**Application**

All monogastric species are affected by mycotoxins, produced by moulds found in feedstuffs and bedding. Clay based mycotoxin binders are commonly a low inclusion solution to mitigate the risk and effects on production and health.

**Introduction**

Mycotoxins are the secondary metabolites of fungi and with the effects of climate change (Hajnal *et al.,* 2023) are becoming increasingly prevalent in feed grains. In monogastrics, the effects of mycotoxin consumption include performance losses, damage to intestinal integrity, increased incidence of uterine prolapse and substantial increases in mortality, leading to reduced overall health and animal performance.

With the impact of climate change it has been suggested that mycotoxin contamination is increasing (Hajnal *et al.,* 2023), so identifying and implementing effective solutions is essential for sustainable animal health and production. In-feed mycotoxin binders are a viable and cost-effective strategy for limiting animal exposure to mycotoxins. To assess the efficacy of different types of proprietary clay-based mycotoxin binders in comparison to a commercially available bentonite, an *in vitro* binding capacity study was performed.

**Materials and Methods**

Three proprietary clay-based mycotoxin binders (Anpro (AN), Anpro-UB (AUB), Anpro-NT (ANT) (Anpario plc)) and a commercially available bentonite (UK and EU approved 1m558) as a commercially relevant control (CTRL) were analysed in blind at an independent European laboratory as part of a larger study. Four replicates of one concentration (0.25 g/L), and one pH level (2.5) are reported here for brevity. The binders were tested against six common mycotoxins at the following concentrations (aflatoxin (AfB1), 10 µg/L, ochratoxin (OTA), 50 µg/L, zearalenone (ZEA), 100 µg/L, deoxynivalenol (DON), 100 µg/L, fumonisin B1 (FumB1), 100 µg/L, and T2, 100 µg/L). Each binder was mixed with the toxin solution or buffer to yield the required inclusion rate. The suspension of products was mixed then shaken for 90 min at 37 °C and 250 rpm. The suspension was transferred into Eppendorf tubes and centrifuged at 14,000 rpm for 20 min at 25 °C. The supernatants were filtered by regenerated-cellulose filters or PTFE filters (0.2 μm) and analysed for toxin content by high performance liquid chromatography (HPLC). The amount of mycotoxin bound to the materials, expressed as percent of adsorption, was calculated as the difference between the amount of mycotoxin in the supernatant of the blank tube (without a binder) and the amount found in the supernatant of the experimental tube (containing a binder), at the end of the test. Data was analysed using ANOVA in IBM SPSS.

**Results**

The proprietary blends (AN, AUB and ANT) bound significantly more AfB1 compared to the CTRL (P<0.001) (Table 1). There was no statistical difference in binding capacity between treatments and CTRL for DON, FumB1, and T2. AN and ANT bound significantly more OTA than AUB (P<0.001) and AN, AUB and ANT bound significantly more OTA than CTRL (P<0.001). All treatments (AN, AUB and ANT) bound significantly more ZEA than CTRL (P<0.001) with AN giving the highest binding capacity at 55.17%. AfB1 was the toxin bound most effectively by all treatments (over 90% of free toxin bound), whereas none of the binders tested had a large binding capacity for DON (<5% of free toxin bound). All products were able to bind OTA and FumB1 between 50% and 81% effectively.

**Table 1** Mycotoxin adsorption capacity at pH 2.5 (0.25 g/L) of product, displayed as a percentage

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| --- |
| Binder product (% of free toxin bound) |
| Mycotoxin | CTRL1 | AN | AUB | ANT | SEM2 | P-value treatment |
| AfB1 | 81.8a | 90.44b | 90.08b | 90.20b | 0.695 | **<0.001** |
| OTA | 21.4a | 79.72c | 62.99b | 80.19c | 2.012 | **<0.001** |
| ZEA | 6.3a | 55.17c | 38.17b | 50.16bc | 3.248 | **<0.001** |
| DON | 2.9 | 1.58 | 2.05 | 3.42 | 1.907 | 0.915 |
| FumB1 | 56.7 | 56.01 | 53.71 | 53.94 | 4.555 | 0.988 |
| T2 | 35.1 | 56.57 | 34.50 | 43.87 | 10.219 | 0.633 |

1 Control is a commercially available UK and EU approved 1m558 bentonite

2 Standard error of the mean, a-c; differing letters denote significant differences

**Conclusions**

The products tested all show effective binding for the 6 toxins tested at pH 2.5 at commercially relevant doses. The three products tested (AN, AUB and ANT) all showed significantly improved efficacy for AfB1, OTA, and ZEA than the control (UK and EU authorised 1m558 bentonite). However binding efficacy is shown to be different for each of the products with some showing higher affinity for common toxins such as zearalenone, a common toxin linked with uterine prolapse in sows and gilts. Therefore, is it recommended that feed is analysed by HPLC to confirm the toxins present and a suitable toxin binder chosen based on these results.

**References**

Janić Hajnal, E., Kos, J., Radić, B., Anić, M., Radović, R., Kudumija, N., Vulić, A., Đekić, S., & Pleadin, J. (2023). Impact of Climate Changes on the Natural Prevalence of *Fusarium* Mycotoxins in Maize Harvested in Serbia and Croatia. *Foods*, *12*(5), 1002.