Mycotoxin adsorption capability of TERRA™ clays and CEREVIDA® yeast extracts with Aflatoxin B₁ and Zearalenone

Performed by: Yu Liang Ph.D.
Research & Development / Quality Assurance Director

Purpose
These series of experiments were conducted to determine the adsorption capability of two MB Nutritional Science Clay Sources (Terra-Red and Terra) and four MB Nutritional Sciences Yeast Extracts against the mycotoxins Aflatoxin B₁ and Zearalenone. Further, we compared the adsorption capability against 4 commercial feed supplements with purported mycotoxin binding activity. We used Aflatoxin B₁ and Zearalenone as candidate mycotoxins because of their different chemistries and can be broadly classified as hydrophilic and hydrophobic, respectively.

Methods
a. The clay:mycotoxin ratios were 100,000:1; 50,000:1; and 25,000 to 1.
b. The yeast extracts:mycotoxin ratios were 10,000:1; 5,000:1; and 2,500:1.
c. These ratios reflect the suggested feed inclusion recommendations and observed mycotoxin concentrations in the feed of livestock.
d. The binding environment for both the clays and yeast extracts were the same, which was performed in a phosphate buffered saline with pH=7.2 under constant agitation at 150 rpm and a temperature of 37°C. All incubations were conducted for 4 hours. The cultures were then centrifuged at 1,200 x g for 15 minutes and the amount of free mycotoxin was determined in the supernatant using an Enzyme Linked Immunosorbent Assay. A standard curve was fitted to calculated absorbance to ppb (part per billion) free mycotoxin remaining in solution.
e. Percent binding was calculated as [(Negative Control – Sample)/Negative Control]*100
   a. Negative Control had no putative binder added to the incubation and therefore represented 0% binding.
Results

**Figure 1.** Aflatoxin B1 adsorption at pH 7.2 after 4 hours of incubation with Terra Red, Terra, and 4 commercial products. 100,000:1; 50,000:1; and 25,000:1 are the ratios of adsorbent to aflatoxin tested. Data reported as the mean ± SEM of triplicate cultures.
Figure 2. Zearalenone adsorption at pH 7.2 after 4 hours of incubation with Terra Red, Terra, and 4 commercial products. 100,000:1; 50,000:1; and 25,000:1 are the ratios of adsorbent to zearalenone tested. Data reported as the mean ± SEM of triplicate cultures.
Figure 3. Zearalenone adsorption at pH 7.2 after 4 hours of incubation with various yeast extracts. YCW is an insoluble extract from yeast cells. MOS and S-MOS are deproteinated extracts from YCW the only difference between the 2 is the S-MOS is 100% soluble, whereas the MOS is approximately 50% soluble. B-Glucan is a 90% purified β-glucan from yeast cell wall extracts. 10,000:1; 5,000:1; and 2,500:1 are the ratios of adsorbent to zearalenone tested. Data reported as the mean ± SEM of triplicate cultures.

Conclusions

These data indicate that both Terra-Red and Terra bind Aflatoxin B1 very well and better than the 4 commercial clay based products evaluated. Further, Terra has excellent Zearalenone binding capabilities and was similar to Competitor #1. The price per ton of Competitor #1 is approximately $2,000 per ton. Terra-Red also had some Zearalenone binding capabilities and was similar to Competitor #3 and better than both Competitors #2 and #4. Competitor #3 has a suggested price per cow of approximately $0.14 per head per day ($2,250 per ton at 56 gram feed rate). These data indicate that Terra is the best clay source for mycotoxin binding and maybe able to be included at a lower feed rate.
The YCW extract had the greatest zearalenone adsorption of any of the MB Nutritional Sciences yeast extracts evaluated. The YCW could be blended with other mineral clays to offer a more broad spectrum of mycotoxin binding as well as supply immune modulating B-glucan to help alleviate some of the immune suppressing effects of mycotoxin exposure.

- **Directions for use**
  - TERRA: 1 to 5 pounds per ton of finished feed
- **Packaging**
  - 2,000 lbs (909 kg) totes