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RESEARCH ARTICLE

Inhibition of Fumonisins (FB_1 & FB_2) Production by Organic Acids and Food Preservatives

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ABSTRACT

Effect of organic acids and food preservatives from fumonisin production by toxigenic strains of Fusarium mould (S_2.PO.16,S_1.PR.25) revealed that 0.2% and 0.3% concentrations of benzoic acid and sodium benzoate completely checked fumonisin B_1 (FB_1) production. Further, benzoic acid and sod.benzoate totally checked FB_2 production at ever 0.1% concentration. This study showed that benzoic acid and sodium benzoate were found to be most effective inhibitors of fumonisin elaboration and can be used for preventing fumonisin contamination in sorghum grains.

Key Words: *Fumonisins, sorghum, Fusarium moniliforme, mycotoxin, organic acids, food preservatives.*

INTRODUCTION

Among millets, Sorghum (*Sorghum vulgare*) is one of the most important crops in world. India is one of the leading countries in the world for the production of sorghum as it serves as food for human beings and fodder for cattle like other food grains; chances of fumonisins contamination in field and storage are most likely in this crop. This contamination not only affects the nutritive value but also harms consumer's health. Fumonisins are a group of mycotoxins, which are primarily produced by *Fusarium moniliforme* (Cawood *et al.*, 1991). Fumonisins have been associated with human oesophageal cancer in South Africa (Rheeder *et al.*, 1992) and China (Chu and Li, 1994). Toxic effects of fumonisins have also been reported on animals, human beings, plants and cell cultures (Gelderblom *et al.*, 1992; Bacon *et.al.*, 1995). Fumonisin B_1 (FB_1) is highly toxic and most abundant representative of known fumonisin.

Fumonisin B_1 is a tumour promoter (Gelderblom *et.al.*, 1988; Tolleson *et al.*, 1996). Presence of FB1 & FB2 was reported in cattle milk also due to consumption of contaminated feed or fodder (Scott *et al.*, 1995), Therefore attempt has been made to study the effect of some organic acids and food preservatives on the production of fumonisins, which may help in evolving suitable control measures for fumonisin contamination.

MATERIALS AND METHODS

The effect of organic acids and food preservatives was studied to minimize the fumonisin contamination, for these purpose different concentrations of organic acids and food preservatives (0.1, 0.2, 0.3, 0.4 and 0.5 percent) were added to sterlized moist maize grains medium. Thereafter, these flasks were inoculated with spore suspention of toxic strains of *Fusarium moniliforme* (S_2.PO.16, and S_1. PR.25) and placed in the incubator at 25 $\pm$ 1^0C for another week.

After incubation period, the content of each flask was dried in an oven at 55 $\pm$ 2^0C for 24 hours. Chemical extraction of fumonisins was done following the method outlined by Cawood *et al.*, 1991. Quantitative estimation of fumonisins was done by ''dilution to extinction" procedure (Jones, 1972). Three replicates of each set were taken untreated flasks served as control.

RESULTS AND DISSCUSSION

Table 1: Effect of some organic acids on fumonisin (FB_1 and FB_2) elaboration by *Fusarium moniliforme* (S_2.PO.16,S_1. PR.25)

Treatment	Conc. (%)	Amount of fumonisin B_1 (FB_1) (ppb)	Amount of fumonisin B_2 (FB_2) (ppb)	% Inhibition in fumonisin B_1 Production	% Inhibition in fumonisin B_2 Production
Propionic Acid	0.1	410	–	84.24	100.00
	0.2	340	–	86.93	100.00
	0.3	–	–	100.00	100.00
	0.4	–	–	100.00	100.00
	0.5	–	–	100.00	100.00
Benzoic Acid	0.1	260	–	90	100.00
	0.2	–	–	100.00	100.00
	0.3	–	–	100.00	100.00
	0.4	–	–	100.00	100.00
	0.5	–	–	100.00	100.00
Sorbic Acid	0.1	650	250	75.00	64.29
	0.2	430	140	83.47	80.00
	0.3	280	–	89.24	100.00
	0.4	200	–	92.31	100.00
	0.5	–	–	100.00	100.00
Control without Organic Acids	–	2600	700	–	–

Table 2: Effect of food preservatives on fumonisin (FB_1 and FB_2) elaboration by *Fusarium moniliforme* (S_2.PO.16, S_1. PR.25)

Treatment	Conc. (%)	Amount of fumonisin B_1 (FB_1) (ppb)	Amount of fumonisin B_2 (FB_2) (ppb)	% Inhibition in fumonisin B_1Production	% Inhibition in fumonisin B_2Production
Sodium Benzoate	0.1	300	–	88.47	100.00
	0.2	220	–	91.54	100.00
	0.3	–	–	100.00	100.00
	0.4	–	–	100.00	100.00
	0.5	–	–	100.00	100.00
Sodium Meta Bisulphide	0.1	780	190	70.00	72.86
	0.2	540	100	79.24	85.72
	0.3	400	–	84.62	100.00
	0.4	180	–	93.08	100.00
	0.5	–	–	100.00	100.00
Potassium Metabi Sulphite	0.1	380	140	85.39	80.00
	0.2	250	–	90.39	100.00
	0.3	100	–	96.16	100.00
	0.4	–	–	100.00	100.00
	0.5	–	–	100.00	100.00
Control without Food preservatives	–	2600	700	–	–

Out of three organic acids, benzoic acid was found to be most potent inhibitor of fumonisin B_1 production as it checked FB_1 production by 90% at 0.1% concentration followed by propionic acid (84.25%) and sorbic acid (75.00%). At 0.2% concentration benzoic acid totally suppressed fumonisin B_1 elaboration but propionic acid could inhibit fumonisin production up to 86.93% only at this concentration. However, at 0.3% concentration FB_1 production was completely checked by propionic acid. Further 0.2%, 0.3% and 0.4% concentrations of sorbic acid inhibited fumonisin B_1 production by 83.47%, 89.24% and 92.31% respectively.

Benzoic acid and propionic acid at 0.1% concentration totally checked fumonisin B_2 (FB_2) production but sorbic acid could inhibit production by 64.29%. At 0.2% concentration sorbic acid showed 80% inhibition of FB_2 However, FB_2 elaboration was completely suppressed by use of sorbic acid at 0.3% concentration.

Among all the food preservatives tested, sodium benzoate was found to be most effective against fumonisin production as; it checked FB_1 production up to 88.47% at 0.1% concentration followed by potassium metabisulphite (85.39%) and sodium metabisulphide (70%). At 0.2% concentration sodium benzoate, potassium metabisulphite and sodium metabisulphide inhibited fumonisin B_1 production by 91.54%, 90.39% and 79.24% respectively. Sodium benzoate completely checked FB_1 production at 0.3% concentration. However potassium metabisulphite and sodium metabisulphide inhibited the FB_1 production up to 96.16% and 84.62% respectively.

Lowest concentration of sodium benzoate (0.1%) completely suppressed fumonisin B_2 (FB_2) production, but at this concentration potassium metabisulphite and sodium metabisulpide inhibited FB_2 production by 80% and 72.86% respectively. At 0.2% concentration FB_2 elaboration was totally checked by potassium metabisulphite. Further at 0.3% concentration complete inhibition was shown by sodium metabisulphide. Thus, benzoic acid or Sodium benzoate at 0.2% can be recommended for control of fumonisin contamination in sorghum grains. Park *et al.*, (1992) reported that ammoniation at high pressure (60 Lb/in^2) and low temperature (20^{0}C) reduce detectable FB_1 level in corn by 79% while Scott and Lawrence (1994) reported that an appreciable reduction of fumonisin content was observed after boiling corn meal with calcium hydroxide solution. Castellus *et al.*, (2009) determined the effect of added sodium chloride, barley malt and sucrose on stability of fumonisin B_1 (FB_1) present in corn flour. Decontamination rates depended on the concentration of added ingredients and ranged from 2% to 92%. Salt at 2% was the most effective ingredient in reducing FB_1 content.

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