INHIBITORY EFFECTS OF BENZOIC , PROPIONIC AND SORBIC ACIDS ON GROWTH AND AFLATOXIN PRODUCTION OF ASPERGILLUS FLAVUS IN PEANUTS AND CORNS

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ABSTRACT

After mixing peanuts and corns with acid mixtures of benzoic:propionic, benzoic:sorbic and propionic:sorbic at 0.2:0.1, 0.2:0.3 and 0.1:0.15 % respectively, growth of Aspergillus flavus ATCC 15546 and its aflatoxin production were completely inhibited. Mixed with feed, the chemicals used showed no decreased growth of male Wistar rats. Aqueous and alcoholic extracts from the treated seeds neither showed toxicity upon development of chick embryo nor mutagenicity using Ames' bacterial test.

INTRODUCTION

Previous studies showed that growth and aflatoxin production by Aspergillus flavus were completely inhibited by benzoic acid at 0.4% in broth (ref. 1), 1.0% in peanuts (ref. 2) and propionic acid at 1.0% in corns (ref. 3). Also, patulin production was inhibited by sorbic acid at 0.3% in broth (ref. 4). However, nobody tried to use the combination of any kind of chemical to control mold growth and mycotoxin production in agricultural products.

EXPERIMENTAL RESULTS

Inhibitory effects of acid mixtures in synthetic medium

Potato Dextrose broth premixed with the combination of two acids showed synergistic effects and exhibited complete inhibition upon growth of A. flavus ATCC 15546 and its aflatoxin production at lower concentration than being used singly (Fig.1).

Fig. 1 A model of using acid mixture

Inhibitory effects of acid mixtures in peanuts and corns

Peanuts and corns were mixed with the selected acid mixtures (benzoic:propionic, benzoic:sorbic and propionic:sorbic at 0.2:0.1, 0.2:0.3 and 0.1:0.15% respectively). When spore suspension of *A. flavus* ATCC 15546 (3×10^6 spores/ml) was added to pretreated seeds and incubated at room temperature, no increased growth of the mold and its aflatoxin production was observed throughout 84 days of the experiment.

Effect of treated peanuts and corns on rat growth

The treated peanuts and corns were then made into food chow and fed to weanling male Wistar rats. Their growth by means of body weights and external appearances were examined. No significant decreased effect upon growth was observed throughout 20 weeks (Fig. 2).

Fig. 2 Bw(g) at week 12

Effects of acid residues on development of chick embryo

Aqueous and alcoholic extracts from pretreated seeds were obtained, dried and adjusted to 12 ng/ml (equals to the acid residues in peanuts or corns possibly consumed by a pregnant woman of 50 kg bw in her daily life). The samples were then injected into the air sac of fertilized eggs. The embryos developed as well in the treated group as in control group.

Mutagenicity test

Salmonella typhimurium TA98 was used as a tester strain in Ames' bacterial test against extracts from pretreated seeds. Number of revertant colonies per plate were counted after 48-hr incubation at 37°C. Neither aqueous nor alcoholic extracts showed mutagenicity.

CONCLUSION

This study provides us a model how to control mycotoxin contamination in agricultural products by using safe and economical chemicals.

References

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