

Enzymatic detoxification of mycotoxins in the bioethanol process



Daniela KOTZ*, Stephan ROSE, Dian SCHATZMAYR, Gerd SCHATZMAYR

BIOMIN Research Center, BIOMIN Holding GmbH, Tulln, Austria

* Corresponding author: daniela.kotz@biomin.net

Introduction

Feeding by-products of the bioethanol industry such as Distiller's Dried Grains with Solubles (DDGS) to livestock increases the likelihood of exposing animals to higher mycotoxin levels, as mycotoxins present in the raw materials are not degraded but concentrated during the bioethanol production process.

The objective of this study was to evaluate the application of the fumonisin B₁ (FB₁) and zearalenone (ZEN) degrading feed additives FUMzyme® and ZENzyme® (both BIOMIN) for the detoxification of FB₁ and ZEN directly within the bioethanol process.

Conclusion

FB₁ and ZEN could be simultaneously degraded up to 99% and 89%, respectively, within the bioethanol production process in lab-scale. Biotransformation was confirmed by formation of the degradation products hydrolyzed FB₁ and hydrolyzed ZEN.

The application of the mycotoxin degrading enzymes FUMzyme® and ZENzyme® in the bioethanol process offers the possibility to produce high-quality DDGS low in FB₁ and ZEN from corn initially contaminated with these mycotoxins.

Material & Methods

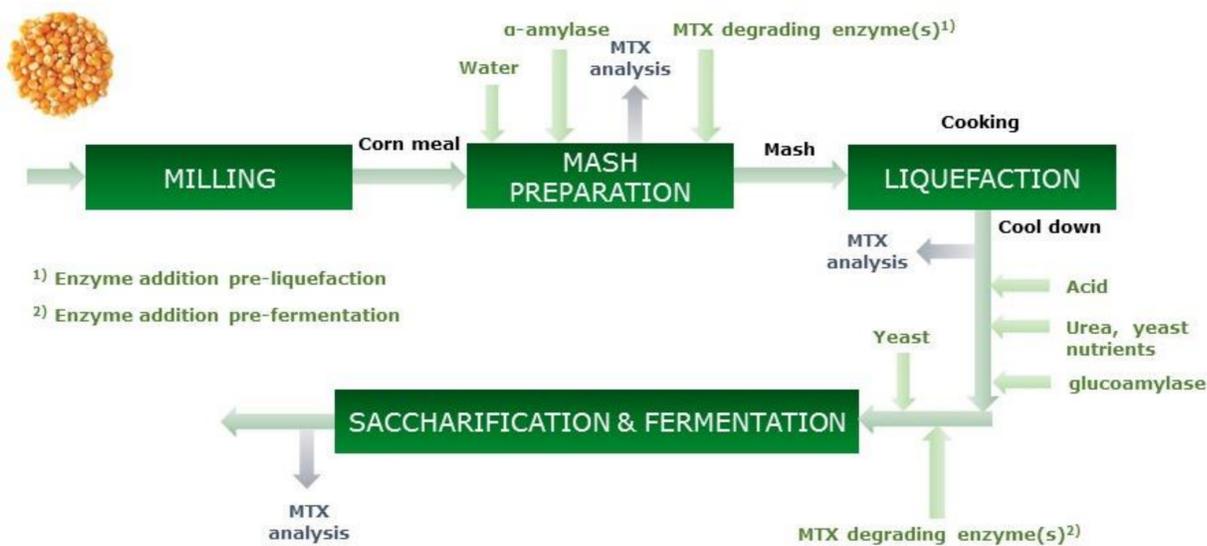


Figure 1. Process flow diagram of the lab-scale bioethanol process

Lab-scale bioethanol process simulations were performed in 450-mL-scale as shown in Figure 1 using naturally contaminated corn (2324 ppb FB₁, 1486 ppb ZEN). FUMzyme® and ZENzyme® were either added before liquefaction or before fermentation. FB₁, hydrolyzed FB₁ (HFB₁), ZEN and hydrolyzed ZEN (HZEN) were quantified by LC-MS.

Results

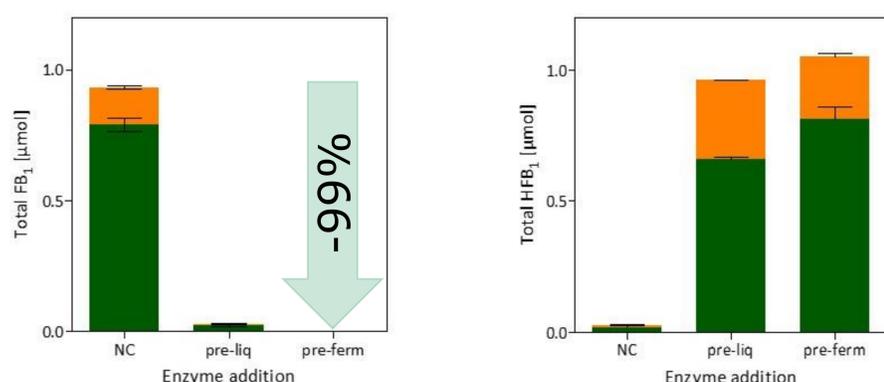


Figure 2. Total amount of FB₁ (left) and HFB₁ (right) in mash pellet (green) and supernatant (orange) per batch at the end of the bioethanol process after addition of FUMzyme® and ZENzyme® before liquefaction (pre-liq) or before fermentation (pre-ferm) compared to the negative control (NC) without enzyme addition. Error bars represent standard deviation (n=2).

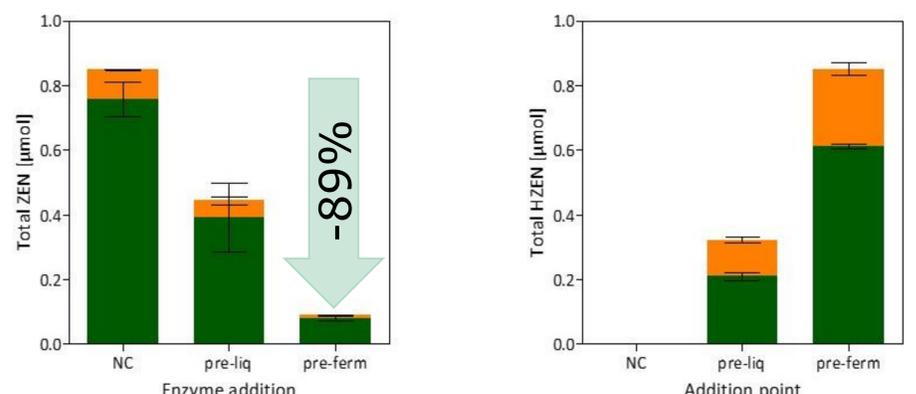


Figure 3. Total amount of ZEN (left) and HZEN (right) in mash pellet (green) and supernatant (orange) per batch at the end of the bioethanol process after addition of FUMzyme® and ZENzyme® before liquefaction (pre-liq) or before fermentation (pre-ferm) compared to the negative control (NC) without enzyme addition. Error bars represent standard deviation (n=2).

