoxina B_1 de 55 a 74%. Pode-se concluir do presente trabalho, que a descontaminação de fungos por irradiação gama antes da produção de aflatoxina B_1 é o método apropriado na preservação de amendoim.

Palavras-chave: amendoim, irradiação gama, aflatoxina B_1.

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